

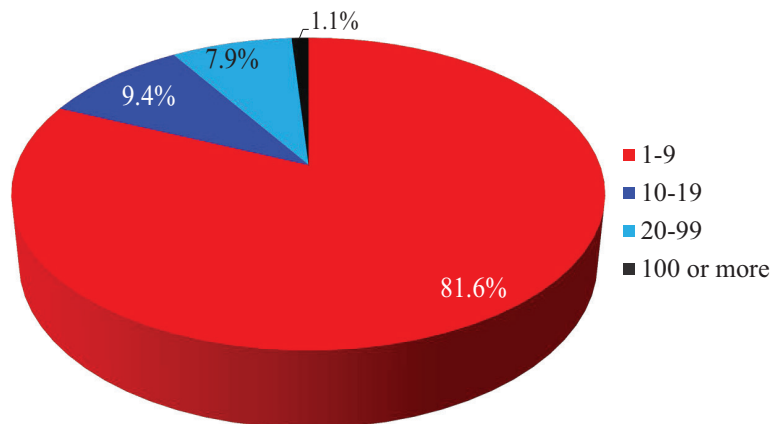


## Fatal Injuries among Small Construction Establishments

Xiuwen Sue Dong, DrPH\*, Xuanwen Wang, PhD, Rebecca Katz, MPH, Chris Trahan Cain, CIH, Rick Rinehart, PhD

Construction is an industry composed of predominantly small establishments<sup>1</sup> (CPWR, 2018). Among construction establishments with payroll, more than 90% had fewer than 20 employees. Smaller construction establishments lag behind their larger counterparts in safety management and practices (Wang et al., 2016; Dodge, 2017, 2016, 2013). Studies suggest that there are considerable challenges to improve safety and health in small construction establishments (CPWR, 2018; Dong et al., 2017, 2014, 2011). This Quarterly Data Report explores fatal occupational injuries in construction by establishment size over time, with an emphasis on the period since 2011. Trends, patterns, and characteristics of fatalities between small and large establishments were compared and analyzed. Fatality numbers were obtained from the U.S. Bureau of Labor Statistics' (BLS) Census of Fatal Occupational Injuries (CFOI). The employment data by establishment size were from the County Business Patterns (CBP) collected by the U.S. Census Bureau. Since the CBP only collects data from payroll establishments, "establishment" in this report refers to establishments with employees, and self-employed workers are excluded from the analysis. Because categories of establishment size differ between the CFOI (1-10 employees) and the CBP (1-9 employees), death rates for establishments with 10 or fewer employees cannot be estimated.

**Figure 1. Percent of payroll establishments in construction, by establishment size, 2016**



### KEY FINDINGS

- In 2016, about 82% of payroll establishments in construction had fewer than 10 employees, and another 9% had 10-19 employees.
- From 2003 to 2016, 5,155 fatalities were reported in establishments with 1-19 employees, accounting for 56.6% of fatalities with known establishment size.
- In 2016 alone, more than two thirds (67.2%) of fatalities occurred in establishments with 1-19 employees.
- The fatality rate for establishments with 1-19 employees was significantly higher than those with 20 or more employees.
- The fatality rate rose 57% for establishments with 1-19 employees from 2008 to 2016, while the rate decreased by about 30% for establishments with 20 or more employees during the same period.

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Source: U.S. Census Bureau. 2016 County Business Patterns. Calculations by the CPWR Data Center.

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## SECTION 1: Characteristics of Construction Establishments

Construction establishments<sup>1</sup> are small. In 2016, among nearly 700,000 payroll establishments in construction, more than 80% had fewer than 10 employees, and another 9% had 10-19 employees (chart 1). Overall, 91% of payroll construction establishments had fewer than 20 employees, sharing about 37% of construction payroll employment. Conversely, establishments with 100 or more employees comprised only 1.1% of construction establishments, yet employed almost 30% of all paid construction employees.

### 1. Number and percent of construction payroll establishments and employees, by establishment size, 2016

Establishment size (number of employees)	Number of establishments	% of all establishments	Number of employees	% of all employees
1 to 9	568,557	81.6%	1,444,429	22.9%
10 to 19	65,702	9.4%	882,061	14.0%
20 to 99	54,833	7.9%	2,125,013	33.7%
100 to 499	7,119	1.0%	1,294,645	20.5%
500 or more	522	0.1%	565,116	9.0%
<b>Total</b>	<b>696,733</b>	<b>100.0%</b>	<b>6,311,264</b>	<b>100.0%</b>

<sup>1</sup>According to the U.S. Census Bureau, an establishment is a single physical location, where business is conducted and services or industrial operations are performed. In construction, the individual sites, projects, fields, lines, or systems of such dispersed activities are not considered to be establishments. The establishment in construction is represented by a relatively permanent main or branch office that is either 1) directly responsible for supervising such activities, or 2) the base from which personnel operate to carry out these activities.

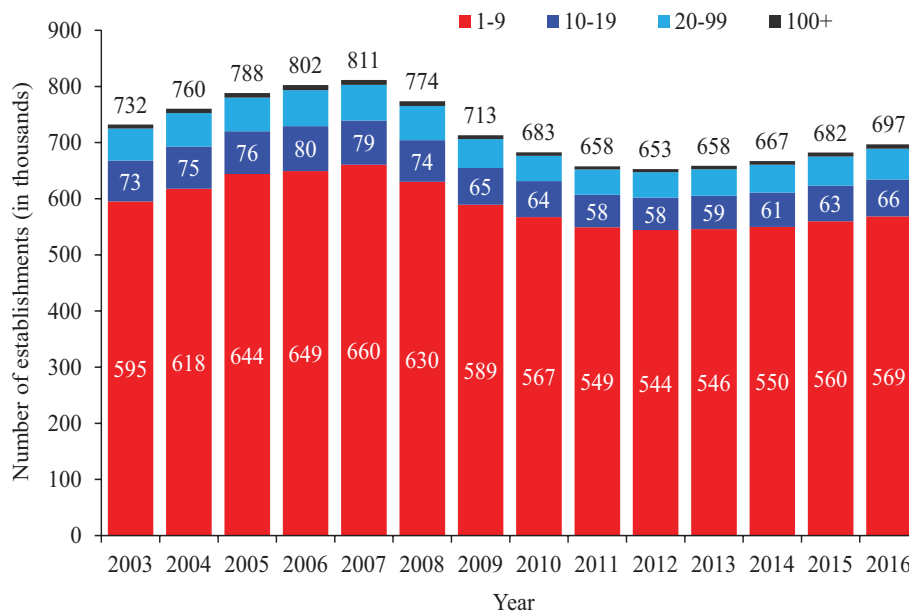
*Source:* U.S. Census Bureau. 2016 County Business Patterns. Calculations by the CPWR Data Center.

