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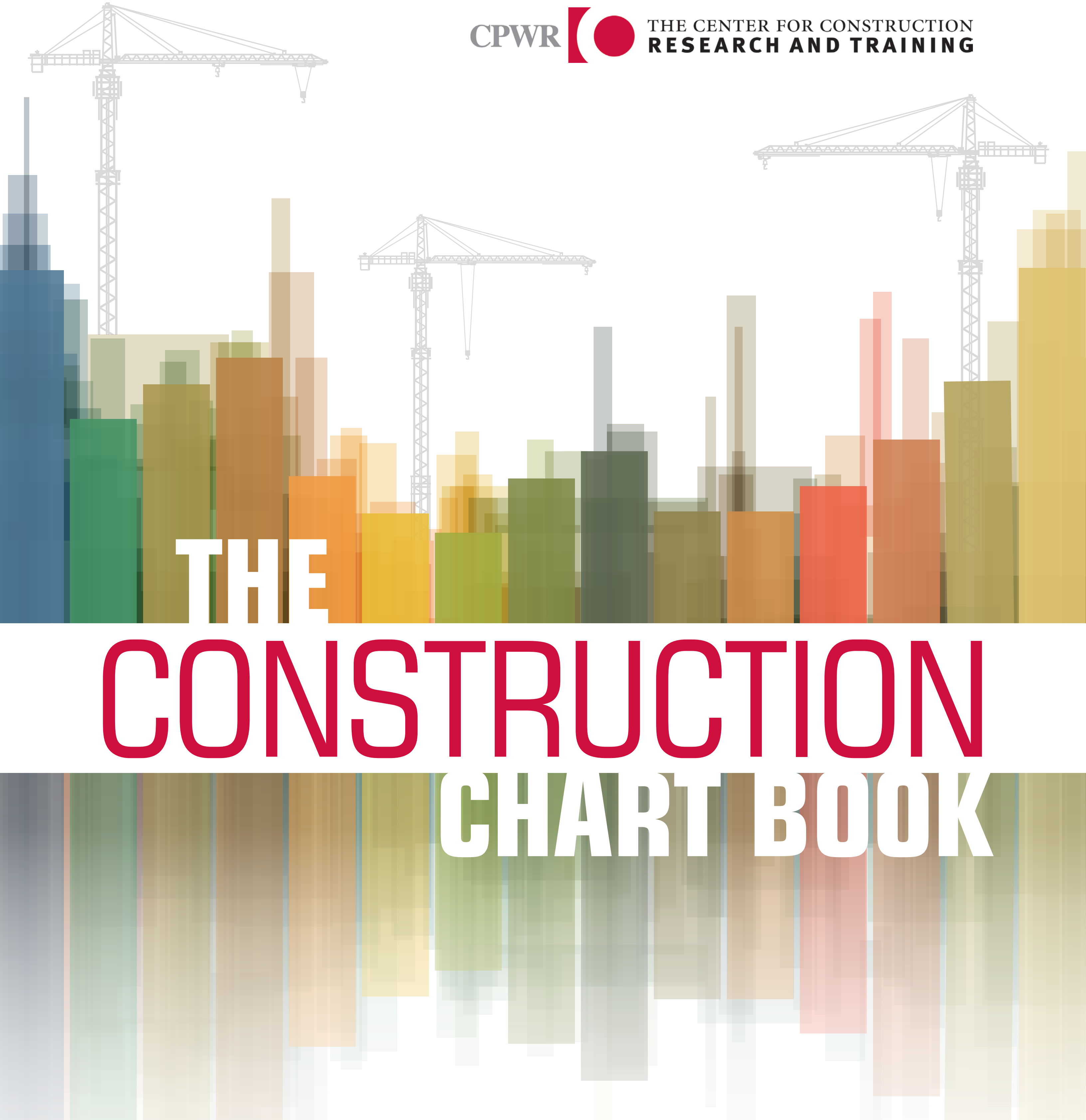

THE CONSTRUCTION CHART BOOK

THE U.S. CONSTRUCTION INDUSTRY AND ITS WORKERS

SIXTH EDITION eChart Book 2018

2018

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Sixth Edition

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February 2018

This publication was made possible by grant number OH009762 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.

CPWR – the research and training arm of NABTU – is uniquely situated to serve workers, contractors, and the scientific community. A core function of CPWR's work is to improve safety and health in the construction industry. This volume is part of that effort.

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FOREWORD

Today, we have access to knowledge sources worldwide in a matter of seconds. Yet with all this information, we still seem to have a deficit of facts that we can use with absolute surety of their accuracy. So we take special pleasure in writing a foreword to a book of numbers based in facts.

The Construction Chart Book: The U.S. Construction Industry and Its Workers delivers an assessment of where we stand as an industry, based on the most recent data available from trusted public and private sources. The book covers construction industry economics, demographics, and changes to employment and training, in addition to safety hazards and dangerous chemicals that can compromise life and health. In short, this book examines aspects of construction that affect every man and woman working in our industry.

This sixth edition sheds light on issues that have arisen in the last few years. With facts and charts we see trends and identify issues that affect workers and industry. If you want to know about unionization in the construction industry, go to page 12, which tells you that about 1.2 million construction workers were union members in 2016, 100,000 more than in 2015; and union market share reached 42% to 50% in the Heavy Civil/Industrial sector. Where can you find the number of U.S. construction workers who've gone back to work since the economic downturn? Page 20. Page 22 shows the percentage of construction workers who are self-employed dipped from 19% in 2010 to 16% in 2015. That change may look like good news, but it means 1.6 million construction workers are still classified under that category in our industry. They aren't protected by OSHA. When they suffer an injury, they are on their own, with no workers' compensation to cover medical and lost-time expenses. We also see that while the overall nonfatal injury trend in construction is declining, falls continue to kill or disable construction workers. Fall prevention remains a big challenge for our industry.

Those of us in North America's Building Trades Unions (NABTU) are proud to point to the book's publisher: CPWR – The Center for Construction Research and Training, a not-for-profit institution created by our organization. CPWR's research products, whether a report, website, conference summary, or this book, are available online at no charge. We are prouder still to see this information offered to all parties interested in the construction industry – owners, contractors, associations, government, academia, and of course unions and workers, union and non-union alike. CPWR is able to offer this top-quality research through its cooperative agreement with one of our nation's most important federal agencies, whose work often goes unnoticed, the National Institute for Occupational Safety and Health (NIOSH).

We'll end with the sobering statistics found on page 38. Our industry remains top in the number of workers killed on the job in this nation. This alone should make all of us who care about construction workers take a look at this book – and the work of CPWR. It's everyone's business to make our worksites safer and healthier for all.

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Abbreviations

ABLES	Adult Blood Lead Epidemiology and Surveillance Program
ACA	Affordable Care Act
ACS	American Community Survey
ATUS	American Time Use Survey
BEA	Bureau of Economic Analysis
BeS	Beryllium sensitivity
BLL	Blood lead level
BLS	Bureau of Labor Statistics
BMI	Body mass index
BRFSS	Behavioral Risk Factor Surveillance System
BTMed	Building Trades National Medical Screening Program
CBD	Chronic beryllium disease
CBP	County Business Patterns
CDC	Centers for Disease Control and Prevention
CES	Current Employment Statistics
CFOI	Census of Fatal Occupational Injuries
CHAMPUS	Civilian Health and Medical Program of the Uniformed Services
CHAMPVA	Civilian Health and Medical Program of the Department of Veterans Affairs
COPD	Chronic obstructive pulmonary disease
CPI	Consumer Price Index
CPI-W	Urban Wage Consumer Price Index
CPS	Current Population Survey
CWCS	Center for Workers' Compensation Studies
DAFW	Days away from work
DALY	Disability-adjusted life year
dBA	A-weighted decibels
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
ECI	Employment Cost Index
eLCOSH	Electrical Library of Construction Occupational Safety and Health
EPA	Environmental Protection Agency
ENM	Engineered nanomaterials
ETA	Employment Training Administration
FRED	Federal Reserve Economic Data
FTE	Full-time equivalent worker
GDP	Gross Domestic Product
GDPDEF	Gross Domestic Product: Implicit Price Deflator
GSA	Government Services Administration
HIV	Human Immunodeficiency Virus
HPD	Hearing protection devices
HRS	Health and Retirement Study
ILO	International Labour Organization
IMIS	Integrated Management Information System
IRS	Internal Revenue Service
ISIC	International Standard Industrial Classification
JOLTS	Job Openings and Labor Turnover Survey
LEED	Leadership in Energy and Environmental Design
LEV	Local exhaust ventilation
MEPS	Medical Expenditure Panel Survey
MMP	Mexican Migration Project
μg/dL	Micrograms per deciliter
$\mu g/m^3$	Micrograms per meter cubed
MSD	Musculoskeletal disorders
NABTU	North America's Building Trades Unions
NAICS	North American Industry Classification System
NASI	National Academy of Social Insurance
NCHS	National Center for Health Statistics
NCS	National Compensation Survey
NEP	Nano-enhanced products
NEC	Not elsewhere classified
NHIS	National Health Interview Survey
NIHL	Noise-induced hearing loss
NIOSH	National Institute for Occupational Safety and Health
NNI	National Nanotechnology Initiative
NORA	National Occupational Research Agenda

Abbreviations continued

OES	Occupational Employment Statistics
OHL	Occupational Hearing Loss
OIICS	Occupational Injury and Illness Classification System
O*NET	Occupational Information Network
OSHA	Occupational Safety and Health Administration
OTI	OSHA Training Institute
PEL	Permissible exposure limit
PFAS	Personal fall arrest systems
PPACA	Patient Protection and Affordable Care Act
PPE	Personal protective equipment
PRC	Pew Research Center
PtD	Prevention through Design
QCEW	Quarterly Census of Employment and Wages
RAPIDS	Registered Apprenticeship Partners Information Management Data System
REL	Recommended exposure level
RNLE	Revised NIOSH Lifting Equation
r2p	Research to practice
SAA	State Apprenticeship Agency
SAVE	Safety voice for ergonomics project
SBO	Survey of Business Owners
SIC	Standard Industrial Classification
SOC	Standard Occupational Classification
SOII	Survey of Occupational Injuries and Illnesses
SVEP	Severe Violator Enforcement Program
SWR	Serious, willful, and repeat
TLV	Threshold limit value
TWI	Temporary Worker Initiative
USGBC	U.S. Green Building Council
WBV	Whole body vibration
WHD	Wage and Hour Division
WMSD	Work-related musculoskeletal disorder

Contents

Topics

Detailed Contents of the Construction Chart Book

Sixth Edition

Introduction

The Construction Chart Book, now in its sixth edition, has been serving construction stakeholders for two decades since it was first published in 1997. In response to the needs of construction stakeholders, this book has evolved across editions, incorporating more data sources and covering a wider variety of topics.

The sixth edition is similar to previous editions in major content areas and layout, but is the first time as a web-based publication at CPWR.com. The online format allows for interactive features that enhance the user experience. Users can click on terms to access definitions instantly, and easily enlarge charts and tables within each page. References, citations, and databases are also hyperlinked to enable users to further explore these sources. In addition, the charts are available in both PDF and PowerPoint formats, which can be downloaded directly from the topic pages.

This new edition consists of nine sections presented in 56 topic pages containing more than 250 charts and tables. *Industry Summary* profiles construction establishments and their owners, and illustrates the recovery of construction after the latest recession. *Labor Force Characteristics* comprises the changing demographics of the construction workforce, and addresses union membership, the aging workforce, Hispanic workers, and immigrant workers employed in construction. *Employment and Income* analyzes variations in construction employment, work hours, earnings, and benefits (such as health insurance coverage and retirement plans), and highlights concerns about temporary workers and employee misclassification. Data on educational attainment and apprenticeships are included in *Education and Training*. This section also provides information regarding access to computers and the internet, and 10-year projections for construction employment, accounting for both replacement and new jobs.

Safety and health issues are covered in the remaining five sections. *Hazards and Exposures* describes general work conditions and hazards in construction, and discusses emerging topics such as the updated OSHA silica standard and engineered nanomaterials in this industry. *Fatal and Nonfatal Injuries* tracks the trends and patterns of construction injuries since 1992, providing insight into the leading causes and outcomes since the recent economic recovery. *Occupational Diseases* explores the prevalence of work-related illnesses among construction workers. OSHA inspections, citations, and penalties in the construction industry are found in *OSHA Enforcement and Injury Costs*. The last section, *Health Indicators and Services*, underscores health risk factors and chronic conditions among construction workers, revealing health and health services disparities among subgroups in construction.

The data contained in the Chart Book are from a wide variety of sources, many of which are large national datasets collected by government agencies such as the U.S. Census Bureau and the U.S. Bureau of Labor Statistics. Data from the National Center for Health Statistics are examined in this book to understand the health status of construction workers. Also included are the O*NET and apprenticeship data maintained by the U.S. Department of Labor Employment and Training Administration, lead exposure data from the NIOSH Adult Blood Lead Epidemiology and Surveillance (ABLES) program, Leadership in Energy and Environmental Design (LEED) data from the U.S. Green Building Council, and data on green construction from Dodge Data & Analytics. Several data sources are new to this edition, including NIOSH Occupational Hearing Loss (OHL) Worker Surveillance Data, the NIOSH Center for Workers' Compensation Studies (CWCS), and the Behavioral Risk Factor Surveillance System (BRFSS). To promote research to practice (r2p), select construction intervention methods and solutions are included in corresponding topic pages as well.

Most of the employment and demographic information in this book feature data up to 2015, matching the injury and illness data for the same time period reported in this book. However, there are some exceptions, contingent on how often a data source is updated. For instance, the industry data from the Economic Census are gathered every five years, with the most recent data collected in 2012. Since many of the figures in this book are tabulated by CPWR Data Center staff, some numbers may not be directly comparable to other publications using similar data sources due to differing quantitative methods. Readers should review accompanying notes associated with the text and charts for further information about how the findings were derived.

Despite data limitations and other constraints, this edition of the Construction Chart Book continues to provide a comprehensive resource and reference tool for our broad audience.

Main Findings

■ As of 2012 (the latest year for which data are available), 80% of the approximately 3 million construction establishments had no employees (or were non-employers, such as sole proprietorships; *see* page 2).

■ More than 80% of construction establishments with employees (or payroll) had fewer than 10 employees (*see* page 2).

■ In 2015, the construction industry contributed 4.1% to the U.S. Gross Domestic Product, compared to 3.5% in 2010 (*see* page 4).

■ By 2015, construction employment recovered to 9.9 million from 8.9 million in 2012, though it remained 2 million short of the peak of 11.8 million in 2007 (*see* page 20).

■ The unemployment rate in construction dropped from a peak of 27.1% in February 2010, to 7.5% by the end of 2015, the lowest level since 2007 (*see* page 20).

■ About 1.2 million construction workers were union members in 2016, 100,000 more than that in 2015. In the Heavy Civil/Industrial sector, union market share reached 42% to 50% (*see* page 12).

■ Between 1985 and 2015, the average age of construction workers jumped from 36.0 to 42.5 years, exceeding the average age for all industries (*see* page 13).

■ In 2015, about 2.4 million construction workers were foreign-born, accounting for nearly a quarter (24.7%) of the construction workforce; of these, the majority (84.3%) were from Latin America (*see* page 15).

■ The number of Hispanic construction workers increased to 2.8 million in 2015 from 2.2 million in 2010, close to its peak of 3.0 million in 2007 (*see* page 16).

■ In 2015, 2.4 million construction workers were self-employed; the proportion of unincorporated self-employed workers in construction decreased from 19% in 2010 to 16% in 2015 (*see* page 22).

■ Between 2010 and 2016, 35 states passed legislation preventing worker misclassification and increasing penalties for violations (*see* page 22).

■ There were 144,583 active apprentices in construction in fiscal year 2016, accounting for more than 70% of the total in all industries (*see* page 30).

■ Construction is expected to add nearly 800,000 wage-and-salary jobs between 2014 and 2024, double the rate projected for the overall economy (12.9% versus 6.5%; *see* page 31).

■ In 2015, only a third (33.7%) of Hispanic construction workers had health insurance through their employment, while the percentage was 56.3% among their white, non-Hispanic counterparts (*see* page 26).

■ Just 27% of construction wage earners participated in employment-based retirement plans in 2015, down from 39% in 2000; among establishments with fewer than 10 employees, only 10% participated in retirement plans (*see* page 27).

■ Union members in construction have advantages in educational attainment, wage and fringe benefits, training, and longer employment tenures, compared with non-union workers (multiple pages).

■ About 2.3 million workers are exposed to silica hazards in their workplaces. The majority – an estimated 2 million – work in construction (*see* page 34).

■ In 2016, among 6,160 cases with elevated blood lead levels (BLLs ≥10 μg/dL) throughout all industries identified by the NIOSH ABLES program, 20% were in the construction industry (*see* page 36).

■ In 2015, fatal injuries in construction increased to 985 deaths from a low of 781 deaths in 2011; the nonfatal cases resulting in days away from work (DAFW) increased from 74,000 to 80,000 in this time period, partly reflecting construction employment growth during the economic recovery (*see* pages 20 and 38). However, the overall rates for both fatal and nonfatal injuries in construction were downward since 1992 (*see* page 38).

■ Between 1992 and 2015, 7,235 deaths (42% of deaths among wage-and-salary construction workers) occurred in establishments with 10 or fewer employees, although less than 30% of construction workers were employed in such establishments (*see* page 40).

■ North Dakota, which was experiencing a boom in the energy extraction sector, had the highest fatal injury rate in the U.S. (41.5 deaths per 100,000 FTEs) in the period of 2011-2015 (*see* page 40).

■ The fatality rate for Hispanic workers in construction remained higher than their white, non-Hispanic counterparts, but the difference between the two groups has reduced from 48% higher for Hispanic workers in1992-2002 to 9% higher in 2012-2015 (*see* page 41).

■ Electrical power-line installers had the highest rate of fatal injuries (67.1 deaths per 100,000 FTEs), but the rate has significantly declined since 1992 (149.3 deaths per 100,000 FTEs; *see* page 42).

■ The "Construction Focus Four" (four major causes of fatal injuries in construction: falls to lower level, being struck by an object or a vehicle, contact with electric current, and caught-in/between) claimed more than 70% of construction fatalities from1992 through 2015, an average of 745 lives per year (*see* page 43).

■ The number of deaths due to falls to a lower level reached 353 in 2015, a 36% increase from 2011. Between 2003 and 2015, a total of 4,439 construction workers died from falls to a lower level, about 341 deaths annually (*see* page 44).

■ In 2015, the rate of work-related musculoskeletal disorders (WMSDs) in construction was 34.6 per 10,000 FTEs, about 25% of its 1992 level. Yet, it was 16% higher than the rate (29.8 per 10,000 FTEs) for all industries (*see* page 48).

■ The prevalence of cigarette smoking in construction declined from nearly 33% in 2000 to less than 24% in 2015, but more than 50% higher than that (15%) among workers in all industries combined (*see* page 55).

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Industrial Classification

The North American Industry Classification System (NAICS) is the standard to classify business *establishments* (*see* Glossary) for data collecting, analyzing, and publishing in North America.[1] NAICS was jointly developed by Canada, Mexico, and the U.S. to facilitate direct comparisons of economic data across borders in North America. NAICS replaced the Standard Industrial Classification (SIC) system in 1997, and is revised periodically to reflect changes in the industrial structure of the U.S. and North American economies.[2] Revisions in NAICS reflect the addition of new and emerging industries, and give special attention to the service industry and industries engaged in the production of advanced technologies. The 2002 NAICS had substantial revisions in construction industry classifications compared to the 1997 NAICS. As a result, construction data from previous years may not be comparable, particularly at the subsector level. Since 2002, the NAICS classifications have remained similar for the construction industry, albeit with minor changes in the 2012 NAICS.[1,3] The 2017 NAICS has been available since January 2017.[3]

NAICS is based solely on production processes and classifies each establishment according to the production processes it uses. Using a six-digit classification system, NAICS allows great flexibility in the coding structure. The first two digits of the six-digit hierarchical coding system designate the highest level groupings among major industry sectors. For example, the construction industry is coded as 23, and each subsequent digit makes the code more specialized (chart 1a). The sixth digit of the NAICS code allows each country to recognize its own, possibly unique, industries in more detail. Therefore, comparisons between the U.S., Canada, and Mexico can be made at the five-digit level, but not at the six-digit level. In the U.S., Residential Building Construction (NAICS 23611, charts 1a and 1b) at the six-digit level is composed of four subsectors (chart 1a). Similarly, for Specialty Trade Contractors (NAICS 238; charts 1a and 1b), the sixth digit of the NAICS codes in the U.S. assigns "1" for residential and "2" for nonresidential (chart 1a).

While NAICS is widely adopted by major data agencies in the U.S., data from household surveys (data collected from individual respondents) are coded by the U.S. Census Bureau's Industry Classification System. For example, the construction industry is coded as 0770 by the Census coding system, corresponding to NAICS 23. Unlike NAICS, the Census classifications do not assign codes for construction subsectors (e.g., residential or nonresidential construction). Therefore in this Chart Book, construction subsector information is unavailable for analyses based on household survey data (*see* pages 10, 12, 15, 21).

1a. NAICS six-digit classification structure

Code	Digit	Sector	Description
23----	First two	Major sector	Construction
236---	Third	Subsector	Construction of Buildings
2361--	Fourth	Industry group	Residential Building Construction
23611-	Fifth	NAICS international industry	Residential Building Construction
236115	Sixth	National industry (U.S.)	New Single-Family Housing Construction (except For-Sale Builders)
236116	Sixth	National industry (U.S.)	New Single-Family Housing Construction (except For-Sale Builders)
236117	Sixth	National industry (U.S.)	New Housing For-Sale Builders
236118	Sixth	National industry (U.S.)	Residential Remodelers
238---	Third	Subsector	Specialty Trade Contractors
2381--	Fourth	Industry group	Foundation, Structure, and Building Exterior Contractors
23811-	Fifth	NAICS international industry	Poured Concrete Foundation and Structure Contractors
238111	Sixth	National industry (U.S.)	Residential Poured Concrete Foundation and Structure Contractors
238112	Sixth	National industry (U.S.)	Nonresidential Poured Concrete Foundation and Structure Contractors
23812-	Fifth	NAICS international industry	Structural Steel and Precast Concrete Contractors
238121	Sixth	National industry (U.S.)	Residential Structural Steel and Precast Concrete Contractors
238122	Sixth	National industry (U.S.)	Nonresidential Structural Steel and Precast Concrete Contractors

1. U.S. Census Bureau. 2016. North American Industry Classification System. https://www.census.gov/eos/www/naics/history/history.html (Accessed December 2016).
2. U.S. Bureau of Labor Statistics. 2016. North American Industry Classification System (NAICS) at BLS. https://www.bls.gov/bls/naics.htm (Accessed December 2016).
3. Office of Management and Budget. 2016. North American Industry Classification System—Revision for 2017; Notice. Federal Register, 81(152). https://www.census.gov/eos/www/naics/federal_register_notices/notices/fr08au16.pdf (Accessed January 2017).

1b. Comparison of the North American Industry Classification System

2017/2012 NAICS	2017/2012 NAICS U.S. Description	2007/2002 NAICS	2007/2002 NAICS U.S. Description	1997 NAICS	1997 NAICS U.S. Description
236 Construction of Buildings					
23611	Residental Building Construction	23611	Residental Building Construction	23321	Single Family Housing Construction
				23322	Multifamily Housing Construction
23621	Industrial Building Construction	23621	Industrial Building Construction	23331	Manufacturing and Industrial Building Construction
				23493	Industrial Nonbuilding Structure Construction
				23499	All Other Heavy Construction
23622	Commercial and Institutional Building Construction	23622	Commercial and Institutional Building Construction	23322	Multifamily Housing Construction
				23331	Manufacturing and Industrial Building Construction
				23332	Commercial and Institutional Building Construction
				23599	All Other Special Trade Contractors
237 Heavy and Civil Engineering Construction					
23711	Water and Sewer Line and Related Structures Construction	23711	Water and Sewer Line and Related Structures Construction	23491	Water, Sewer, and Pipeline Construction
				23499	All Other Heavy Construction
				23581	Water Well Drilling Contractors
23712	Oil and Gas Pipeline and Related Structures Construction	23712	Oil and Gas Pipeline and Related Structures Construction	21311	Support Activities for Mining
				23491	Water, Sewer, and Pipeline Construction
				23493	Industrial Nonbuilding Structure Construction
23713	Power and Communication Line and Related Structures Construction	23713	Power and Communication Line and Related Structures Construction	23492	Power and Communication Transmission Line Construction
				23493	Industrial Nonbuilding Structure Construction
23721	Land Subdivision	23721	Land Subdivision	23311	Land Subdivision and Land Development
23731	Highway, Street, and Bridge Construction	23731	Highway, Street, and Bridge Construction	23411	Highway and Street Construction
				23412	Bridge and Tunnel Construction
				23521	Painting and Wall Covering Contractors
23799	Other Heavy and Civil Engineering Construction	23799	Other Heavy and Civil Engineering Construction	23412	Bridge and Tunnel Construction
				23499	All Other Heavy Construction
				23599	All Other Special Trade Contractors
238 Specialty Trade Contractors					
23811	Poured Concrete Foundation and Structure Contractors	23811	Poured Concrete Foundation and Structure Contractors	23571	Concrete Contractors
23812	Structural Steel and Precast Concrete Contractors	23812	Structural Steel and Precast Concrete Contractors	23591	Structural Steel Erection Contractors
23813	Framing Contractors	23813	Framing Contractors	23551	Carpentry Contractors
23814	Masonry Contractors	23814	Masonry Contractors	23541	Masonry and Stone Contractors
				23542	Drywall, Plastering, Acoustical, and Insulation Contractors

Note: Note: Chart 1b – Asterisk (*) indicates the classification changed in NAICS 2012.

Source: Chart 1a – U.S. Census Bureau. 2016. North American Industry Classification System. http://www.census.gov/eos/www/naics/ (Accessed January 2017).
U.S. Bureau of Labor Statistics, BLS NAICS 2012 Search. https://www.bls.gov/cew/bls_naics/bls_naics_app.htm (Accessed January 2017).
Chart 1b – U.S. Census Bureau. 2016. North American Industry Classification System. http://www.census.gov/eos/www/naics/ (Accessed January 2017).

2017/2012 NAICS	2017/2012 NAICS U.S. Description	2007/2002 NAICS	2007/2002 NAICS U.S. Description	1997 NAICS	1997 NAICS U.S. Description
23815	Glass and Glazing Contractors	23815	Glass and Glazing Contractors	23592	Glass and Glazing Contractors
23816	Roofing Contractors	23816	Roofing Contractors	23561	Roofing, Siding, and Sheet Metal Contractors
23817	Siding Contractors	23817	Siding Contractors	23561	Roofing, Siding, and Sheet Metal Contractors
23819	Other Foundation, Structure, and Building Exterior Contractors	23819	Other Foundation, Structure, and Building Exterior Contractors	23591	Structural Steel Erection Contractors
				23599	All Other Special Trade Contractors
23821	Electrical Contractors and Other Wiring Installation Contractors	23821	Electrical Contractors and Other Wiring Installation Contractors	23491	Water, Sewer, and Pipeline Construction
				23499	All Other Heavy Construction
23822	Plumbing, Heating, and Air-Conditioning Contractors	23822	Plumbing, Heating, and Air-Conditioning Contractors	23511	Plumbing, Heating, and Air-Conditioning Contractors
				23591	Structural Steel Erection Contractors
				23595	Building Equipment and Other Machinery Installation Contractors
23829	Other Building Equipment Contractors	23829	Other Building Equipment Contractors	23595	Building Equipment and Other Machinery Installation Contractors
				23599	All Other Special Trade Contractors
23831*	Drywall and Insulation Contractors	23819	Other Foundation, Structure, and Building Exterior Contractors - Building Fireproofing Contractors	23591	Structural Steel Erection Contractors
				23599	All Other Special Trade Contractors
		23831	Drywall and Insulation Contractors	23542	Drywall, Plastering, Acoustical, and Insulation Contractors
		23833	Flooring Contractors- Fireproof Flooring Construction Contractors	23552	Floor Laying and Other Floor Contractors
23832	Painting and Wall Covering Contractors	23832	Painting and Wall Covering Contractors	23521	Painting and Wall Covering Contractors
23833	Flooring Contractors	23833	Flooring Contractors	23552	Floor Laying and Other Floor Contractors
23834	Tile and Terrazzo Contractors	23834	Tile and Terrazzo Contractors	23543	Tile, Marble, Terrazzo, and Mosaic Contractors
23835	Finish Carpentry Contractors	23835	Finish Carpentry Contractors	23551	Carpentry Contractors
23839	Other Building Finishing Contractors	23839	Other Building Finishing Contractors	23561	Roofing, Siding, and Sheet Metal Contractors
				23599	All Other Special Trade Contractors
23891	Site Preparation Contractors	23891	Site Preparation Contractors	21311	Support Activities for Mining
				23499	All Other Heavy Construction
				23511	Plumbing, Heating, and Air-Conditioning Contractors
				23593	Excavation Contractors
				23594	Wrecking and Demolition Contractors
				23599	All Other Special Trade Contractors
23899	All Other Specialty Trade Contractors	23899	All Other Specialty Trade Contractors	23499	All Other Heavy Construction
				23571	Concrete Contractors
				23599	All Other Special Trade Contractors
				56172	Janitorial Services

Payroll Establishments and Employees in Construction

The Economic Census, one of the main sources of information on the structure and performance of the U.S. economy, is conducted every five years by the U.S. Census Bureau and covers nearly all businesses and industries in the private, non-farm U.S. economy. The most recent Economic Census, conducted in 2012, reported 598,065 construction *establishments* (*see* Glossary) with payroll, an 18% decrease from 729,345 establishments in 2007 in the aftermath of the Great Recession.[1] Establishments without paid employees (*nonemployer, see* Glossary) are excluded from the Economic Census, and are reported separately in the annual Nonemployer Statistics series (*see* page 3).

According to the Economic Census definition, an establishment (with payroll) is a single physical location at which business is conducted and/or services are provided. Therefore, a company or *corporation* (*see* Glossary) may consist of multiple establishments or offices. An establishment usually has a permanent address and may be responsible for multiple projects at one time.

Based on this definition, the majority of construction establishments are small; about 81% of payroll establishments had fewer than 10 employees in 2012 (chart 2a). Large establishments, those with 500 or more employees, accounted for 0.1% of the total number of construction establishments with payroll, yet employed over 9% of the industry's *paid employees* (*see* Glossary).

The number of payroll establishments in the construction industry fluctuated with the business cycle, generally increasing until 2007, and then decreased significantly in each major construction sector (chart 2b). While the overall economy was climbing out of the recession by 2012, economic recovery was delayed in construction. The number of establishments in the Specialty Trade Contractors sector was 400,950 in 2012, about 16% less than the 2007 peak of 477,950. During this period, establishments in both Construction of Buildings and Heavy and Civil Engineering Construction also decreased by 22% and 17%, respectively.

Across business cycles, construction employment tends to be more volatile than the number of construction establishments. During the Great Recession, while the overall number of construction establishments fell by 18% between 2007 and 2012, the number of construction paid employees fell by 23% from 7.32 million to 5.67 million in the same time period. Following the trends in overall construction employment, employment in the Specialty Trade Contractors sector fell from 4.73 million to 3.62 million, a decrease of more than 23% (chart 2c). Employment in the Construction of Buildings sector fell by 29.6%, while the Heavy and Civil Engineering Construction sector decreased by 7.9%. These changes reflect the significant impact of the housing market in the construction industry[2] and the stabilizing role of government construction expenditures on non-housing projects during the Great Recession (chart 2c).