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The number of establishments followed the pattern of construction employment (CPWR, 2018), reaching a peak of 811,000 in 2007 before falling to a low of 653,000 in 2012, and then rising to 697,000 in 2016 (chart 2). However, the smallest establishments (1-9 employees) as a proportion of construction payroll establishments remained relatively stable over time, moving from 81.3% in 2003 to 83.5% in 2011, before returning to 81.6% in 2016.

**2. Number of construction payroll establishments, by establishment size, 2003-2016**



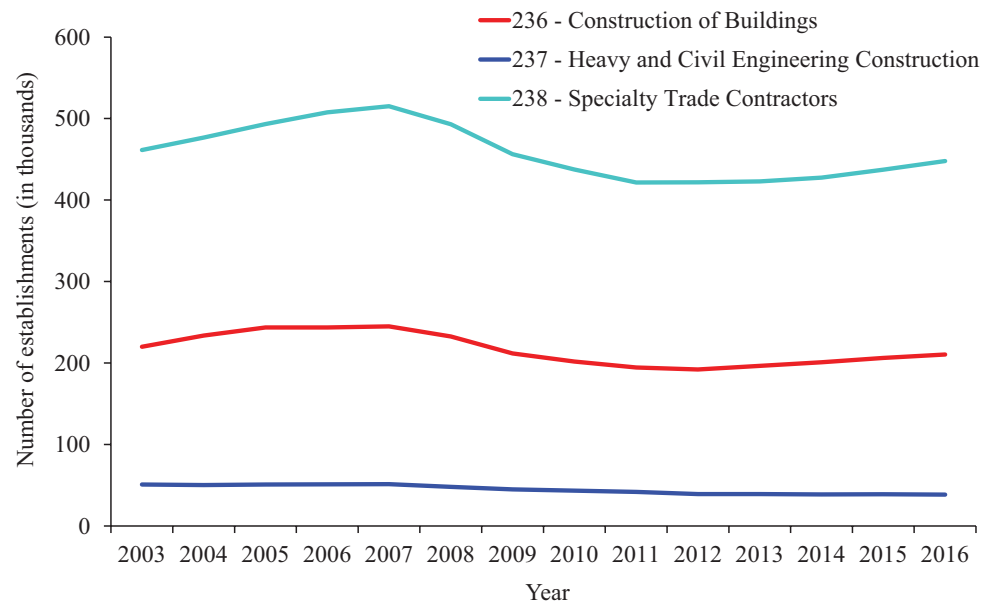
Source: U.S. Census Bureau. 2003-2016 County Business Patterns.

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Of the construction subsectors, the number of construction payroll establishments in the Construction of Buildings subsector fluctuated with the economic cycle, rising to 244,900 establishments in 2007, falling to a low of 192,100 in 2012, and then climbing to 210,500 by 2016, but remained 14% below the level before the recession (chart 3). Similarly, the Specialty Trade Contractors subsector reached 515,200 establishments in 2007, fell 18% in 2011, and then rose to 447,800 in 2016. Conversely, the Heavy and Civil Engineering Construction subsector steadily dropped with less fluctuation, falling 25% from a high of 51,400 in 2007 to a low of 38,500 in 2016.

**3. Number of construction payroll establishments, by major construction subsector, 2003-2016**



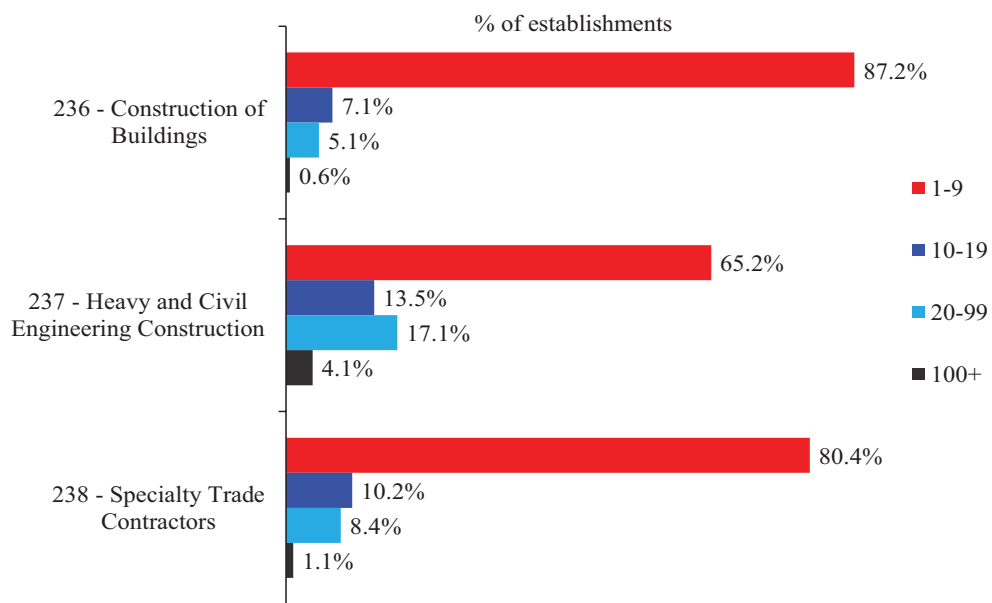
Source: U.S. Census Bureau. 2003-2016 County Business Patterns.

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By establishment size, more than 87% of establishments in the Construction of Buildings subsector had fewer than 10 employees, the largest share out of the three major subsectors (chart 4). The Heavy and Civil Engineering Construction subsector had the lowest percentage of establishments with fewer than 10 employees (65.2%).

**4. Percent of construction payroll establishments, by major construction subsector and establishment size, 2016**

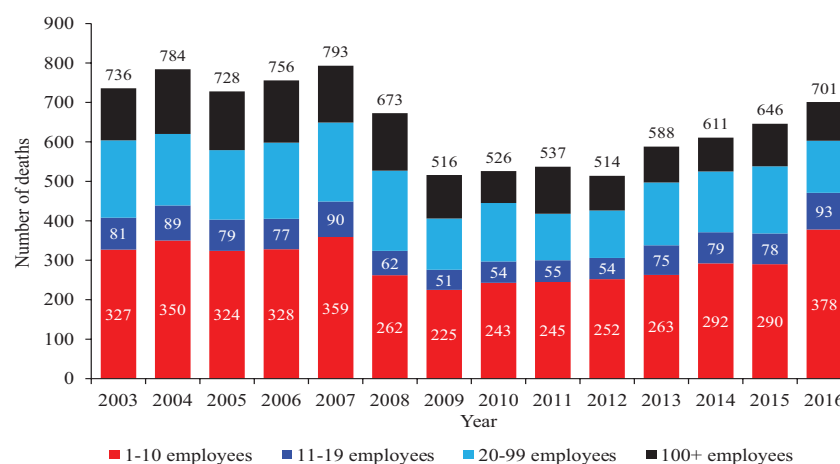


Source: U.S. Census Bureau. 2016 County Business Patterns. Calculations by the CPWR Data Center.

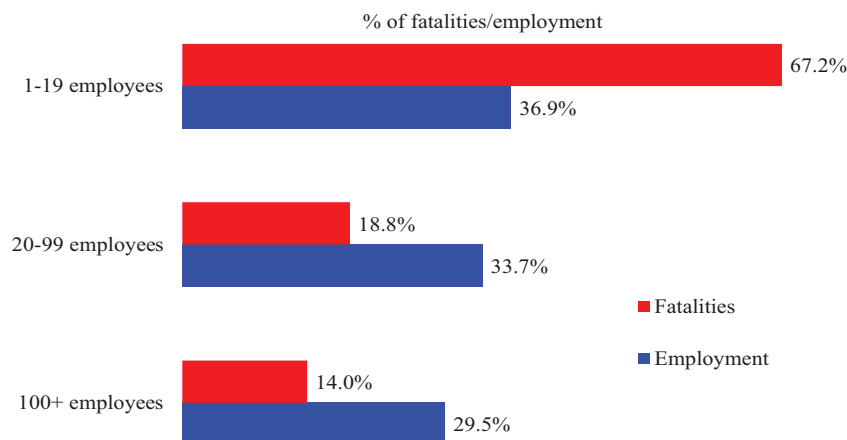
## SECTION 2: Trends of Fatal Injuries in Construction by Establishment Size

Overall, fatalities among construction wage-and-salary workers followed the pattern of payroll establishments (*see* chart 2), peaking at 793 in 2007, falling 35% to a low of 514 in 2012, and then rising 36% to 701 in 2016 (chart 5). Small establishments suffer a disproportionate share of fatal work injuries. From 2003 to 2016, 5,155 fatalities were reported in establishments with fewer than 20 employees, accounting for more than half (56.6%) of fatalities with known establishment size.<sup>2</sup> The share of fatalities among establishments with 1-10 employees generally increased over time, from 44% in 2003 to 54% in 2016, the highest since 2003. In 2016 alone, more than two-thirds (67.2%) of fatalities among wage-and-salary workers occurred in establishments with fewer than 20 employees (chart 6). On the opposite end, establishments with 100 or more employees shared 14% of fatalities, but employed nearly 30% of wage-and-salary workers in construction.

**5. Number of fatalities in construction, by establishment size, 2003-2016 (Wage-and-salary workers)**



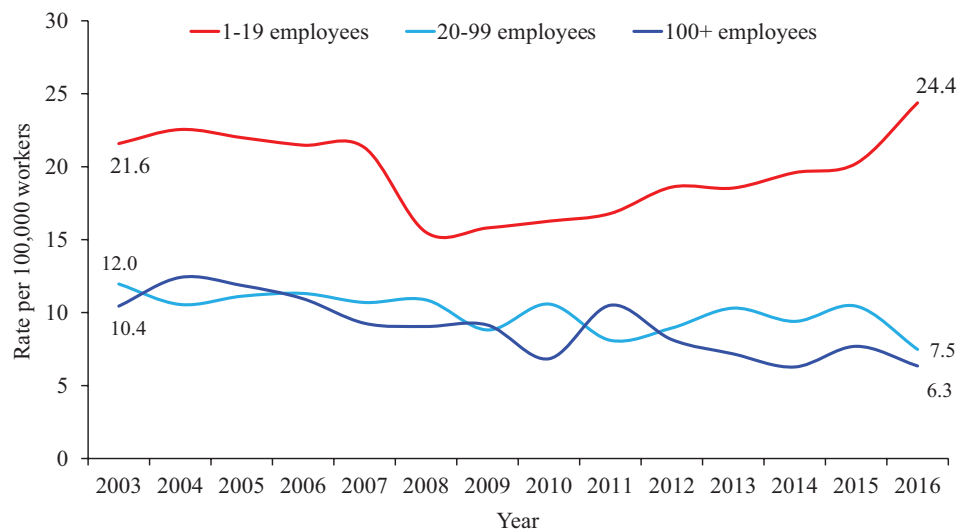
**6. Distribution of construction fatalities and employment, by establishment size, 2016 (Wage-and-salary workers)**



<sup>2</sup>Deaths without establishment size information were excluded from calculations.  
**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 County Business Patterns. Calculations by the CPWR Data Center.

From 2003 to 2016, the rate<sup>3</sup> of fatalities for establishments with fewer than 20 employees was significantly higher than those with 20 or more employees. Moreover, for these small establishments, the rate rose 57% from 15.5 in 2008 to 24.4 per 100,000 wage-and-salary workers in 2016, while the rate decreased by about 30% among establishments with 20 or more employees during the same period (chart 7).

**7. Rates of fatal injuries in construction, by establishment size, 2003-2016  
(Wage-and-salary workers)**



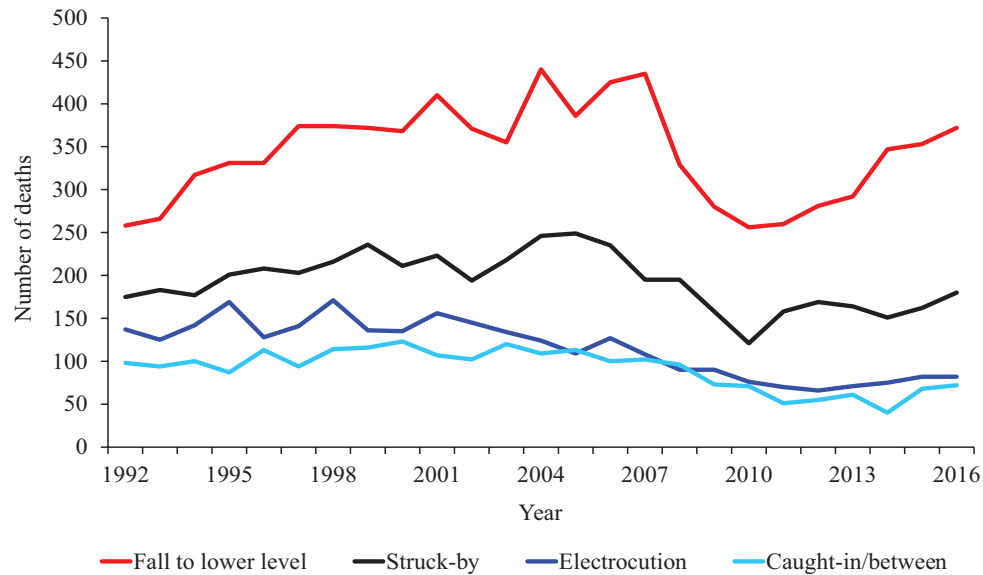
<sup>3</sup>Since the County Business Patterns did not collect data on hours worked, the employment (denominator) used for calculations was the number of workers instead of full-time equivalent workers.