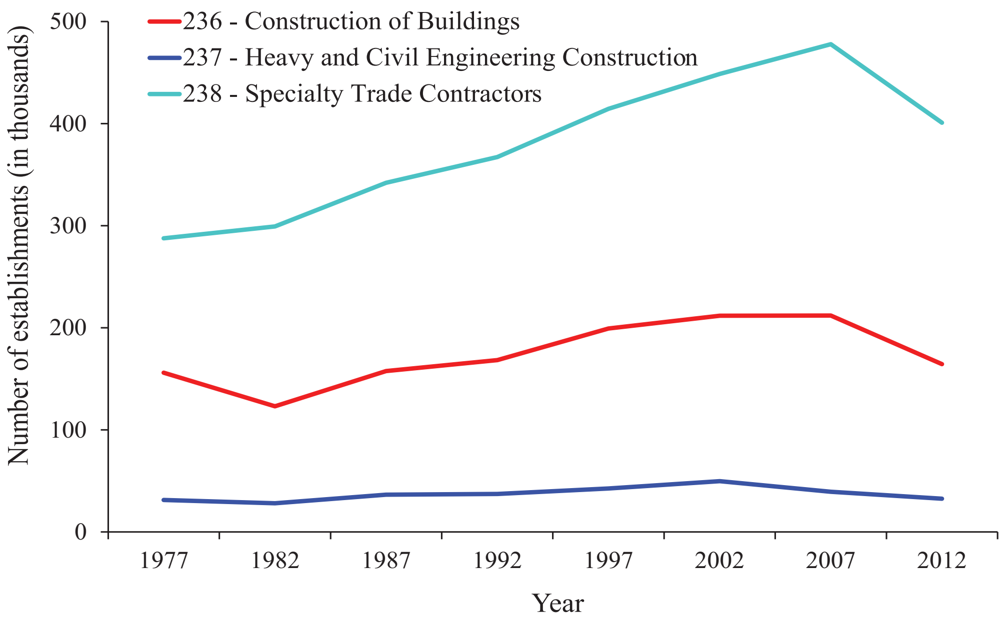
In addition to economic cycles, construction employment is affected by seasons. The census averages quarterly counts of employees. In 2012, payroll employment in construction was at its lowest level of 5.4 million in March and rose to 5.9 million in September.[3]

2a. Number and percentage of construction establishments and employees, by establishment size, 2012 (With payroll)

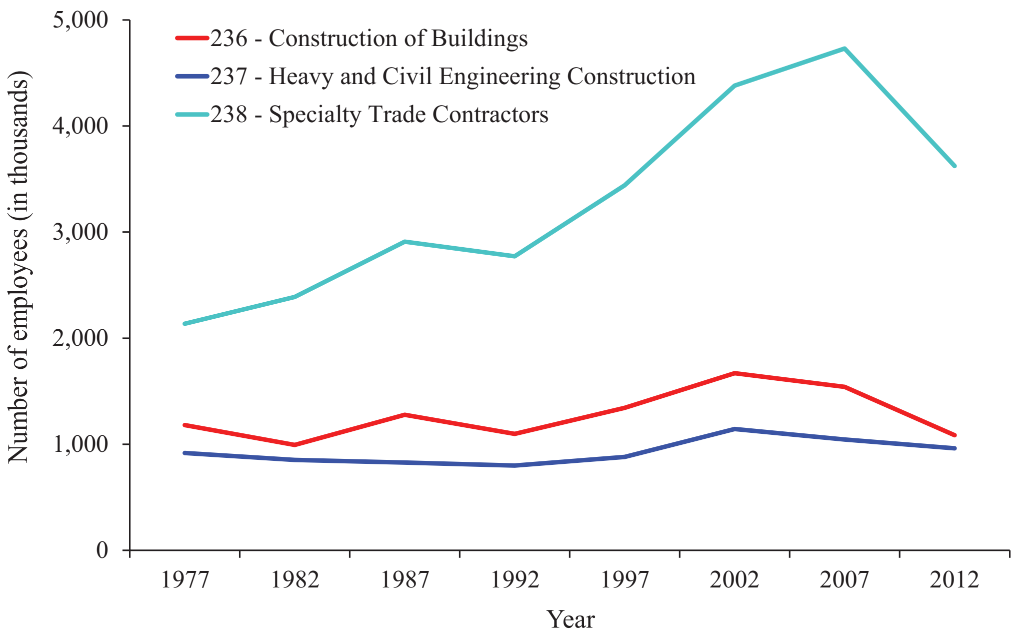
Establishment size (number of employees)	Number of establishments	% of all establishments	Number of employees	% of all employees
1 to 9	484,866	81.1%	1,409,984	24.9%
10 to 19	58,731	9.8%	805,819	14.2%
20 to 99	48,151	8.1%	1,868,325	33.0%
100 to 499	5,866	1.0%	1,069,382	18.9%
500 or more	452	0.1%	516,112	9.1%
Total	598,065	100.0%	5,669,623	100.0%

1. U.S. Census Bureau. 2012 and 2007 Economic Census. http://www.census.gov/programs-surveys/economic-census.html (Accessed March 2016).
2. Scopelliti DM. 2014. Housing: Before, During, and After the Great Recession. U.S. Bureau of Labor Statistics. Spotlight on Statistics. http://www.bls.gov/spotlight/2014/housing/pdf/housing.pdf (Accessed November 2016).
3. The average number of non-leased construction employees is the sum of establishment averages of non-leased construction workers who were on the payroll during the pay periods including the 12th of March, June, September, and December. http://www.census.gov/programs-surveys/economic-census.html (Accessed March 2016).

2b. Number of construction establishments, 1977-2012 (With payroll)



2c. Number of construction employees, 1977-2012 (With payroll)



Note: All charts – Data cover the private sector only.
Chart 2a – Totals may not add to 100% (or the exact sum) due to rounding.
Charts 2b and 2c – In 2012, payroll establishments totaled 598,065, with 5.7 million employees.

Source: Chart 2a – U.S. Census Bureau. 2012 Economic Census. Construction Summary Series (EC1223SG01). http://www.census.gov/data/tables/2012/econ/census/construction.html (Accessed April 2016).
Charts 2b and 2c – U.S. Census Bureau. 2012 and previous years Economic Census, Industry Series, Construction. www.census.gov/econ/construction.html (Accessed April 2016).

Nonemployer Establishments in Construction

Establishments without payroll (i.e., nonemployer establishments) constitute the majority of businesses in the construction industry. A nonemployer establishment has no paid employees, has annual business receipts of $1 or more in the construction industry, and is subject to federal income taxes. Nonemployer businesses may operate from a home address or a separate physical location. More than 90% of nonemployer establishments in construction are individual proprietorships or self-employed (*see* page 22), and the rest are small corporations and partnerships without paid employees.[1]

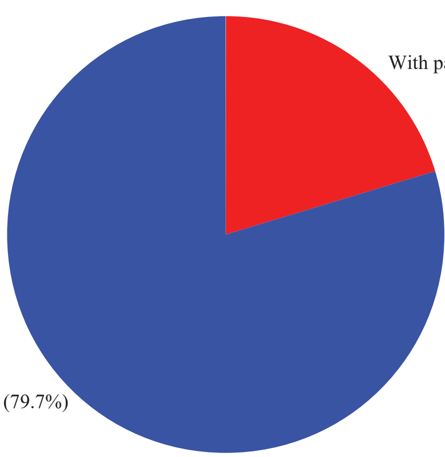
In 2012, there were 2.35 million nonemployer establishments in construction, a decrease of more than 11% from 2.66 million in 2007, reflecting the intervening economic recession in the U.S. during this time period.[1] In total, there were 2.94 million construction establishments in 2012, including both establishments with and without payroll (*see* page 2). Even though nonemployer establishments accounted for almost 80% of construction establishments (chart 3a), they produced just 8.5% of the *dollar value of business done* (*see* Glossary) in the construction industry (chart 3b).

Nonemployer establishments are more common in Residential Construction (NAICS 2361, *see* page 1 for industry codes and definitions) and some Specialty Trade Contractor sectors. In 2012, 79% of establishments in Residential Construction had no paid employees (chart 3c). Among the Building Finishing Contractors sector (NAICS 2383), the proportion of nonemployer establishments was even higher (86%). Corresponding to the number of establishments, the proportion of the dollar value of construction work produced by nonemployer establishments was the largest in the building finishing sector — over one-fifth of the dollar value ($25.2 billion of $113 billion; chart 3d).

The proportion of nonemployer establishments varies by state. In 16 states and the District of Columbia, establishments without payroll made up more than 80% of construction establishments in 2012 (in decreasing order: Texas [88%], Tennessee, Mississippi, Georgia, Arkansas, Kentucky, Alabama, Louisiana, District of Columbia, Ohio, Oklahoma, Michigan, New Hampshire, North Carolina, Connecticut, South Carolina, and Missouri; chart 3e). Washington had the lowest proportion of establishments without payroll at 63%, though it has increased from 59% in 1997. Overall, the proportion of nonemployer establishments in construction increased from 74% in 1997[2] to about 80% in 2012.

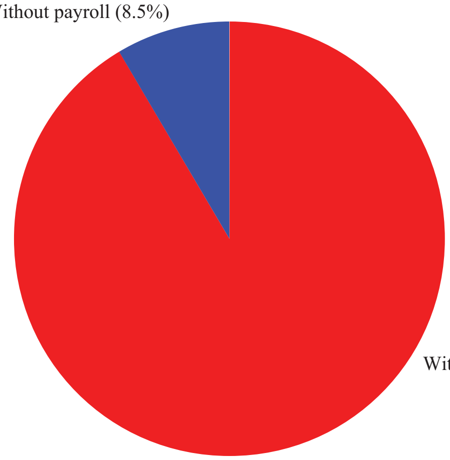
3a. Percentage of construction establishments with and without payroll, 2012

Total number of establishments = 2.94 million



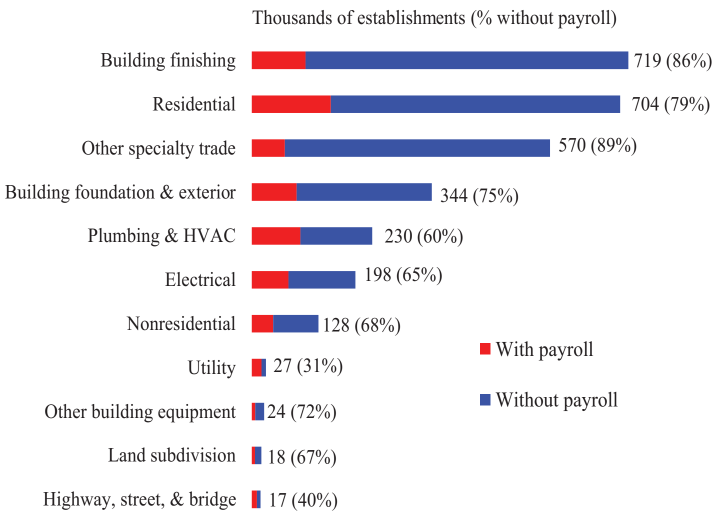
3b. Share of dollar value produced in construction establishments with and without payroll, 2012

Total dollar value produced = $1.49 trillion

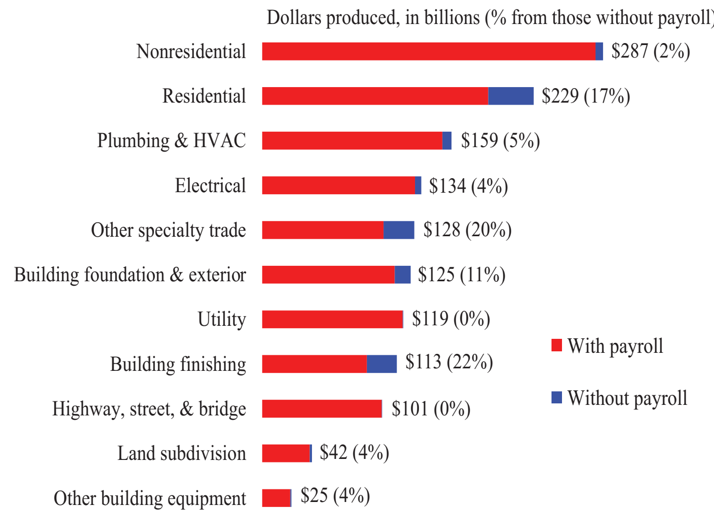


1. U.S. Census Bureau. Nonemployer Statistics. https://www.census.gov/programs-surveys/nonemployer-statistics.html (Accessed February 2016). An *individual proprietorship* is also referred to as a "sole proprietorship," or an unincorporated business with a sole owner. Also included in this category are self-employed persons. A *partnership* is an unincorporated business owned by two or more persons having a shared financial interest in the business. A *corporation* is a business legally incorporated under state laws. These data are from tax return information published by the Internal Revenue Service. The data are subject to non-sampling error such as errors of self-classification by industry on tax forms, as well as errors of response, non-reporting, and cover age. The non-reporting can be due to the underground economy.
2. U.S. Census Bureau. 1997 Economic Census: Industry Summary, Construction Subject Series, https://www.census.gov/prod/ec97/97c23-is.pdf and 1997 Economic Census: Nonemployer Statistics, Core Business Statistics Series, https://www.census.gov/prod/ec97/97x-cs4.pdf (Accessed February 2017).

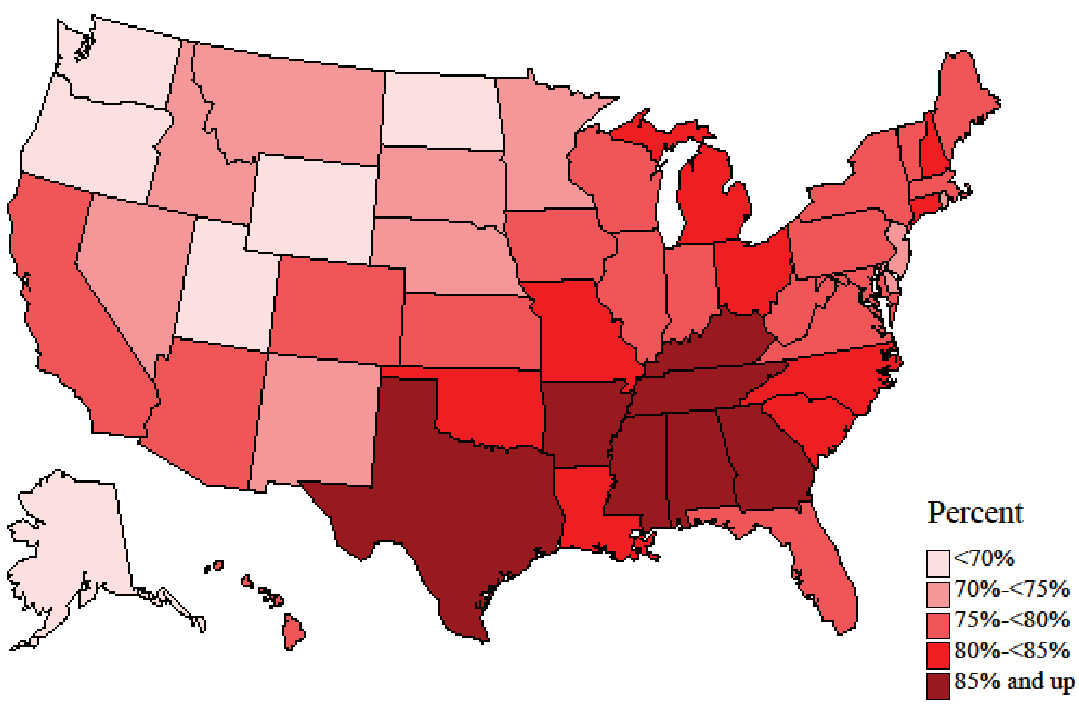
3c. Number of establishments in selected construction sectors with and without payroll, 2012



3d. Dollar value of construction work produced, selected construction sectors with and without payroll, 2012



3e. Nonemployer establishments as a percentage of all construction establishments, by state, 2012



Note: Charts 3a and 3b – Data cover the private sector only. Detail may not add to total due to rounding. In 2012, payroll establishments totaled 598,065 with 5.7 million employees.
Charts 3c and 3d – Number for each category is a combination of establishments with and without payroll. Data are matched at the four- or five-digit NAICS level.
Chart 3e – Total of 2,346,798 nonemployer establishments ranged from 63% to 88% of the total by state.

Source: Charts 3a-3d – U.S. Census Bureau. 2012 Economic Census. Construction Summary Series. (EC1223SG01) https://www.census.gov/econ/construction.html (Accessed April 2016). U.S. Census Bureau. 2012 Nonemployer Statistics. https://www.census.gov/programs-surveys/nonemployer-statistics.html (Accessed April 2016).
Chart 3e – U.S. Census Bureau. 2012 Economic Census, Construction Geographic Areas Series. (EC1223A1) https://www.census.gov/econ/construction.html (Accessed April 2016). U.S. Census Bureau. 2012 Nonemployer Statistics. https://www.census.gov/programs-surveys/nonemployer-statistics.html (Accessed April 2016).

Value Produced and Expended in Construction

An industry's contribution to the *Gross Domestic Product (GDP, see* Glossary) is measured by its value added.[1] In 2015, the construction industry contributed $623.9 billion (4.1%) to the total GDP of the U.S. (chart 4a). While the number and percent of real value added dipped to a low point during the economic recession, it has climbed gradually since.

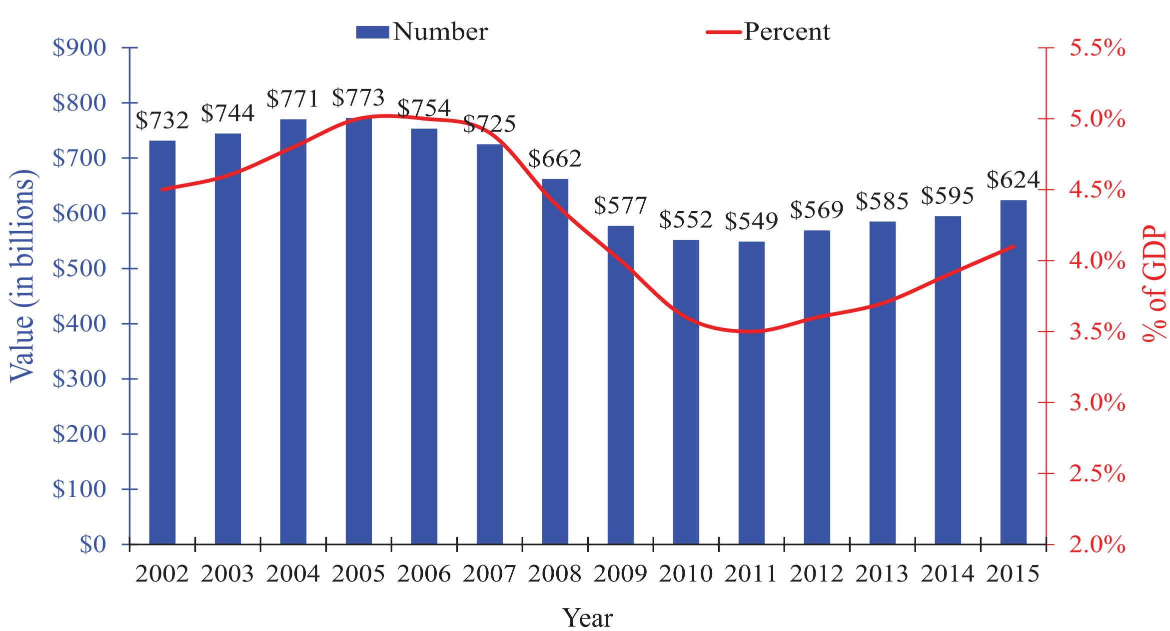
Value added prices (*see* Glossary) quantify changes in an industry's cost and labor inputs, and reflect the productivity of capital and labor used by the industry. Compared with the overall private *goods-producing industry* (*see* Glossary) as measured by the value added price indices,[2] construction fell faster at the outset of the Great Recession (which began earlier for construction compared to the overall economy) and has grown at a similar pace but from a lower level in the subsequent recovery (chart 4b).