**Note:** Around 20% of deaths did not have information on establishment size. Therefore, employment data were adjusted in the rate calculations assuming the information was missing at random.

**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 County Business Patterns. Calculations by the CPWR Data Center.

Fall to a lower level were the leading cause of fatalities, causing 8,583 deaths from 1992 to 2016, nearly twice as many as were caused by struck-by, the second leading cause of fatalities during this period (4,828; chart 8). Overall, the “Construction Focus Four” (Falls, Struck-By, Electrocution, and Caught-In or -Between) recognized by the Occupational Safety and Health Administration (OSHA), claimed 743 lives on average per year in construction, accounting for 70% of all construction fatalities during this period.

**8. Leading causes of fatalities in construction, 1992-2016**  
(All employment)

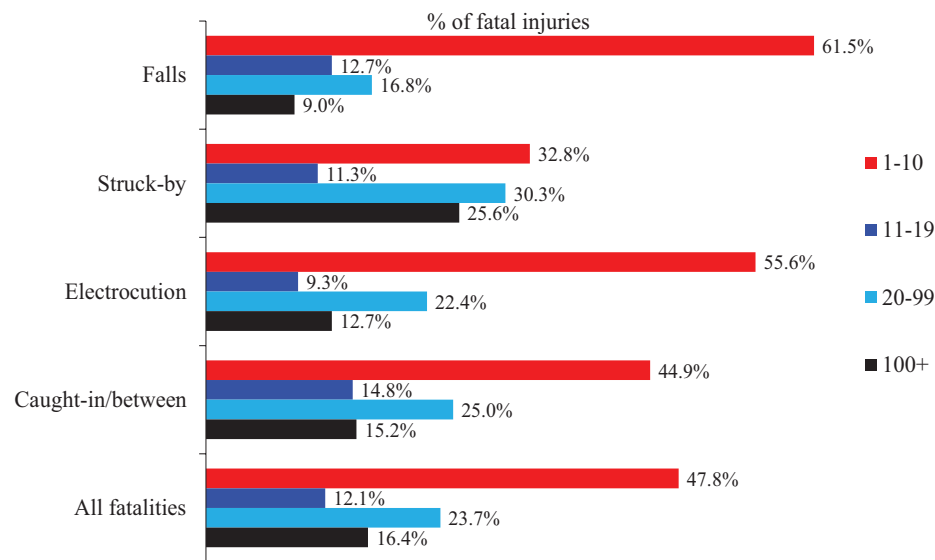


Source: U.S. Bureau of Labor Statistics, 1992-2016 Census of Fatal Occupational Injuries. Numbers were from the online CFOI database.



Fatalities caused by falls or electrocutions were disproportionately higher in small construction establishments than those by other causes. From 2011 to 2016, nearly 62% of fall fatalities occurred in establishments with 10 or fewer employees (chart 9). More than half of all electrocution deaths (55.6%) during this time were also at the smallest establishments (1-10 employees). Overall, about 48% of all fatalities in construction during this period occurred at establishments with 1 to 10 employees.

**9. Fatal injuries in construction, by leading causes and establishment size, sum of 2011-2016 (Wage-and-salary workers)**

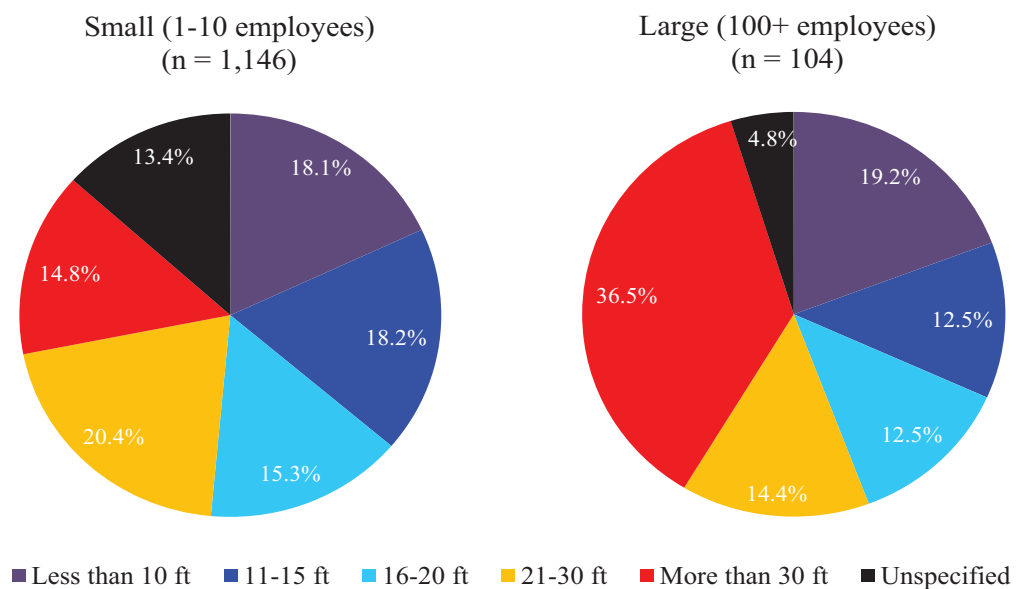


*Note:* Deaths without establishment size information were excluded.

*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.

The characteristics of fall deaths varied by establishment size. While the smallest establishments (1 to 10 employees) had more fatal falls from 15 feet or less (36.3%), establishments with 100 or more employees were more than twice as likely to have falls from more than 30 feet (36.5% versus 14.8%; chart 10).

**10. Fatal falls in construction, by height of fall, small versus large establishments, sum of 2011-2016 (Wage-and-salary workers)**



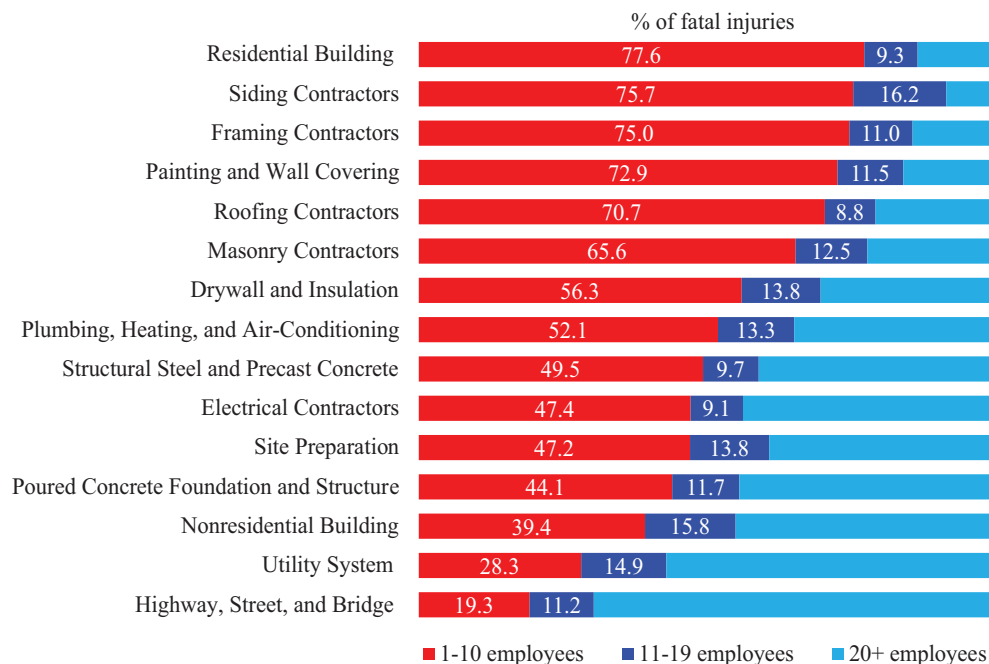
*Source:* Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

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### SECTION 3: Fatal Injuries among Small Construction Establishments by Subgroup

By construction subsector, nearly 78% of fatal injuries in the Residential Building subsector occurred at establishments with 1-10 employees, a higher percentage than any other subsector, followed by Siding Contractors (75.7%) and Framing Contractors (75.0%; chart 11). Conversely, the Highway, Street, and Bridge subsector had the lowest percentage of deaths (19.3%) for the smallest establishments.

**11. Percentage of fatal injuries among selected construction subsectors, by establishment size, sum of 2011-2016 (Wage-and-salary workers)**



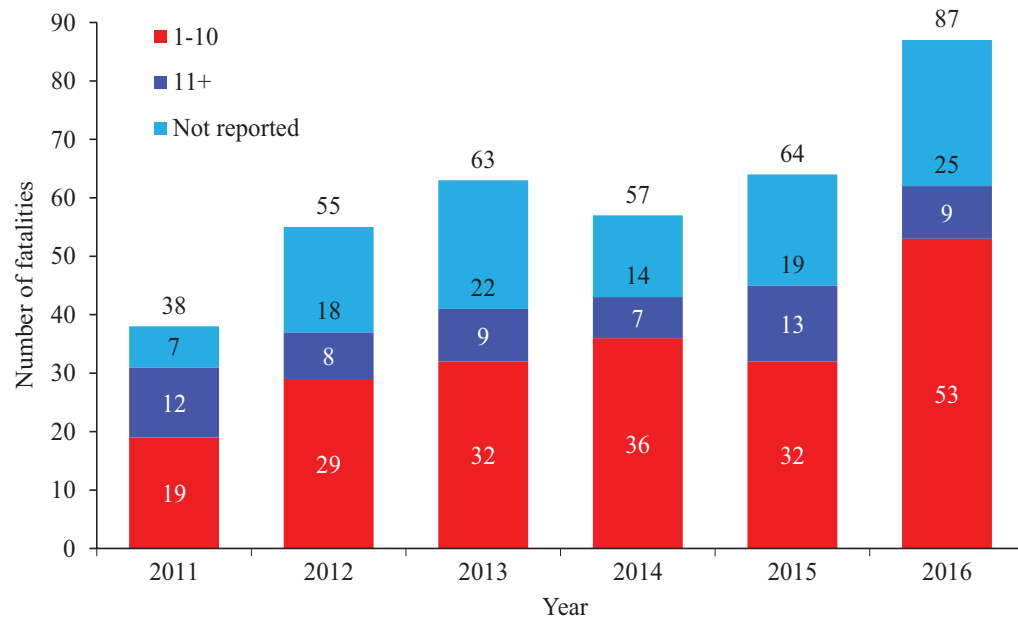
*Note:* Deaths without establishment size information were excluded.  
*Source:* Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

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by Subgroup

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There were 87 fatal injuries among the Residential Building sector in 2016, more than twice as many as in 2011 (38; chart 12). In addition, the number of deaths at establishments with 10 or fewer employees rose by nearly three times during this period (53 versus 19).

**12. Number of fatal injuries among the residential building construction sector, by establishment size, 2011-2016 (Wage-and-salary workers)**



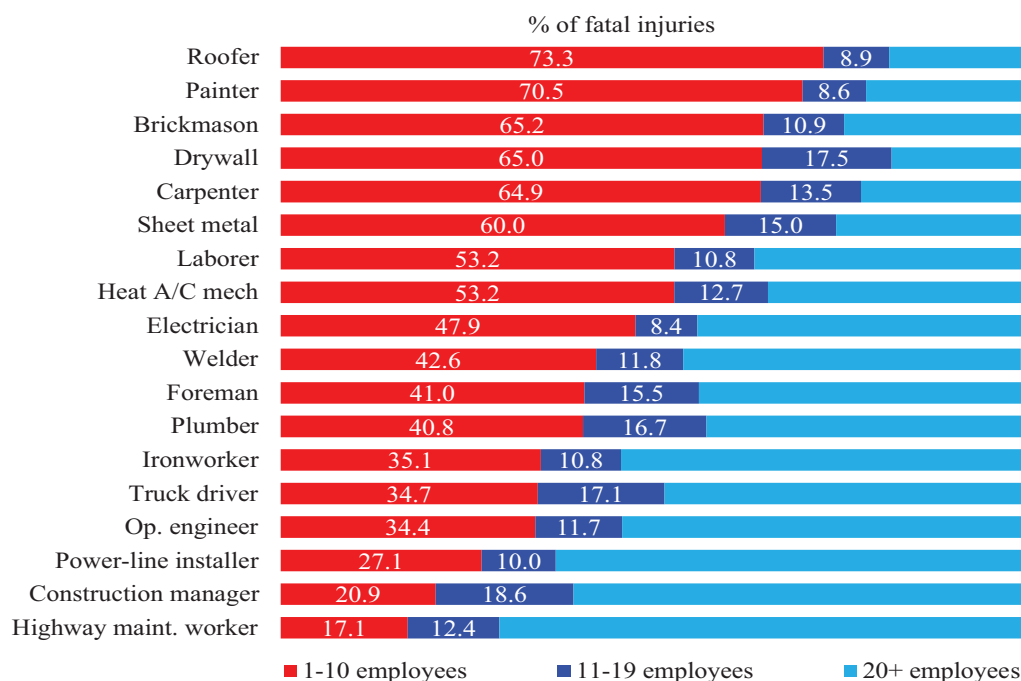
Source: Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