Despite fluctuations in construction value through several business cycles, payroll and fringe benefits in construction have declined as a proportion of the value of *construction work done* (*see* Glossary). From 1977 to 2012, the proportion allocated to compensation dropped 16% from 30.5% to 25.5% of overall construction value (chart 4c). The percentage of receipts directed towards compensation in the Construction of Buildings sector (NAICS 236) shrank from 18.7% to 13.4%, a decrease of more than 28% during this period. The Construction of Buildings sector also represented the smallest share of compensation among the three major construction sectors.

In 2012, materials (including components and supplies) comprised the largest proportion of expenses for construction payroll establishments, accounting for 28% of the total value of construction business done (chart 4d). Subcontracting was the second largest category at 25% (totaling $340 billion) of the dollar value produced by such establishments.[3] Expenses on payroll and fringe benefits made up 20% and 5%, respectively. In addition, of the service expenses for payroll establishments (about $92 billion), roughly $3.9 billion was used to pay temporary staff and leased employees. Overall, 11.4% ($156.2 billion) of the value of construction business done was not categorized and may include profits.

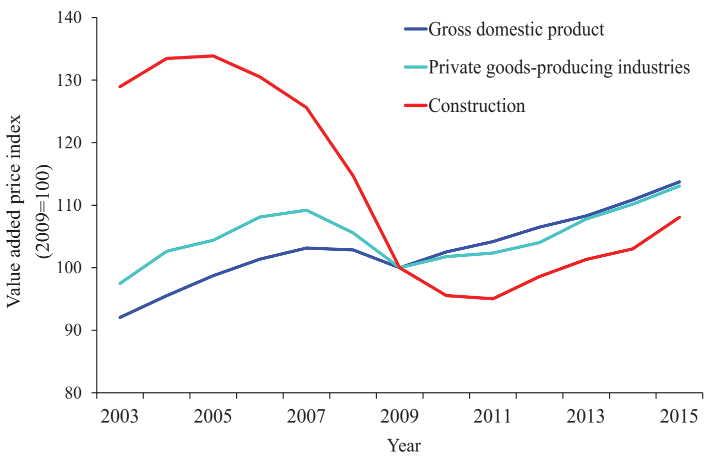
As some types of establishments subcontract a large share of their work, their output may appear disproportionately high compared with their number of direct employees. For instance, Nonresidential Building Construction (NAICS 2362), which had 10% of overall payroll employees in construction, produced $314 billion or 23% of the value of construction work from payroll establishments in 2012, while 49% of the work produced by this sector was done by subcontractors.[4]

4a. Real value added by construction and as a percentage of GDP in the U.S., 2002-2015 (2009 dollars)

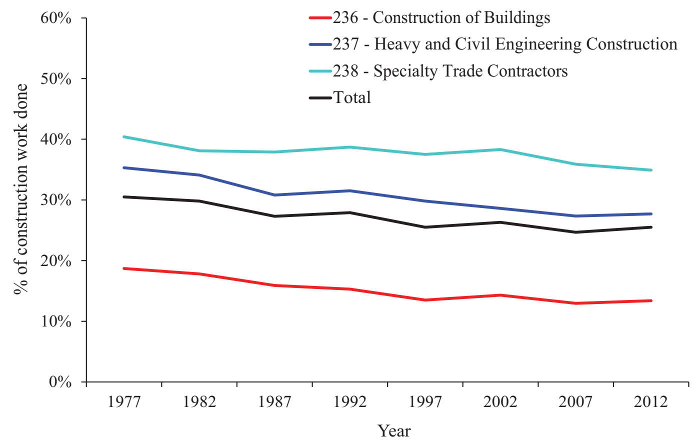


1. U.S. Bureau of Economic Analysis (BEA). Value Added by Industry. http://www.bea.gov/industry/gdpbyind_data.htm (Accessed April 2016).
2. In the chain-type price indices for value added reported by the BEA, 2009 is used as a base year in the 2002–2015 data.
3. The U.S. Census Bureau does not detail the components of the subcontracting category.
4. U.S. Census Bureau. 2012 Economic Census, Construction Subject Series. https://www.census.gov/econ/construction.html (Accessed April 2016).

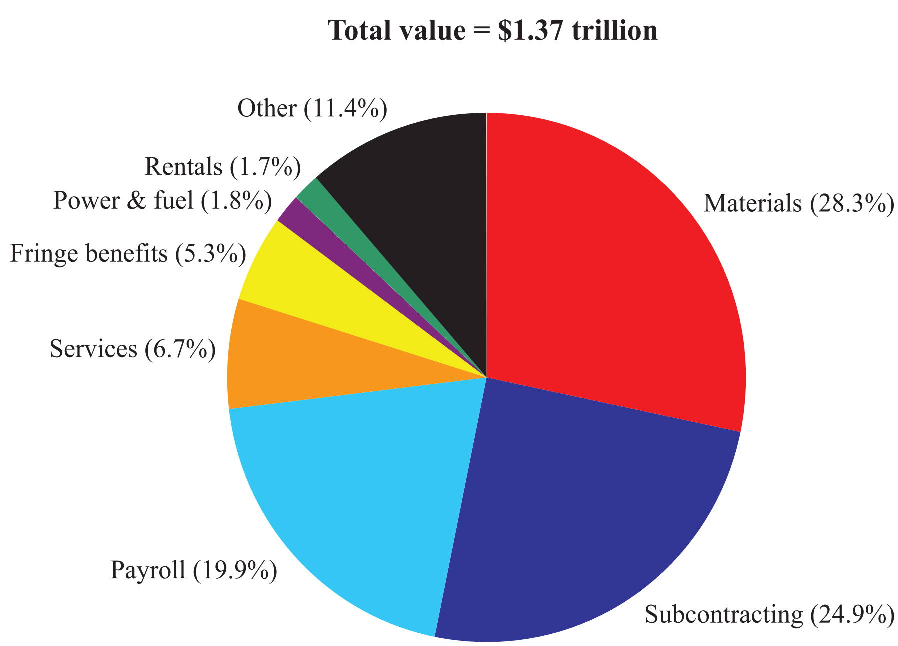
4b. Chain-type price indices for value added by industry, 2003-2015



4c. Payroll and fringe benefits as a percentage of the value of construction work done, 1977-2012



4d. Where construction dollar value goes, 2012 (Payroll establishments)



Note: Chart 4a – Real dollar value means that dollars are adjusted for inflation.
Charts 4a, 4c, and 4d – Data cover the private sector only.
Chart 4d – "Other" includes profits and uncategorized items.

Source: Chart 4a – U.S. Bureau of Economic Analysis. Real Value Added by Industry. http://www.bea.gov/iTable/index_industry_gdpIndy.cfm (Accessed November 2016).
Chart 4b – U.S. Bureau of Economic Analysis. Chain-Type Quantity Indices for Value Added by Industry. http://www.bea.gov/iTable/index_industry_gdpIndy.cfm (Accessed November 2016).
Chart 4c – U.S. Census Bureau. 2012 and previous years Economic Census, Construction Subject Series. https://www.census.gov/econ/construction.html (Accessed April 2016).
Chart 4d – U.S. Census Bureau. 2012 Economic Census, Construction Subject Series. (EC1223SG03) https://www.census.gov/programs-surveys/nonemployer-statistics.html (Accessed April 2016).

Construction Spending: Private and Public Sector

Construction spending (formerly known as the value of construction put in place) is collected in a monthly survey that has been conducted by the U.S. Census Bureau since 1960.[1] Information on ownership (private or government, state, local, and federal level) and type of construction projects (for example, residential, commercial, or highways and streets) are collected by the survey. In 2015, the annual value of construction was $1.12 trillion, a 26% increase since 2010 after adjusting for inflation, but still lower than the 2006 peak of $1.35 trillion.[2,3,4]

Private construction is categorized as residential (*see* page 6) or nonresidential. Nonresidential construction is further categorized to include power facilities, commercial, manufacturing, and health care. Public construction consists primarily of educational, highways and streets, transportation, sewage and waste disposal, conservation and development, and water supply.

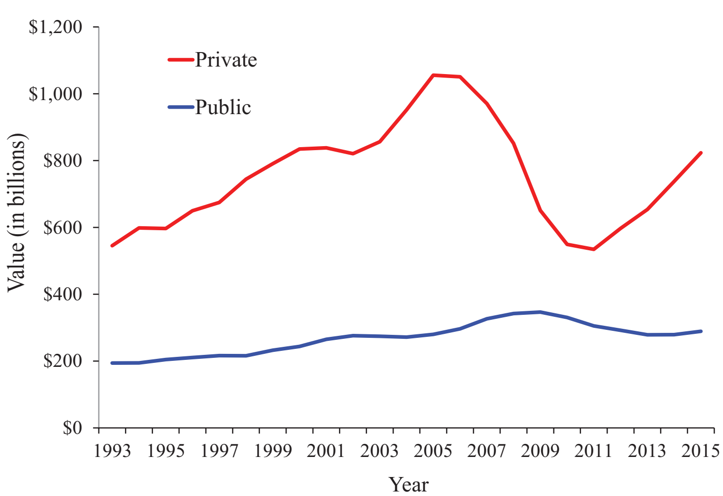
After adjusting to 2015 dollars, the value of private construction climbed to $1.06 trillion in 2005, declined to $534 billion in 2011, and rose again to $824 billion in 2015 (chart 5a). By contrast, the value of public construction increased modestly during this period, with a minor decline beginning in 2010. By 2015, public construction spending was close to 2006 levels when inflation was taken into consideration. The ratio of private to public construction sectors also fluctuated over time, from a ratio of 3.8:1 in 2005 down to a ratio of 1.7:1 in 2010, and then up to 2.9:1 in 2015, indicating that the impact of the Great Recession was greater for private construction than for public construction.

Within private construction, new single-family buildings and home improvements were the two largest types, accounting for about 46% of the total value in 2015 (chart 5b). The value of new single-family buildings rose from 22% in 2010 to 28% in 2015; meanwhile, the proportion of home improvements (*see* page 6) fell slightly from 23% to 18%.[1]

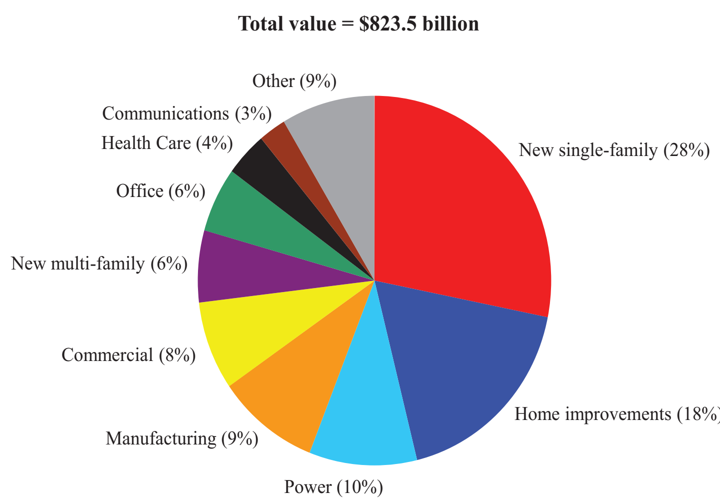
Geographically, privately-owned nonresidential construction grew in all four *regions* (*see* Glossary) in the mid-2000s, and then sharply declined between 2008 and 2010. Private nonresidential construction then grew again in all four regions from 2011 to 2015 (chart 5c).[3] The greatest percentage gain was reported in the South, where the value of nonresidential construction rose by 69.7% from 2010 to 2015. The South also had the highest share among all regions, accounting for 43% of the total value of non-residential construction in the U.S. in 2015.

Highway and street construction accounted for the largest share of the dollar value of public spending at $89.4 billion (or 31%) in 2015 (chart 5d). Construction of educational facilities was the second largest at $66.6 billion, encompassing 23% of public construction.

5a. Value of construction, private versus public sector, 1993-2015 (2015 dollars)

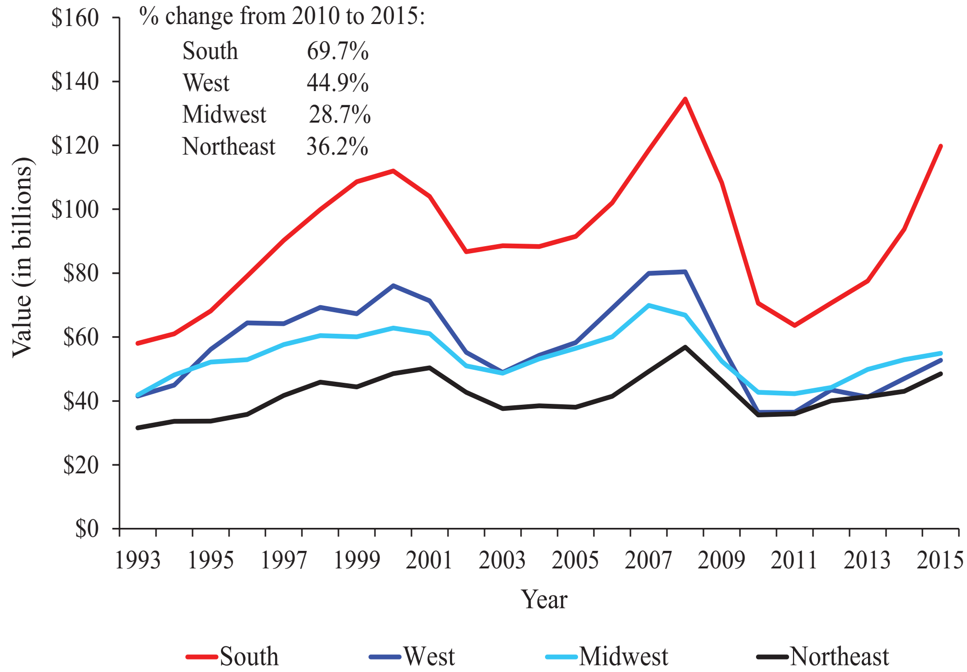


5b. Share of dollar value of private sector construction, by type, 2015

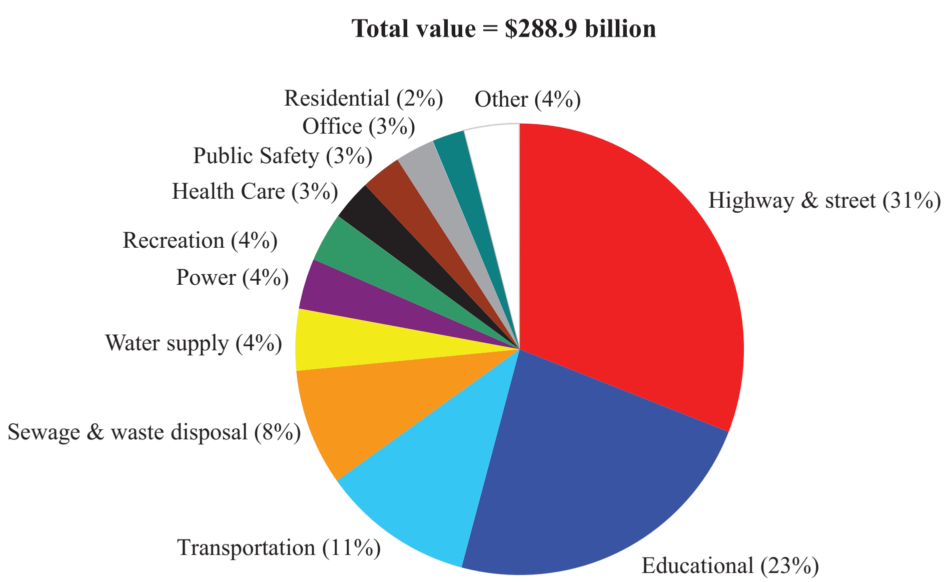


1. U.S. Census Bureau. Construction Spending: Overview. http://www.census.gov/construction/c30/c30index.html (Accessed January 2017). Construction spending includes: 1) materials installed or erected, 2) labor, 3) construction rental equipment, 4) the contractor's profit, 5) architectural and engineering work, 6) miscellaneous overhead and office costs chargeable to the project on the owner's books, and 7) interest and taxes paid during construction (except state and locally-owned projects).
2. U.S. Census Bureau. Historical Annual Value of Construction Put in Place series. https://www.census.gov/construction/c30/xls/total.xls (Accessed January 2017).
3. Dollar values were adjusted for inflation.
4. Variations in the values reported for construction result from differing survey and estimation methods. The Value of Construction Put in Place measures the value of a project from the project owner's perspective and includes all construction expenditures in a given period regardless of who worked on the projects. In contrast, the Economic Census is based on the receipts and expenditures of establishments performing the construction work.

5c. Value of private nonresidential construction, by region, 1993-2015 (2015 dollars)



5d. Share of dollar value of public sector construction, by type, 2015



Note: Chart 5a – According to the Value of Construction Put in Place series, public and private construction totaled $1.12 trillion. The Gross Domestic Product Implicit Price Deflator was used to adjust current dollar value to 2015 dollars.
Chart 5b – "Other" private construction includes lodging, educational, religious, public safety, amusement and recreation, transportation, sewage and waste disposal, and water supply. Total may not add to 100% due to rounding.
Chart 5c – Private nonresidential construction by region excludes power, communications, and railroad work. The Gross Domestic Product Implicit Price Deflator was used to adjust current dollar value to 2015 dollars.
Chart 5d – "Other" public construction includes conservation and development, as well as commercial spending. Total may not add to 100% due to rounding..

Source: Chart 5a – U.S. Census Bureau. Annual Value of Construction Put in Place series. http://www.census.gov/construction/c30/historical_data.html and http://www.census.gov/construction/c30/pdf/totalha.pdf (Accessed January 2017). U.S. Bureau of Economic Analysis, Gross Domestic Product: Implicit Price Deflator [GDPDEF], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPDEF (AccessedFebruary 2017).
Chart 5b – U.S. Census Bureau. Annual Value of Construction Put in Place private series. http://www.census.gov/construction/c30/xls/private.xls (Accessed January 2017).
Chart 5c – U.S. Census Bureau. Annual Value of Private Nonresidential Construction Put in Place by region, for selected types of construction. http://www.census.gov/construction/c30/pdf/region.pdf (Accessed January 2017). U.S. Bureau of Economic Analysis, Gross Domestic Product: Implicit Price Deflator [GDPDEF], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPDEF (AccessedFebruary 2017).
Chart 5d – U.S. Census Bureau. Annual Value of Construction Put in Place public series. http://www.census.gov/construction/c30/xls/public.xls (Accessed January 2017).

Private Residential and Nonresidential Construction

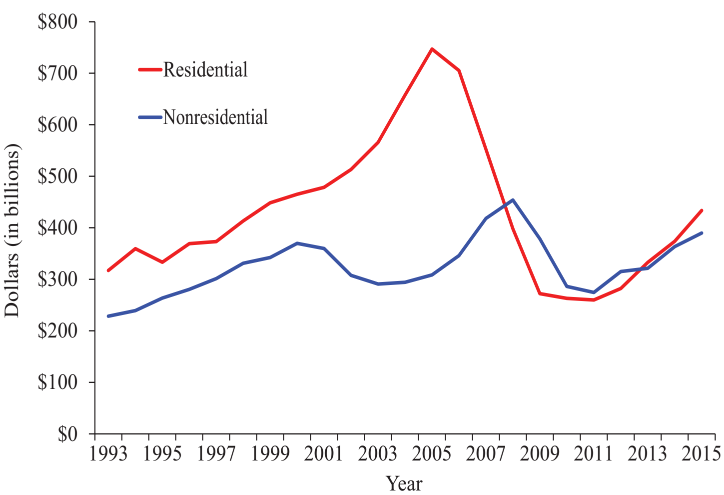
Private spending on construction dramatically dropped during the recent recession and recovered afterwards; this trend was especially pronounced in residential construction (*see* page 5). By 2015, private residential spending was at $433.7 billion, 65% higher than the $263.0 billion spent in 2010, after adjusting for inflation. Despite the rebound, spending is still 42% lower than its peak of $746.9 billion in 2005 (chart 6a).[1] Compared to residential construction, the value of private nonresidential construction fluctuated moderately, reaching $453.8 billion in 2008, falling to $274.5 billion in 2011, and then recovering to $389.9 billion by 2015; 14% less than its value in 2008.

Spending on new single-family housing nearly doubled from 2009 to 2015 after adjusting for inflation, but remained about 58% lower than its 2005 level (chart 6b). Spending on private multi-family housing and home improvements both showed strong signs of recovery, reaching pre-recession levels by 2015.[2]

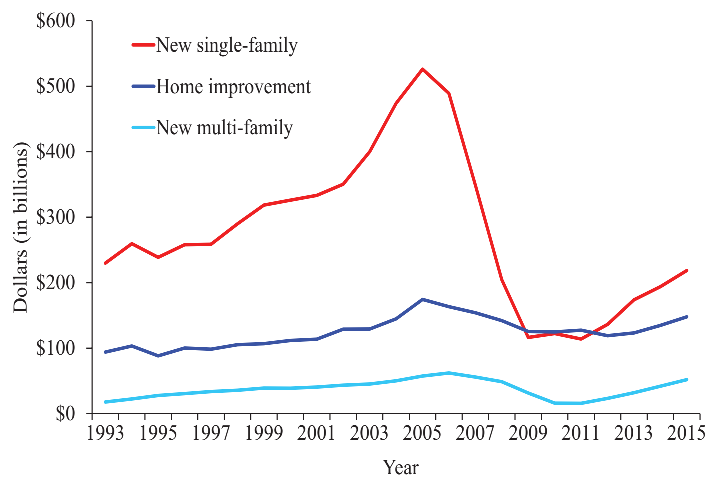
The New Residential Construction series measures new privately-owned residential construction activity by the number of building permits authorized, housing units started, and housing units completed.[3] Corresponding to the pattern in residential construction value, the number of new privately-owned single-family housing unit starts reached 715,000 by 2015, 66% higher than the 431,000 units started in 2011, but only about 42% of the 1.72 million housing projects started in 2005 (chart 6c). New privately-owned multi-family housing unit starts, while declining during the recession, surpassed the 2005 level by 2015. Overall, total starts gradually recovered after the recent market crash,[3] with the exception of manufactured home shipments, which dropped continuously from 1998 through 2010, ending with an 81% decrease by 2015. The number of single- and multi-family building permits authorized followed a similar trajectory as starts.[4]

Housing market trends affect jobs not only in the Residential Building Construction sector (NAICS 2361), but also in the Specialty Trade Contractors sector (NAICS 238). Typically, a large amount of work in residential construction is subcontracted to contractors in specialty trades. For example, 66% of the value of construction work done by framing contractors (NAICS 23813) in 2012 was related to residential construction (chart 6d).

6a. Value of private construction, residential versus nonresidential, 1993-2015 (2015 dollars)

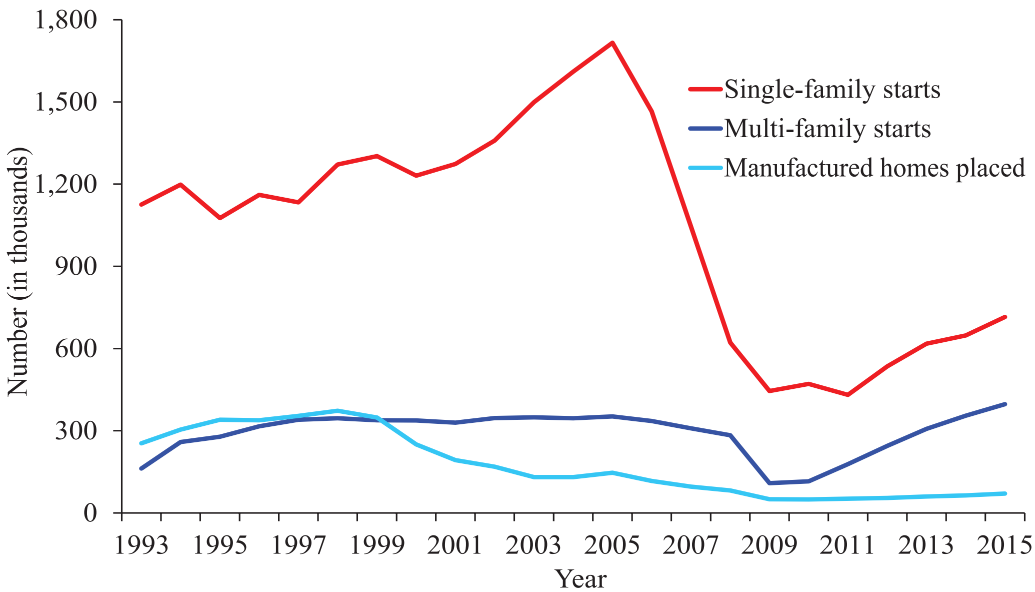


6b. Value of private residential construction, by type, 1993-2015 (2015 dollars)

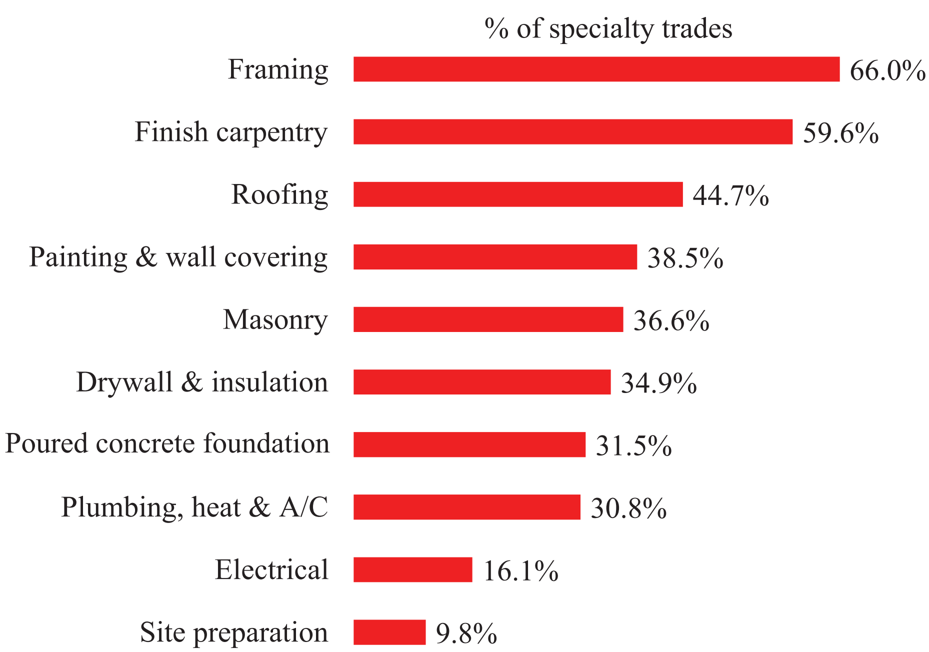


1. All the numbers are in constant dollar value, which means that the dollars are adjusted for inflation.
2. U.S. Census Bureau. Construction Spending: Definitions of Construction. http://www.census.gov/construction/c30/definitions.html (Accessed January 2017). Residential construction includes new single-family (new houses and town houses), new multi-family (new apartments and condominiums), and home improvements (such as remodeling, additions, and major replacements).
3. U.S. Census Bureau. New Residential Construction. http://www.census.gov/construction/nrc/ (Accessed January 2017). The New Residential Construction series compiles data on new privately-owned residential housing units authorized, started, and completed. This data source provides the number of: 1) new housing units authorized by building permits, 2) housing units authorized to be built, but not yet started, 3) housing units started (defined as excavation for the footings or foundation), 4) housing units under construction, and 5) housing units completed
4. Joint Center for Housing Studies of Harvard University. The State of the Nation's Housing 2016. http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/jchs_2016_state_of_the_nations_housing_lowres.pdf (Accessed June 2016).

6c. **Number of housing starts, 1993-2015**



6d. **Residential construction as a percentage of work done, selected specialty trades, 2012**



Note: Chart 6a – The Gross Domestic Product Implicit Price Deflator was used to adjust current dollar value to 2015 dollars.
Chart 6b – Private sector residential construction totaled $433.7 billion in 2015 (not seasonally adjusted). Year-to-year comparisons are adjusted in 2015 dollars.
Chart 6c – Total of 1.183 million housing unit starts in 2015; data cover the private sector only.

Source: Chart 6a – U.S. Census Bureau. Historical Annual Value of Construction Put in Place series. http://www.census.gov/construction/c30/historical_data.html and http://www.census.gov/construction/c30/pdf/totalha.pdf (Accessed January 2017). U.S. Bureau of Economic Analysis, Gross Domestic Product: Implicit Price Deflator [GDPDEF], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/GDPDEF (Accessed February 2017).
Charts 6b and 6c – Joint Center for Housing Studies of Harvard University. The State of the Nation's Housing 2016, Table A-1 – Housing Market Indicators: 1980–2015. http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/jchs_2016_state_of_the_nations_housing_lowres.pdf (Accessed June 2016).
Chart 6d – U.S. Census Bureau. 2012 Economic Census. Construction Industry Series. Value of Construction Work for Type of Construction by Subsectors and Industries (EC1223SG09). https://www.census.gov/econ/construction.html (Accessed January 2017).

Demographics of Business Owners in Construction and All Industries

Demographic data on business owners are reported by the Survey of Business Owners (SBO), part of the Economic Census conducted by the U.S. Census Bureau every five years (most recently in 2012; *see* pages 2 and 3). In 2012, there were 2.9 million construction firms, the majority of which were owned by men.[1] Roughly 7.4% were jointly male/female owned,[2] and only 266,000, less than one out of ten (9.0%), were owned by women (chart 7a). The share of woman-owned firms in all industries, by contrast, is more than one in three (35.8%). However, women-owned firms in construction generated 6.3% of the construction industry's revenue, compared to 4.2% for all U.S. industries.

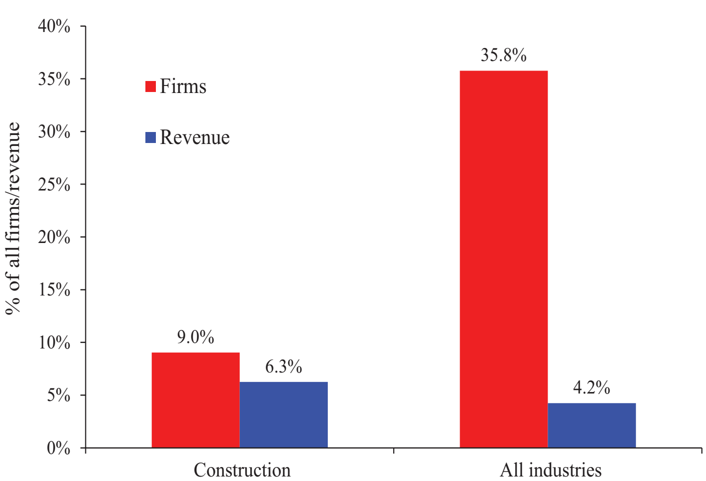
Hispanic-owned (*see* Glossary) firms accounted for 16.2% (475,000) of all firms in construction compared to 12.0% (3.3 million) of Hispanic-owned firms among all industries.[1] However, Hispanic-owned firms only accounted for 3.8% of construction revenue and 1.4% of overall business revenue, respectively (chart 7b). These revenue numbers indicate that Hispanic-owned firms tend to be relatively small, especially among non-construction firms.

African American-owned firms accounted for less than one in ten (9.4%) of all firms in the U.S., but less than one in 20 firms (4.7% or 137,000 firms) in construction (chart 7c). Construction firms with African American owners produced less than 1% ($11.1 billion) of business revenue in this industry for 2012, close to the proportion for all industries combined. Other minority groups (Asian, American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, and other groups) owned 10.2% (298,000) of construction firms with $39.8 billion in business revenue (chart 7d). These minority groups own a smaller proportion of construction firms, but they have a similar proportion of revenue compared to other industries.

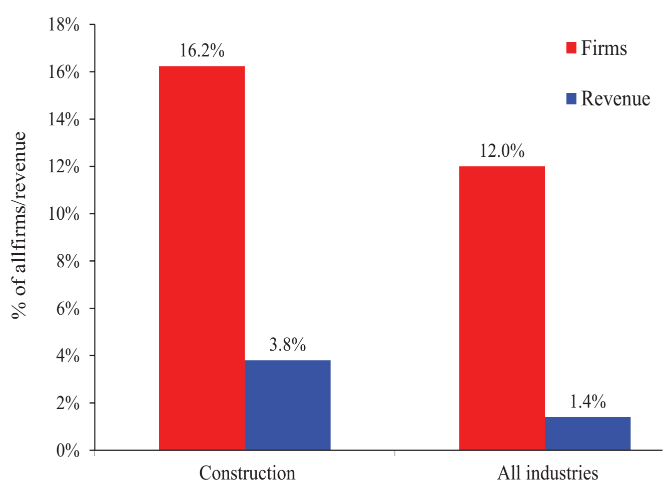
Construction owners tended to be younger than other business owners. About 35% of construction owners were under age 45, compared to 33% of all business owners (chart 7e). More than 40% of all business owners were 55 years or older, in contrast with 35% for construction owners. Among minority construction firm owners, this pattern may be even more pronounced; over half (52%) of Hispanic construction owners were younger than 45 years old.[1]

The SBO defines an owner as an individual or group of individuals having 51% or more of the stock, interest, or equity in the business, and categorizes this by gender, race, and ethnicity. Business owners were asked to provide the percentage of ownership for the primary owner(s), and to select one or more races or ethnicities to describe themselves. Therefore, it is possible for a business or owners to be classified and tabulated under more than one race or ethnicity category. The SBO is conducted on a company or firm basis, whereas data collected for the Economic Census are based on establishments. The SBO covers firms both with and without paid employees (nonemployer) by combining data from this survey with data from the main Economic Census and administrative records. Due to survey changes and variations in response rates among subgroups, the numbers are not comparable with data from previous surveys.