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By construction occupation, more than 73% of fatalities among roofers were in establishments with 10 or fewer employees, a larger percentage than for any other occupation (chart 13). Painters and brickmasons were the next two occupations with the largest share of deaths at establishments of this size (70.5% and 65.2%, respectively).

**13. Percentage of fatal injuries among selected construction occupations, by establishment size, sum of 2011-2016 (Wage-and-salary workers)**



*Note:* Deaths without establishment size information were excluded.

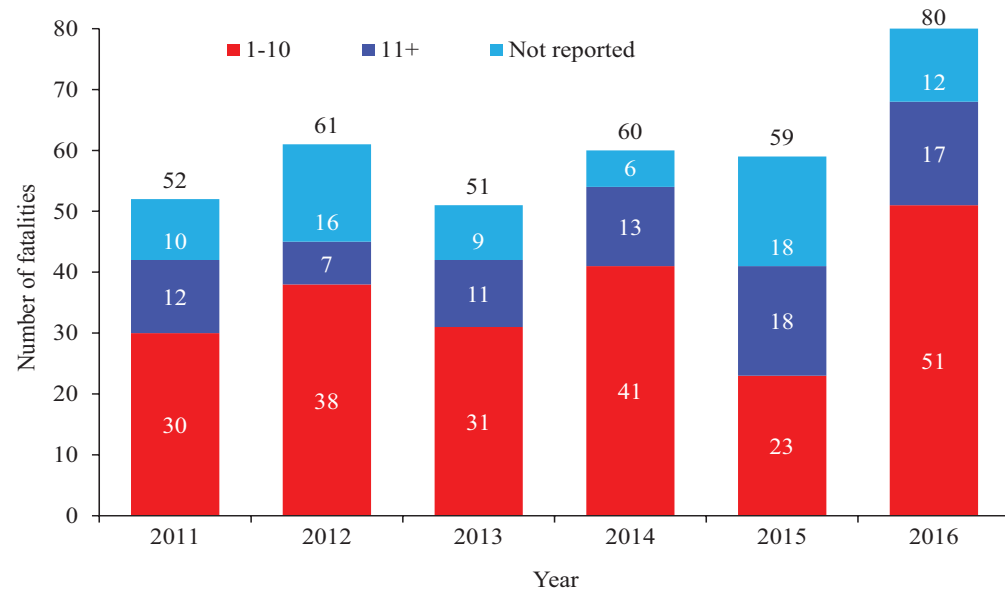
*Source:* Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

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There were 80 fatal injuries among roofers in 2016, 51 of which happened in establishments with 10 or fewer employees, accounting for nearly 64% of all fatalities in this occupation (chart 14). The number of deaths among roofers in the smallest establishments jumped 70% in 2016 from 30 deaths in 2011, faster than the 54% increase in total deaths among this occupation during the same period.

**14. Number of fatal injuries among roofers, by establishment size, 2011-2016**  
(Wage-and-salary workers)



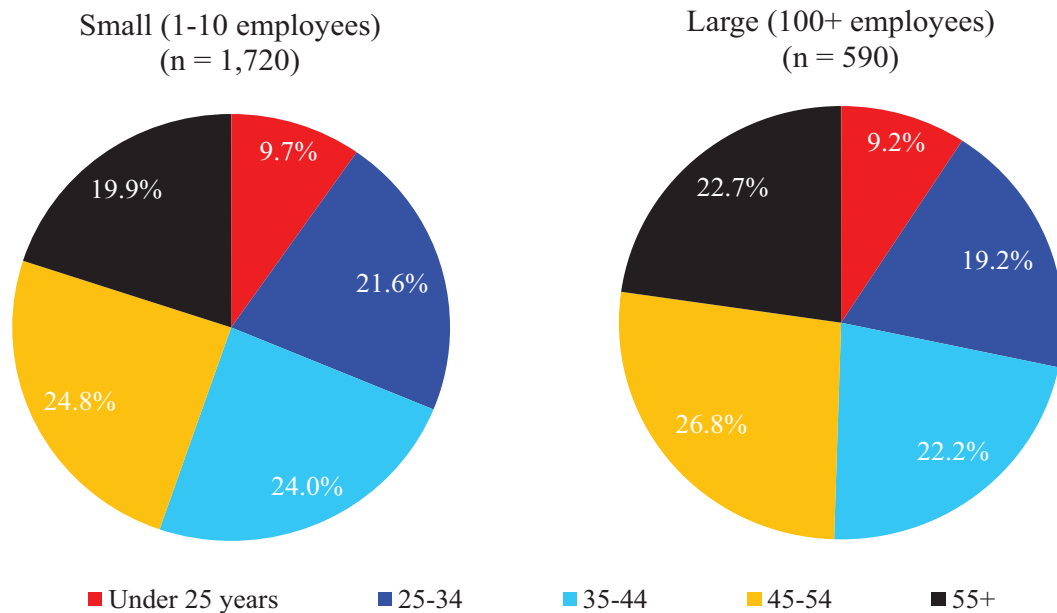
*Source:* Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

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Fatalities at small construction establishments are more likely to occur for younger employees. Among establishments with 10 or fewer employees, 55.3% of fatalities from 2011 to 2016 were among workers under the age of 45, compared to 50.6% at establishments with 100 or more employees (chart 15).