7a. Women-owned firms as a percentage of the total, construction versus all industries, 2012

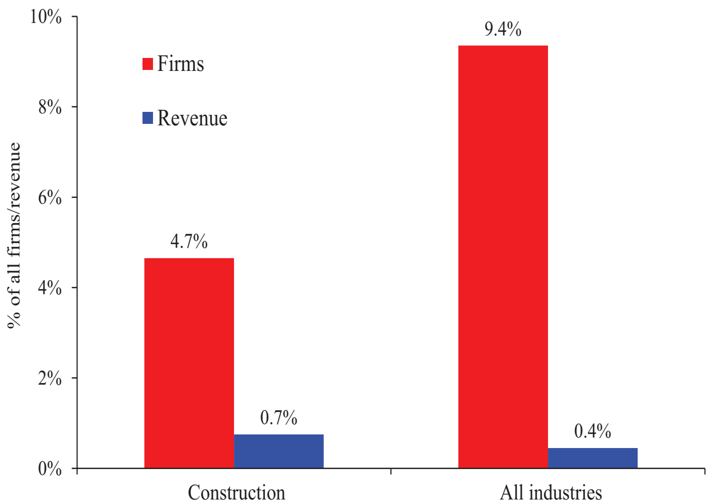


7b. Hispanic-owned firms as a percentage of the total, construction versus all industries, 2012

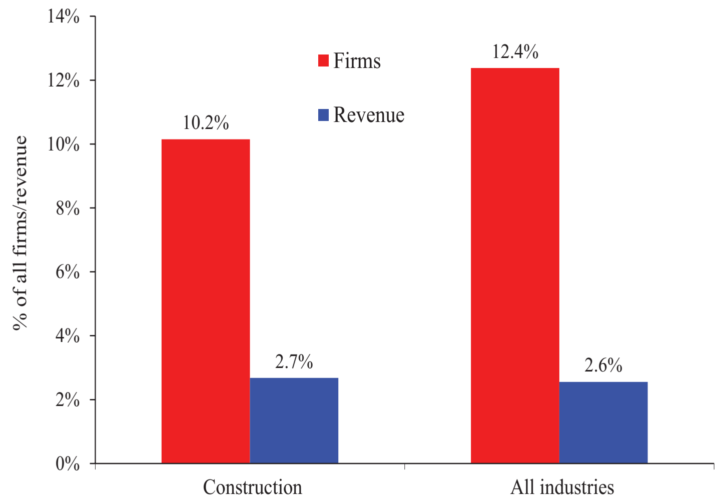


1. U.S. Census Bureau. 2012 Economic Census. Survey of Business Owners. (SB1200CSA01) https://www.census.gov/econ/overview/mu0200.html (Accessed March 2016). The figures on this page are based on the firms that are able to be classified by gender, race, ethnicity, and the revenue that these firms generated.
2. Equally male/female ownership was based on equal shares of interest reported for businesses with male and female owners.

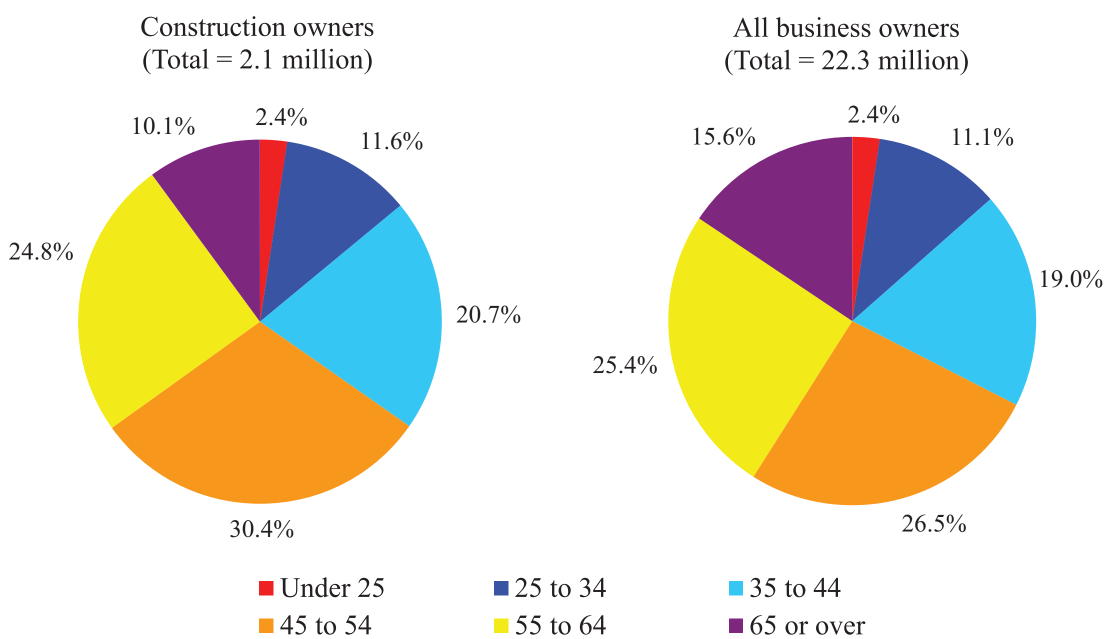
7c. African American-owned firms as a percentage of the total, construction versus all industries, 2012



7d. Other minority-owned firms as a percentage of the total, construction versus all industries, 2012



7e. Age distribution among business owners, construction versus all industries, 2012



Note: All charts – Data cover the private sector only.
Chart 7a – Women-owned firms totaled 266,000 in construction and 9.9 million overall in 2012.
Chart 7b – Hispanic-owned firms totaled 475,000 in construction and 3.3 million overall in 2012.
Chart 7c – African American-owned firms totaled 137,000 in construction and 2.6 million overall in 2012.
Chart 7d – "Other minorities" include American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, and some other race. Other minority-owned firms totaled 298,000 in construction and 3.4 million overall in 2012.
Chart 7e – Those that did not report age were excluded from the tabulation. Totals may not add to 100% due to rounding.

Source: All charts – U.S. Census Bureau. 2012 Economic Census. Survey of Business Owners. (SB1200CSA01) https://www.census.gov/econ/overview/mu0200.html (Accessed March 2016).

Characteristics of Construction Businesses

Construction businesses are highly diverse, and range widely with regard to business age, sources of capital, type of ownership, worker composition, and other factors.[1] Hispanic-owned firms (*see* page 7) and *nonemploye*r (*see* Glossary) firms in construction are younger than all construction firms on average. Between 2008 and 2012, about one-third of construction firms (33.1%) were established while more than half (51.4%) of Hispanic-owned construction firms were established during the same period (chart 8a).[2] Around 24% of Hispanic-owned firms were established in the year 2012 alone, nearly twice the proportion of all construction firms (12.5%) established that year. The majority of these Hispanic-owned firms were classified as nonemployer businesses.[1]

In 2012, the most common source of capital to start a construction firm was owners' personal/family savings (chart 8b). Although more than one source of capital could be used, two out of three (66%) owners reported starting their businesses with personal savings. Other common sources included credit cards, loans, and other personal assets. However, 23.5% of construction owners reported that they did not need any money to start their businesses. In addition, nonemployer firms needed less capital amounts to start than employer firms.[1]

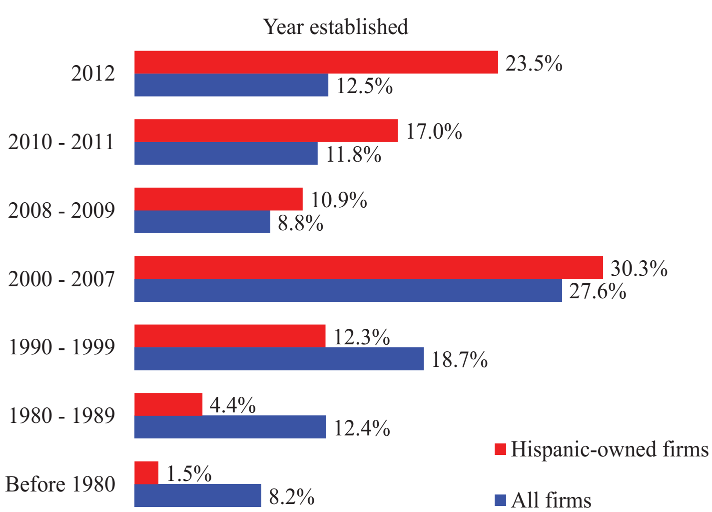
Nearly 70% of construction firms operated from home in 2012, higher than 52% for all industries combined.[1] Within construction, nonemployer firms were more likely than employer firms to be home-based (74.7% versus 50.6%). More than half (58.5%) of employer firms had one owner, compared with 85.3% for nonemployer firms (chart 8c).

Among employer firms in construction, 38.7% had a company website and 3.0% engaged in e-commerce in 2012 (chart 8d). In contrast, only one in ten (9.8%) nonemployer firms had a website and 1.6% were involved in e-commerce.

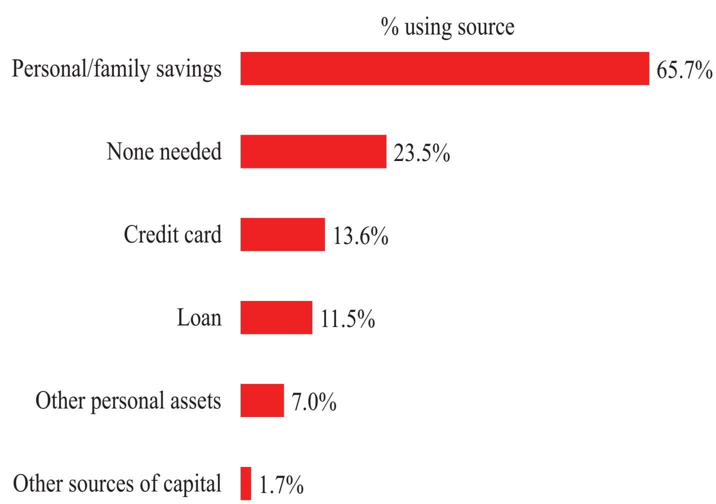
In terms of types of workers, nearly half (49.0%) of employer firms and 28.0% of nonemployer firms used contractors, subcontractors, independent contractors, or outside consultants (chart 8e). Use of alternative types of workers reflects the varied categories of work, skills, and degree of specialization in the construction industry.

Day laborers (*see* Glossary) make up an important segment of the construction workforce; Hispanic-owned construction firms were more likely to use day laborers than non-Hispanic-owned firms (chart 8f). About 8% of construction firms used day laborers, 29% of employer firms had no full-time employees on their payroll, and 5% hired temporary workers through temporary help services.[1]

8a. Years construction businesses were established, Hispanic-owned firms versus all firms, 2012

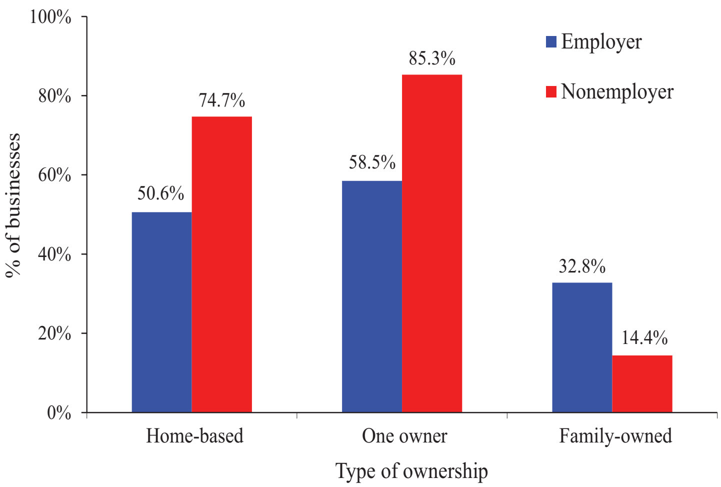


8b. Sources of capital needed to start a business in construction, 2012

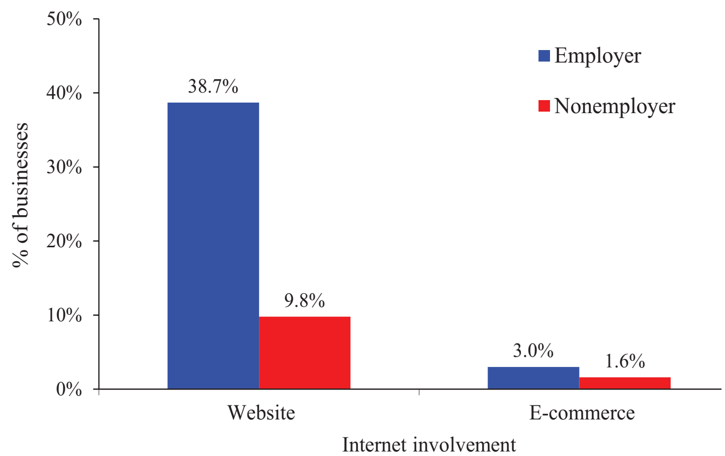


1. U.S. Census Bureau. 2012 Economic Census. Survey of Business Owners (SBO). https://www.census.gov/programs-surveys/sbo.html (Accessed March 2016). Firms not responding to the 2012 SBO survey questions and those that did not know the answers to questions were excluded from the percentages reported in the text. The categories and data used on this page are not directly comparable to other pages and previous editions of this chart book due to changes in coding systems and divergent survey methodologies.
2. About 40% of U.S. firms were established between 2008 and 2012.

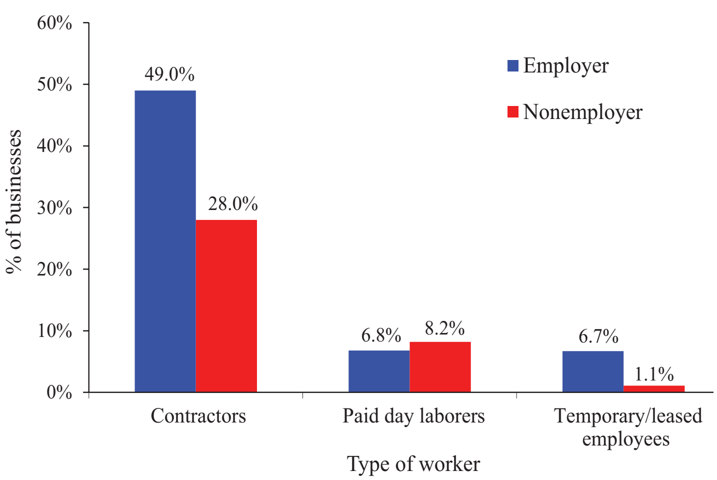
8c. Types of businesses in construction, employer versus nonemployer, 2012



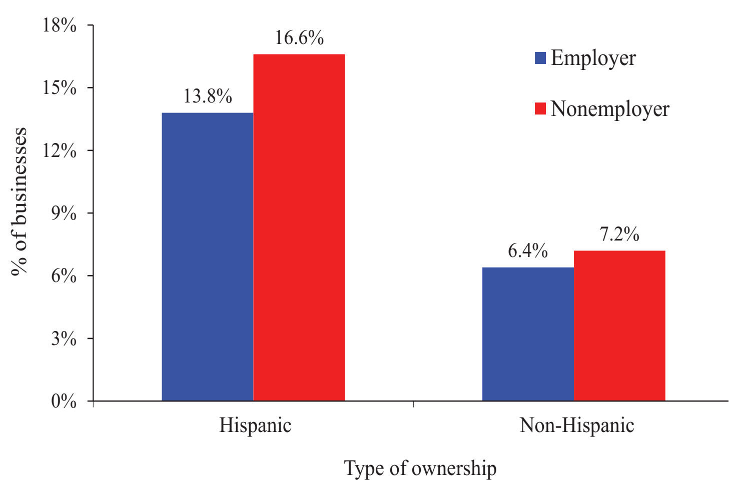
8d. Internet involvement in construction businesses, employer versus nonemployer, 2012



8e. Types of workers in construction businesses, employer versus nonemployer, 2012



8f. Paid day laborers in Hispanic and non-Hispanic-owned construction businesses, employer versus nonemployer, 2012



Note: Chart 8a – Firms without related information were excluded from the distributions.
Chart 8b – "Loans" include business loans from federal, state, or local governments, banks, and financial institutions; government-guaranteed business loans from banks or finan cial institutions; and business loans and investments from family and friends. More than one source may have been used, therefore the percentages will not add to 100%.
Chart 8d – "E-commerce" is the sale of goods and services where the buyer places an order, or the price and terms of the sale are negotiated, over an Electronic Data Interchange, the Internet, or any other online system (extranet, e-mail, instant messaging). Payment may or may not be made online.
Chart 8e – "Contractors" include contractors, subcontractors, independent contractors, and outside consultants.

Source: Chart 8a – U.S. Census Bureau. 2012 Economic Census. Survey of Business Owners. (SB1200CSCB10). https://www.census.gov/programs-surveys/sbo.html (Accessed February 2017).
Charts 8b-8f – U.S. Census Bureau. 2012 Economic Census. Survey of Business Owners. https://www.census.gov/programs-surveys/sbo.html (Accessed March 2016).

Green Construction in the United States

Green products and sustainable designs are used increasingly in the construction industry, in part due to the cost benefits that come from energy efficiency.[1] According to the U.S. Green Building Council (USGBC), construction projects with LEED certification[2] have increased dramatically in the U.S. market, even during the economic downturn. From 2009 to 2011, the annual number of nonresidential LEED-certified projects in the U.S. more than doubled from 2,207 to 4,878, and reached 6,527 in 2013 (chart 9a). LEED certification declined over the last two years, but has remained high.

From the adoption of the LEED standard in 2000 through 2015, a total of 70,000 construction projects in the U.S. have been registered with the USGBC, of which more than half (52.6%) have received LEED certification.[3] Among the LEED-registered projects (47,694) where owner information is available, 42.4% are owned by corporations and other for-profit organizations (chart 9b). Federal, state, and local governments have contributed significantly to the growth in green building; combined government buildings account for more than one in five LEED-registered projects. The U.S. Government Services Administration (GSA) has also named LEED the most credible rating system available for green projects.[4] Accordingly, the GSA increased the minimum requirement for new construction and substantial renovations of federally-owned facilities to LEED Gold. As of June 2016, the GSA owned 154 LEED certified buildings, 49 of which were gold and 10 of which were platinum, the highest rating available. These buildings accounted for 44.6 million square feet, or nearly one quarter of all GSA-owned space.

Green construction activity, as measured by square footage, varies by *region* (*see* Glossary). Projects in the southern part of the United States accounted for just over one-third (33.9%) of all LEED-certified square feet, followed closely by the West with 32.7% (chart 9c). In contrast, the Midwest and the Northeast had a much smaller proportion of LEED-certified square feet, with 18.2% and 15.1%, respectively. This may be partially due to less construction activity overall in these regions of the country.

At the state level (including the District of Columbia), in terms of the average square feet per capita (or per person), green construction was distributed unevenly. In 2015, the District of Columbia reported the highest LEED-certified space per capita, at 19.3 square feet (chart 9d). Illinois had the second highest LEED-certified square feet per capita at 3.4, followed closely by Maryland (3.1) and Massachusetts (3.0). The large number of federal government buildings in the District of Columbia likely contributes to the high density of LEED-certified space. However, the District of Columbia as a city may not be directly comparable to other states.

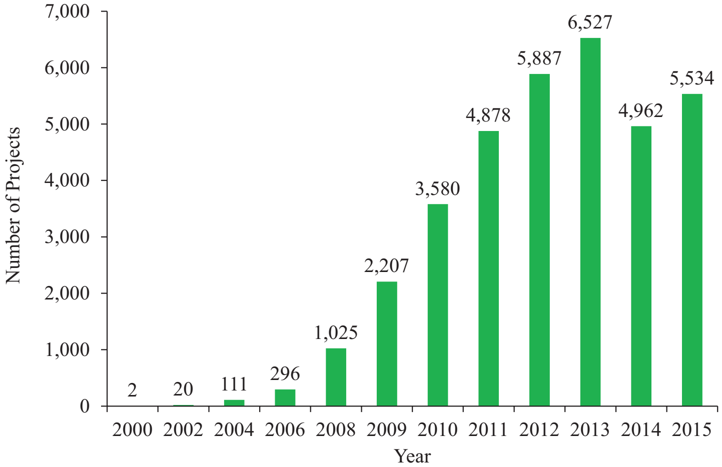
The green trend has been transforming residential construction as well.[5] According to Dodge Data & Analytics (formerly known as McGraw-Hill Construction), the proportion of new single-family home builders involved in green construction is projected to increase in the coming years as more builders take on an increasing number of green projects. By 2020, it is estimated that activities for nearly one-third of single-family home builders will be entirely or almost entirely green (chart 9e). By 2030, building energy use could be cut more than 20% using technologies known to be cost effective today.[1]

Among the various information sources on green construction, single-family firms are more likely to rely on information from trade shows, conferences, workshops, or colleagues and other builders. In contrast, multifamily firms tend to trust information from homebuilding websites or product manufacturers regarding green building practices and products (chart 9f).

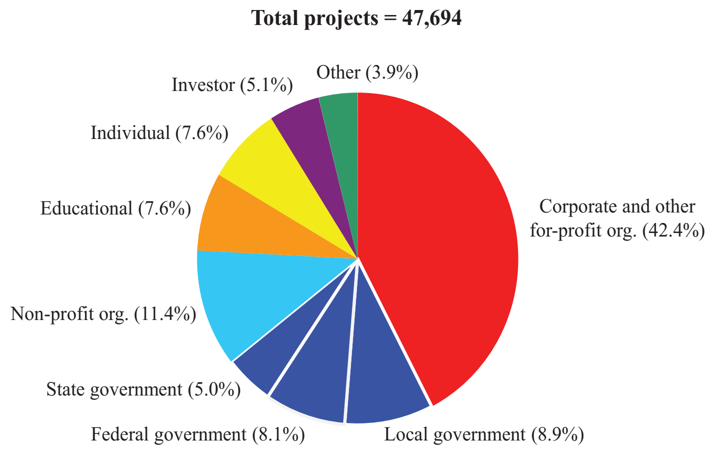
Although green construction is anticipated to benefit the environment and the economy, it is unclear whether it creates new hazards or exacerbates existing hazards for construction workers. Therefore, it is important to promote the NIOSH Prevention through Design (PtD) initiative[6] for green construction and sustainable design.

1. U.S. Department of Energy. 2015. An Assessment of Energy Technologies and Research Opportunities. Chapter 5: Increasing Efficiency of Building Systems and Technologies. https://energy.gov/sites/prod/files/2015/09/f26/QTR2015-05-Buildings.pdf (Accessed January 2017).
2. U.S. Green Building Council. LEED (Leadership in Energy and Environmental Design) is a rating system that assigns points to buildings for sustainable site selection, water efficiency, energy usage and atmosphere, sustainable materials and resources, indoor environmental quality, location and proximity to transportation, design innovation, and regional priority. There are four levels of certification, based on the number of points awarded. LEED Certified denotes the minimum number of points earned for certification (40-49 points), followed by LEED Silver (50-59 points), LEED Gold (60-79 points), and LEED Platinum (80+ points), the highest of the four. The standard has been adopted in more than 150 countries since the program was piloted in 1999. http://www.usgbc.org/articles/green-building-facts (Accessed August 2016).
3. U.S. Green Building Council. 2016. Public LEED project directory, 2000-2015. http://www.usgbc.org/projects (Accessed May 2016). Calculations by the CPWR Data Center. Does not include residential projects.
4. U.S. General Services Administration. 2016. LEED Building Information. http://www.gsa.gov/portal/category/25999 (Accessed August 2016).
5. Dodge Data & Analytics. 2015. Smart Market Report. Green and Healthier Homes: Engaging Consumers of all Ages in Sustainable Living. https://www.nahb.org/~/media/Sites/NAHB/Research/Priorities/green-building-remodeling-development/Green-and-Healthier-Homes%202015.ashx (Accessed January 2017).
6. The National Institute for Occupational Safety and Health. 2016. Prevention through Design. https://www.cdc.gov/niosh/topics/ptd/ (Accessed November 2016).

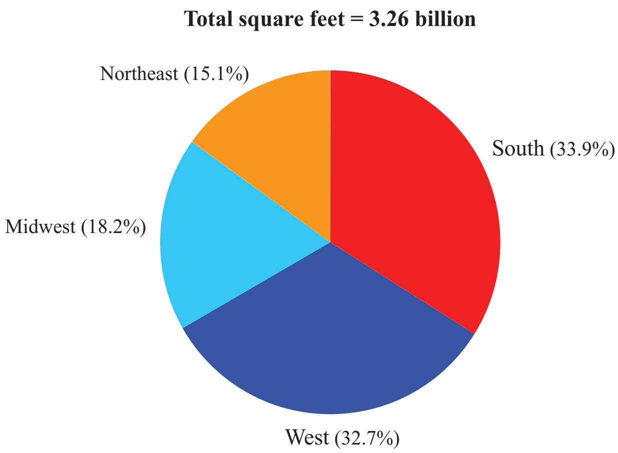
9a. **LEED-certified projects, 2000-2015, selected years**



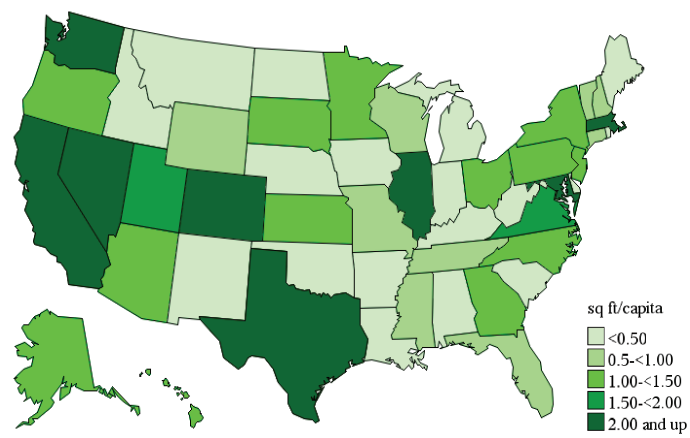
9b. **Owner of LEED-registered projects, 2000-2015**



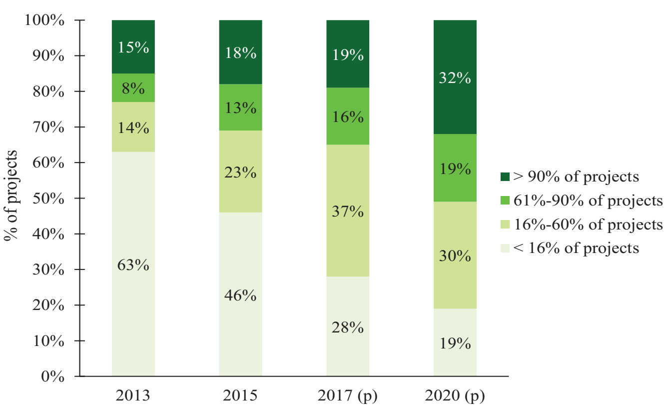
9c. **LEED-certified square feet, by region, 2000-2015**



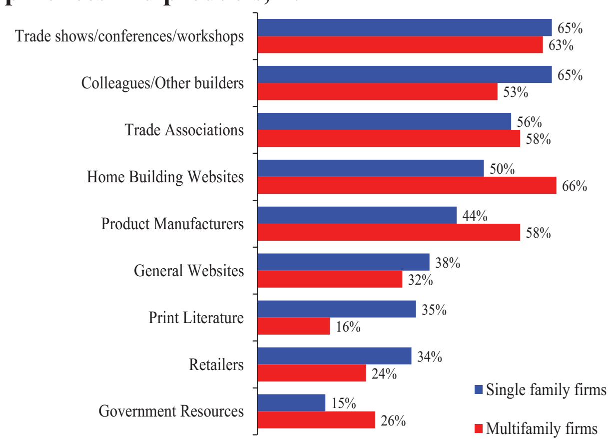
9d. **LEED-certified square feet per capita, by state, 2015**



9e. **New single-family home builder involvement in green activities, 2013-2020 (projected)**



9f. **Most trusted sources of information about green building practices and products, 2014**



Note: Charts 9a-9d – LEED residential projects are not included.
Chart 9b – "Other" includes those with multiple types of owners, other government, religious establishments, those listed as other, and those difficult to classify.
Chart 9e – "(p)" represents market projections.

Source: Charts 9a-9c – U.S. Green Building Council. Public LEED project directory, 2000-2015. http://www.usgbc.org/projects (Accessed May 2016). Calculations by the CPWR Data Center.
Chart 9d – U.S. Green Building Council. Square feet of LEED-certified space, per capita, by state (including the District of Columbia). Contact: Leticia McCadden.
Chart 9e – Dodge Data & Analytics. 2015. Smart Market Report. Green and Healthier Homes: Engaging Consumers of all Ages in Sustainable Living. https://www.nahb.org/~/media/Sites/NAHB/Research/Priorities/green-building-remodeling-development/Green-and-Healthier-Homes%202015.ashx (Accessed January 2017).
Chart 9f – Dodge Data & Analytics. 2014. Smart Market Report. Green Multifamily and Single Family Homes: Growth in a Recovering Market. http://analyticsstore.construction.com/2014GreenHomesSMR?sourcekey=PRESREL (Accessed January 2017).

Labor Force Structure and Definitions

In 2015, the *civilian labor force* (*see* Glossary) totaled 157.1 million, accounting for about 63% of the U.S. non-institutional population (chart 10a).[1] Construction workers accounted for about 6.7% of the overall U.S. workforce, 6.5% (685,000) of whom were jobless in 2015. As in most years, the construction unemployment rate was higher than the nationwide unemployment rate (5.3%), but the rate in 2015 was the lowest since 2007 (*see* page 20).

Among *employed* (*see* Glossary) construction workers, 2.4 million (24.5%) reported being *self-employed* (both unincorporated and incorporated; *see* Glossary) and 7.5 million (75.4%) reported they were *wage-and-salary* (*see* Glossary) workers. These proportions have shifted over the last five years. Between 2010 and 2015, the segment of self-employed workers declined from 27.9% to 24.5%, while the portion of private wage-and-salary workers grew from 67.2% to 71.6% (chart 10b). This suggests workers had no alternative but self-employment during the economic downturn, and workers preferred to take wage-and-salary jobs once the economy recovered (*see* page 22). The share of government employees in construction also declined slightly (from 4.9% to 3.9%), indicating that job opportunities for directly employed construction workers in the public sector are still limited.

These numbers were estimated from the Current Population Survey (CPS), a monthly household (self-reported) survey sponsored jointly by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics. The CPS is a major source of labor force statistics, collecting demographic and employment information, such as gender, age, race, Hispanic origin, industry and occupational groups, unionization, hours of work, and information on unemployment.[2] In addition to the regular monthly surveys, CPS supplements collect information on topics related to the labor market and economy, such as health insurance coverage (*see* page 26), pension plans (*see* page 27), and computer and Internet usage (*see* page 29).

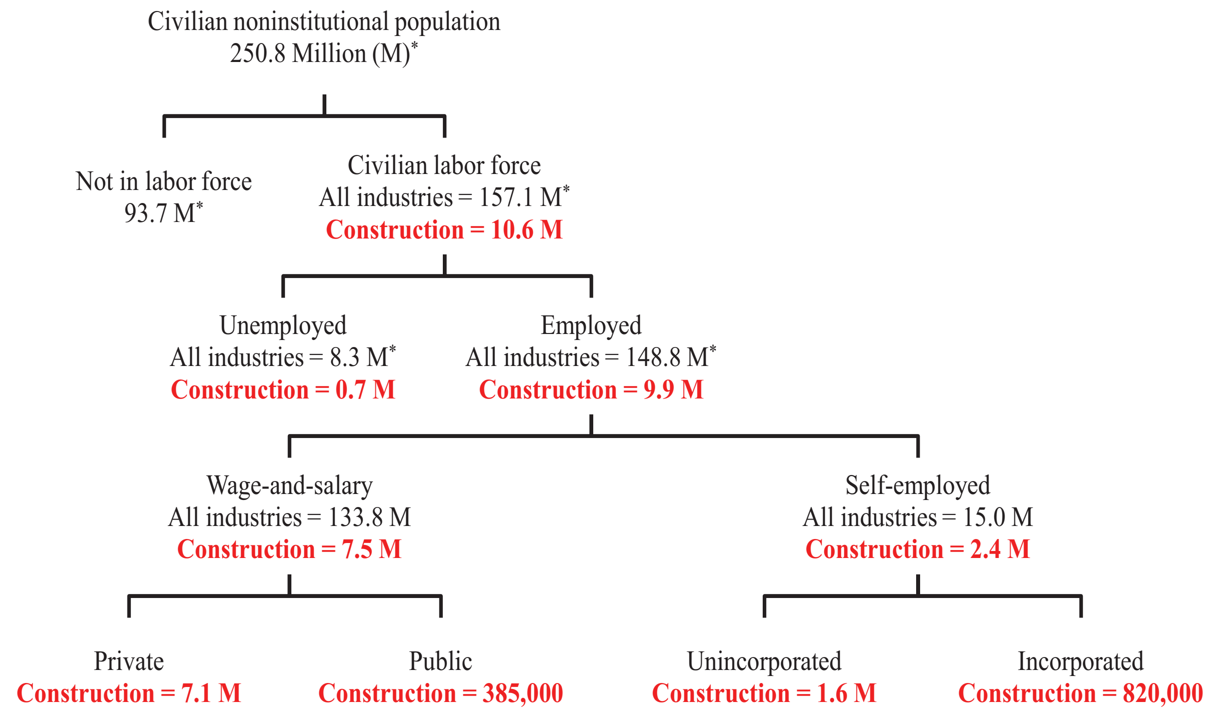
The CPS classifies the labor force as either employed or unemployed. Employed persons comprise all who, during the reference week: 1) did any work for pay or profit, or worked 15 hours or more as an unpaid worker in a family enterprise, or 2) had a job but was not working because of illness, bad weather, vacation, labor-management dispute, or because they were taking time off for personal reasons. Persons are classified as *unemployed* if they did not work during the reference week, but were available for work, and had actively looked for employment at some point in the previous four weeks. Individuals on layoff or waiting to report to work are also considered unemployed. The employed are classified by industry, occupation, and *class-of-worker* (wage-and-salary workers, self-employed workers, and unpaid family workers).[3]

In addition to self-reported data, labor force information is collected from employers, through payroll and establishment surveys such as the Current Employment Statistics (CES) survey.[4] The CES covers only wage-and-salary workers on nonfarm payrolls and does not collect demographic information. As a result, data on self-employment and worker demographics used in this book are mainly obtained from the CPS and other household surveys. Since the construction industry is coded as a single category in the CPS, detailed industry information provided in this book is derived from the CES and other establishment surveys. The employment numbers estimated from the CPS and CES are also used as denominators when calculating injury and illness rates.