**15. Fatal injuries in construction, by age group, small versus large establishments, sum of 2011-2016 (Wage-and-salary workers)**



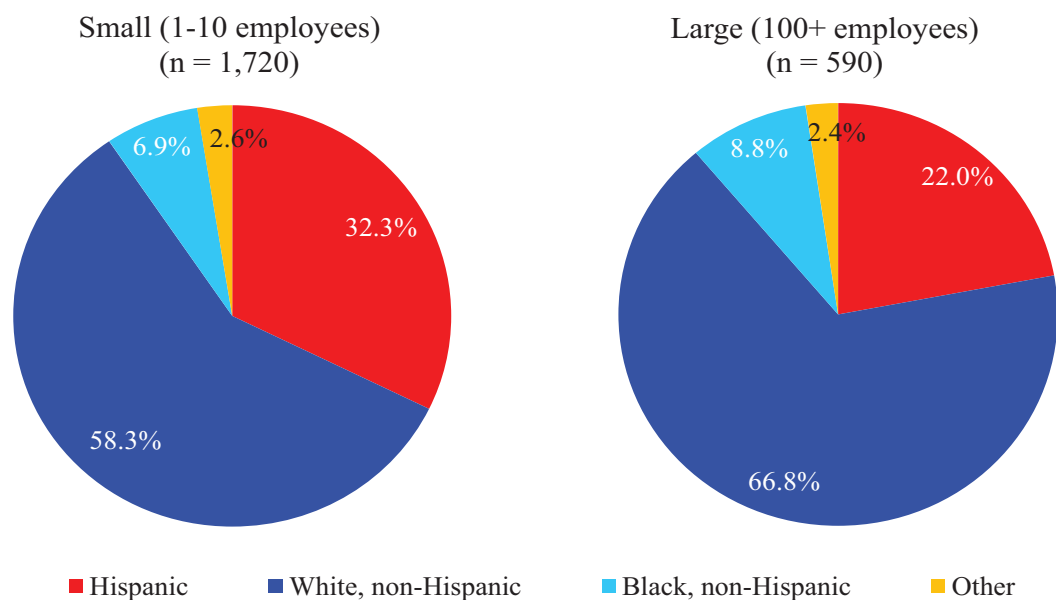
*Source:* Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

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A larger proportion of deaths in establishments with 10 or fewer employees occurred to Hispanic wage-and-salary workers compared to establishments with 100 or more employees (32.3% versus 22.0%; chart 16).

**16. Fatal injuries in construction, by race/ethnicity, small versus large establishments, sum of 2011-2016 (Wage-and-salary workers)**



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.

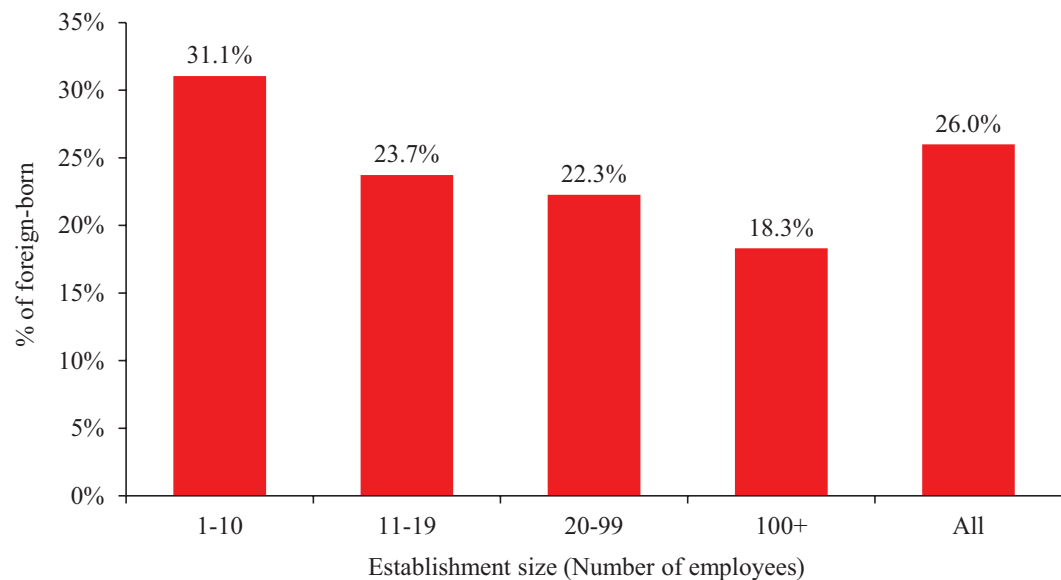


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Foreign-born workers were overrepresented among fatalities in the smallest construction establishments. Nearly one-third (31.1%) of deaths among establishments with 10 or fewer employees were to foreign-born workers, higher than their share of all fatalities (26%; chart 17).

**17. Percentage of fatal injuries among foreign-born workers in each establishment size, sum of 2011-2016 (Wage-and-salary workers)**



*Note:* Deaths without establishment size information were excluded.

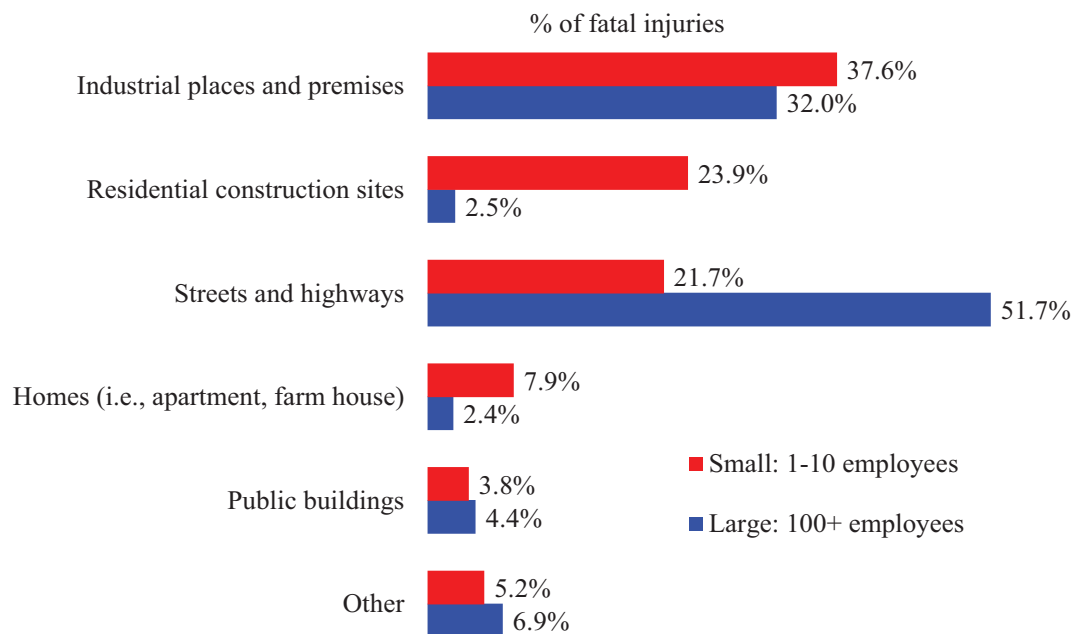
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Among the smallest establishments (1-10 employees), more fatalities occurred at industrial places and premises than other locations (37.6%), followed by residential construction sites (23.9%; chart 18). Among the largest establishments (100+ employees), more than half of fatalities occurred on streets and highways (51.7%), followed by industrial places and premises (32%).

**18. Fatal injuries in construction, by location of incident, small versus large establishments, sum of 2011-2016 (Wage-and-salary workers)**



*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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## Conclusion/Discussion

Small establishments continue to vastly outnumber large establishments in the construction industry. In 2016, about 82% of payroll establishments in construction had fewer than 10 employees, and another 9% had 10-19 employees. In the same year, more than two thirds (67.2%) of fatalities among wage-and-salary workers occurred in establishments with fewer than 20 employees, which is disproportionately high given that these establishments employed less than 37% of paid construction workers. Likewise, the rate of fatalities for small establishments (1-19 employees) was significantly higher than for their larger counterparts, and the gap widened over time. In terms of event or exposure, almost 62% of fall fatalities and more than half (55.6%) of electrocution deaths occurred in establishments with 10 or fewer employees. Young, Hispanic, and foreign-born workers were also overrepresented among fatalities in smaller establishments.

Small construction businesses may face many barriers to implementing health and safety programs, such as limited resources and increasing pressures from business competition (NIOSH, 2018). To assist small businesses in improving worker safety and health, numerous materials and resources have been developed for free use. OSHA's [Small Business Assistance](#) website provides resources and information designed specifically for small business employers, such as the Small Business Safety and Health Management Series, easy-to-follow guides for specific OSHA standards, the Safety and Health Achievement Recognition Program ([SHARP](#)), and many others. NIOSH also provides a [Small Business Resource Guide](#), which includes plans, tools, tips, and information on how to keep workers safe and healthy while managing time and cost investments. CPWR has developed the [Safety Climate Assessment Tool for Small Contractors \(S-CAT<sup>SC</sup>\)](#), designed to help small construction employers and their employees assess and improve their jobsite safety climate. CPWR also provides [Hazard Alert Cards](#) and [Toolbox Talks](#) in both English and Spanish for free download, and offers dedicated resources and websites, such as [silica-safe.org](http://silica-safe.org), to assist small establishments with safety and health planning.

While construction industry researchers and practitioners have long recognized the need to reach small employers, as evidenced by efforts in the previous decade from the NORA Construction Sector Council-initiated Falls Campaign, the increased fatality rate for these establishments as reported in this brief is particularly alarming. CPWR will continue to work with its industry partners, OSHA, NIOSH, and the NORA Construction Sector Council to address the needs of small establishments and will also launch a new initiative to characterize over 90% of U.S. construction industry employers with fewer than 20 employees. Working with our industry stakeholders, including unions, joint labor/management organizations, and contractor associations, in combination with our periodic employer surveys in collaboration with Dodge Data & Analytics, we hope to learn more about the construction subsectors, for instance, the Specialty Trade Contractors subsector that comprises the majority of the construction industry. As part of our larger research to practice (r2p) efforts, our aim is to identify and develop various ways to inform these groups of small contractors about the free resources and tools available to them, and to provide us feedback so that we can continue to improve our efforts to help reduce fatalities.

**“Establishing a safe and healthful working environment requires every employer – large and small – and every worker to make safety and health a top priority.”** (OSHA, 2018).

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## References

- CPWR - The Center for Construction Research and Training. [2018]. The Construction Chart Book: The U.S. Construction Industry and Its Workers, 6th Ed. Silver Spring, MD: CPWR - The Center for Construction Research and Training. <https://www.cpwr.com/publications/construction-chart-book> (Accessed September 2018)
- Dodge & Data Analytics. [2017]. Safety Management in the Construction Industry 2017. <https://www.cpwr.com/publications/safety-management-construction-industry-2017> (Accessed September 2018)
- Dodge & Data Analytics. [2016]. Building a Safety Culture: Improving Safety and Health Management in the Construction Industry. <http://www.cpwr.com/sites/default/files/research/Building%20a%20Safety%20Culture%20SmartMarket%20Report%202016%20ff.pdf> (Accessed September 2018)
- Dodge & Data Analytics. [2013]. Safety Management in the Construction Industry. [https://www.cpwr.com/sites/default/files/publications/SafetyManagementinConstructionSMR-2013\\_0.pdf](https://www.cpwr.com/sites/default/files/publications/SafetyManagementinConstructionSMR-2013_0.pdf) (Accessed September 2018)
- Dong XS, Fujimoto A, Ringer K, Stafford E, Platner J, Gittleman J, Wang X. [2011]. Injury Underreporting among Small Establishments in the Construction Industry. *Am J Ind Med.* May; 54(5):339-49
- Dong XS, Largay JA, Choi SD, Wang X, Cain CT, Romano N. [2017]. Fatal falls and PFAS use in the construction industry: Findings from the NIOSH FACE reports. *Accid Anal Prev.* May; 102:136-4
- Dong XS, Wang X, Largay JA, Platner J, Stafford E, Cain CT, Choi SD. [2014]. Fatal falls in the U.S. residential construction industry. *Am J Ind Med.* Sept; 57(9):992-1000
- National Institute for Occupational Safety and Health (NIOSH). [2018]. Small Business - Understanding Small Business Challenges. <https://www.cdc.gov/niosh/topics/smbus/challenges.html> (Accessed September 2018)
- Occupational Safety and Health Administration (OSHA). [2018]. Q & A's for Small Business Employers. <https://www.osha.gov/Publications/OSHA3163/osha3163.html> (Accessed September 2018)
- Wang X, Dong XS, Goldenhar LM. [2016]. Safety Management and Safety Culture among Small Construction Firms. [http://www.cpwr.com/sites/default/files/publications/2nd%20Quarter%202016\\_0.pdf](http://www.cpwr.com/sites/default/files/publications/2nd%20Quarter%202016_0.pdf) (Accessed September 2018)

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## Data Sources

- U.S. Bureau of Labor Statistics, 2003-2016 Census of Fatal Occupational Injuries
- U.S. Census Bureau, 2003-2016 County Business Patterns

## 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/>

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

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

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

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

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