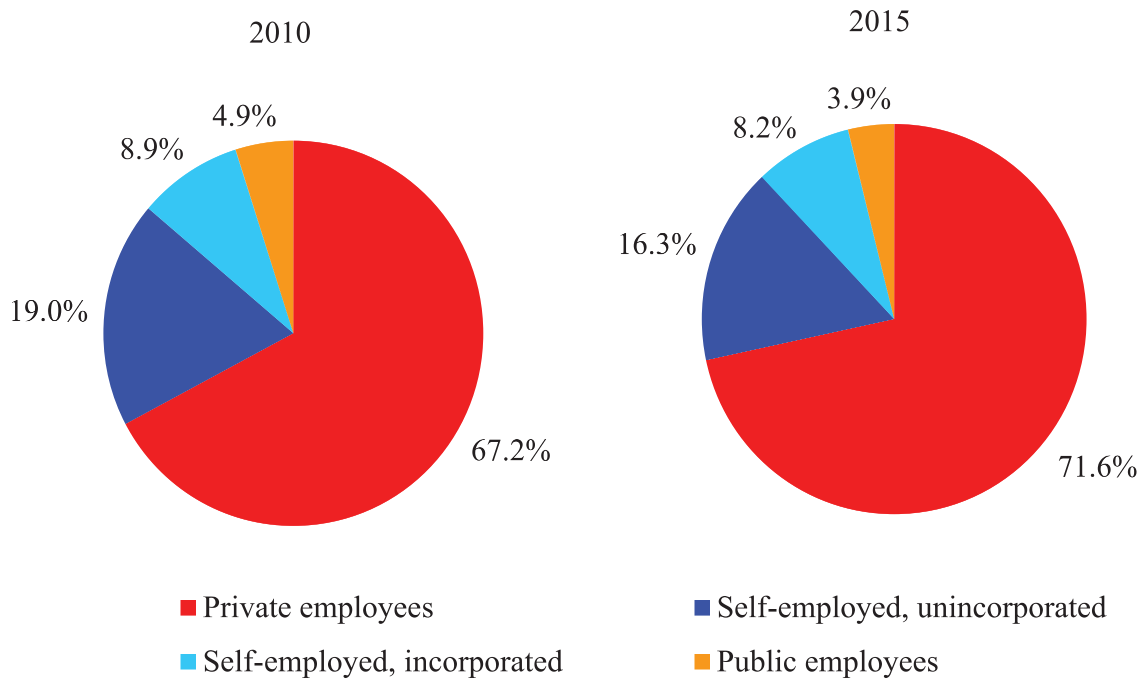
Although the CPS and CES have significant differences, they indicate a similar trend in employment over time (*see* chart 20a). Both the CPS and CES data are available from the U.S. Bureau of Labor Statistics (BLS) website; however, detailed data on construction workers provided in this Chart Book were tabulated by the CPWR Data Center.

1. U.S. Bureau of Labor Statistics. 2016. Household Data Annual Averages. Table 1: Employment status of the civilian noninstitutional population, 1945 to date. http://www.bls.gov/cps/cpsaat01.pdf (Accessed February 2016). The civilian noninstitutional population consists of persons 16 years of age and older residing in the 50 states and the District of Columbia who are not inmates of institutions (for example, penal and mental facilities and homes for the aged) and who are not on active duty in the Armed Forces.
2. U.S. Bureau of Labor Statistics. 2010. Handbook of Methods. Chapter 1: Labor force data derived from the Current Population Survey. http://www.bls.gov/opub/hom/pdf/homch1.pdf (Accessed April 2016).
3. U.S. Bureau of Labor Statistics. 2006. Design and Methodology: Current Population Survey. http://www.census.gov/prod/2006pubs/tp-66.pdf (Accessed April 2016).
4. U.S. Bureau of Labor Statistics. 2010. Handbook of Methods. Chapter 2: Employment, hours, and earnings from the Establishment Survey. http://www.bls.gov/opub/hom/pdf/homch2.pdf (Accessed April 2016).

10a. **Type of labor force and class of workers, construction and all industries, 2015**



10b. **Distribution of class of worker in the construction workforce, 2010 and 2015**



Note: All charts – Charts cover all construction occupations, including managers and clerical staff. Figures for the self-employed provided in BLS publications prior to 2011 may include only the unincorporated self-employed, and therefore may be smaller than the estimate in chart 10a.

Source: Chart 10a – U.S. Bureau of Labor Statistics. 2016. Household Data Annual Averages. Table 1: Employment status of the civilian noninstitutional population, 1945 to date. http://www.bls.gov/cps/cpsaat01.pdf (Accessed February 2016). This source pertains to any number in the Chart Book with an asterisk (*); all other numbers are from the 2015 Current Population Survey. Calculations by the CPWR Data Center.
Chart 10b – U.S. Bureau of Labor Statistics. 2010 and 2015 Current Population Survey. Calculations by the CPWR Data Center.

Occupational Classifications and Employment Distributions in Construction

The construction workforce is defined by the Economic Census (*see* pages 2 and 3) as "construction workers" and "other employees." "Construction workers" includes those directly engaged in construction operations, such as apprentices, working foremen, painters, carpenters, and laborers. "Other employees" refers to supervisors above working foremen, as well as office staff, executives, architects, engineers, and others engaged in non-construction activities.[1] Using these definitions, the proportion of construction workers in construction payroll establishments declined from 86% in 1967 to 73% in 2012 (chart 11a). This overall decrease reflects development in construction management and technology.[2] Construction industry innovations have and will continue to transform the workforce in profound ways.[3,4] Moreover, worker safety, environmental protection, and pressure to complete projects on time and within budget limitations are also driving employment growth in managerial and professional occupations (*see* pages 29 and 31).[2,3,5]

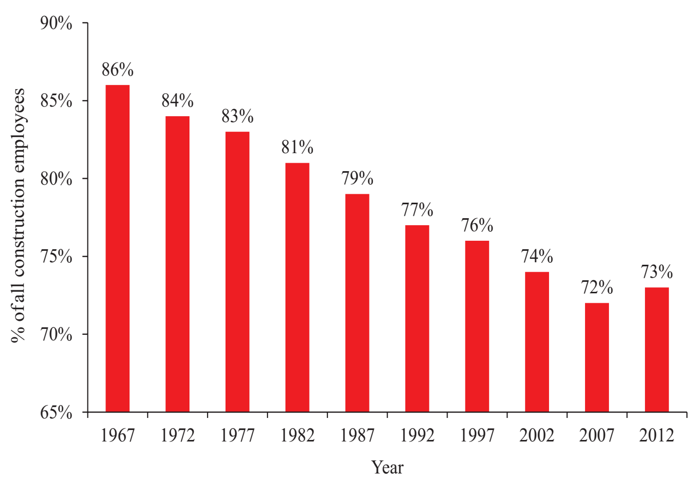
Surveys related to the workforce (such as the Current Population Survey, *see* page 10; the Occupational Employment Statistics, *see* page 25) often classify the construction workforce into detailed occupations by work performed, skills, or training needed to perform the work.[6] These classifications are altered and updated over time (*see* page 25). Most of the occupational data used in this Chart Book are based on the 2010 Census Occupational Classification system,[7] which includes 10 major occupational groups:

1. Management, business, and financial (0010-0950)
2. Professional and related occupations (1000-3540)
3. Service (3600-4650)
4. Sales and related occupations (4700-4965)
5. Office and administrative support (5000-5940)
6. Farming, fishing, and forestry (6000-6130)[8]
7. Construction and extraction (6200-6940)
8. Installation, maintenance, and repair (7000-7630)
9. Production (7700-8965)
10. Transportation and material moving (9000-9750)

Chart 11b presents employment by detailed occupational categories as a percent of the total construction workforce in 2015. Laborers and carpenters are the two largest occupations in construction, together accounting for nearly 30% of the construction workforce (chart 11b). Notably, some related occupations are combined; for example, installation, maintenance, and repair workers are listed under the repairer occupation. Except when noted, the combined occupational categories are used consistently throughout this Chart Book. The numbers presented in this Chart Book may differ from other published counts since occupations may be grouped in different ways.

In this Chart Book, the construction workforce is also categorized as *production workers* (blue-collar; Census codes 6200-9750; similar to "construction workers" used in chart 11a) and non-production workers (white-collar; Census codes 0010-5940; similar to "other employees" described above and includes managerial and administrative support staff). [8] Unless otherwise noted, the term "construction workers" in this Chart Book refers to all those employed in the construction industry, regardless of occupation.

11a. Percentage of all construction employees that meet the Economic Census definition of "construction worker," 1967-2012 (With payroll)



1. U.S. Census Bureau. 2012 Economic Census. Construction: Summary Series. General Summary: Detailed Statistics for Establishments: 2012, (EC1223SG01) http://www.census.gov/data/tables/2012/econ/census/construction.html (Accessed April 2016).
2. Wright S. 2016. 6 Ways Construction Technology Has Transformed the Industry. http://blog.capterra.com/6-ways-construction-technology-has-transformed-the-industry/ (Accessed November 2016).
3. Whirlwind Team. 2015. 5 Ways the Construction Industry Has Changed in 20 Years. http://www.whirlwindsteel.com/blog/bid/406699/5-ways-the-construction-industry-has-changed-in-20-years (Accessed November 2016).
4. The World Economic Forum. 2016. The Future of Jobs. http://reports.weforum.org/future-of-jobs-2016/ (Accessed November 2016).
5. U.S. Bureau of Labor Statistics. 2015. Occupational Outlook Handbook. Construction Managers: Job Outlook. http://www.bls.gov/ooh/Management/Construction-managers.htm#tab-6 (Accessed March 2016).
6. U.S. Bureau of Labor Statistics. 2016. Standard Occupational Classification. http://www.bls.gov/soc/ (Accessed November 2016).
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8. Less than 0.1% of construction workers were coded in this occupational group.

11b. **Workers by occupational classification and distribution in construction, 2015 (16 years and older)**

Occupation	Code	Description	Number (thousands)	Percent
Laborer	6260	Construction laborer	1,611	16.2%
Carpenter	6230	Carpenter	1,134	11.4%
Manager	0010-0430 (except 0220)	Manager (except construction manager)	906	9.1%
Construction manager	0220	Construction manager	709	7.1%
Foreman	6200	First-line supervisor/manager of construction trade	625	6.3%
Electrician	6350	Electrician	560	5.6%
Painter	6420, 6430	Painter and paperhanger	524	5.3%
Admin support	5000-5930	Administrative support	485	4.9%
Plumber	6440	Pipelayer, plumber, pipefitter, and steamfitter	462	4.7%
Professional	0500-3650	Professional	390	3.9%
Heat A/C mech	7310	Heating, air conditioning, and refrigeration mechanic	301	3.0%
Operating engineer	6320	Operating engineer and other construction equipment operator	252	2.5%
Repairer	7000-8960 (except 7310, 7410, 8140)	Installation, maintenance, and repair worker	232	2.3%
Roofer	6510	Roofer	213	2.1%
Truck driver	9130	Driver/sales worker and truck driver	165	1.7%
Brickmason	6220	Brickmason, blockmason, and stonemason	162	1.6%
Service	3770-4980	Service/sales	155	1.6%
Drywall	6330	Drywall installer, and ceiling tile installer	154	1.6%
Carpet and tile	6240	Carpet, floor, and tile installer and finisher	131	1.3%
Welder	8140	Welding, soldering, and brazing worker	91	0.9%
Highway maint	6730	Highway maintenance worker	88	0.9%
Material moving	9000-9750 (except 9130, 9520)	Transportation and material moving	60	0.6%
Concrete	6250	Cement mason, concrete finisher, and terrazzo worker	49	0.5%
Ironworker	6530	Structural iron and steel worker	48	0.5%
Helper	6600	Construction helper	45	0.5%
Insulation	6400	Insulation worker	42	0.4%
Sheet metal	6520	Sheet metal worker	41	0.4%
Fence erector	6710	Fence erector	40	0.4%
Misc worker	6760	Miscellaneous construction and related worker	36	0.4%
Inspector	6660	Construction and building inspector	29*	0.3%
Glazier	6360	Glazier	29*	0.3%
Plasterer	6460	Plasterer and stucco mason	28*	0.3%
Dredge	9520	Dredge, excavating, and loading machine operator	26*	0.3%
Driller	6820	Earth driller, except oil and gas	21*	0.2%
Power-line installer	7410	Electrical power-line installer and repairer	16*	0.2%
Elevator	6700	Elevator installer and repairer	15*	0.2%
Paving	6300	Paving, surfacing, and tamping equipment operator	14*	0.1%
Iron reinforcement	6500	Iron reinforcement	9*	0.1%
Boilermaker	6210	Boilermaker	8*	0.1%
Other	--	Farming/fishing/forestry, hazardous material removal, etc.	32	0.3%
TOTAL			**9,938**	**100.00%**

Note: Chart 11a – Yearly figures are based on quarterly averages. "Construction workers" are defined as non-supervisory and non-clerical.
Chart 11b – Only workers employed in the construction industry were included. Construction managers plan, coordinate, budget, and supervise construction projects from start to finish. Managers (except construction managers) refer to all other managerial occupations, including architectural and engineering managers, equipment managers, financial managers, human resources mangers, etc. Operating engineers maintain and run heavy equipment, such as bulldozers and tower cranes. Braziers join metals using lower heat than welders use. "Other" includes farming/fishing/forestry, hazardous material removal workers, explosives workers, pile-driver operators, rail-track laying and maintenance equipment operators, and septic tank servicers and sewer pipe cleaners. An asterisk (*) indicates relatively small sample sizes that may make these numbers less reliable.

Source: Chart 11a – U.S. Census Bureau. 2012 and previous years Economic Census, Construction.
Chart 11b – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.

Union Membership and Coverage in Construction and Other Industries

In 2016, nearly 1.2 million (1,150,000) construction workers were union members, an increase of 100,000 from 2015 (1,050,000). About 1,039,000 union members in construction worked for private companies, and the remaining 111,000 were government (federal, state, and local government) employees.[1] An additional 62,900 construction workers who were not union members were covered by union contracts.

Overall, the construction industry in 2016 had a higher rate of union representation[2] than all other industries combined (15.5% versus 11.7%; chart 12a), including less than 1% of construction workers who reported no union affiliation but were covered by a union contract. Unionization is more common among *production* (blue-collar, *see* Glossary) occupations, with 18.1% union representation for construction in 2016. Moreover, the union membership rate among construction workers employed in government was more than double that of those who worked for private construction companies (31.8% versus 13.9%; chart 12b).

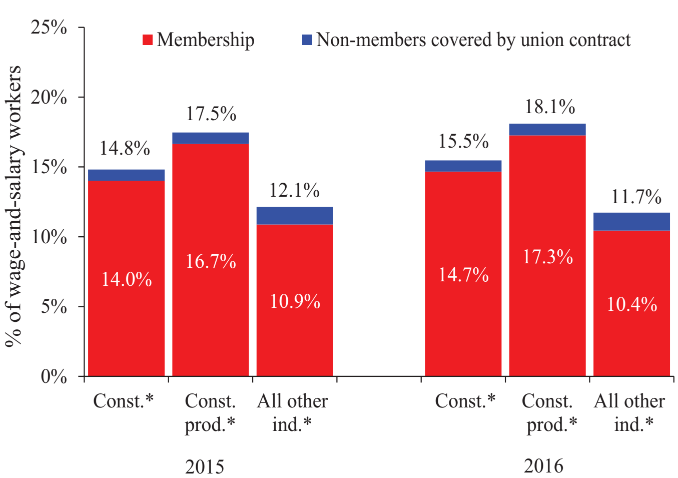
Union membership varies among construction occupations. In 2015, 40% of ironworkers and 39% of sheet metal workers were union members, while the rate of union membership was only 7% among painters and carpet and tile workers (chart 12c).

Union membership is also distributed differently by construction subsector. According to the rates estimated by the Subject Matter Experts (SMEs),[3] very few union members were employed in residential construction. In contrast, among union members who were boilermakers, almost all (99%) worked in the Heavy Civil/Industrial sector (chart 12d). As a result, estimated *union market share* (*see* Glossary) in this sector ranged as high as 42% to 50% between 2005 and 2012 (chart 12e), significantly higher than that for overall construction on average.

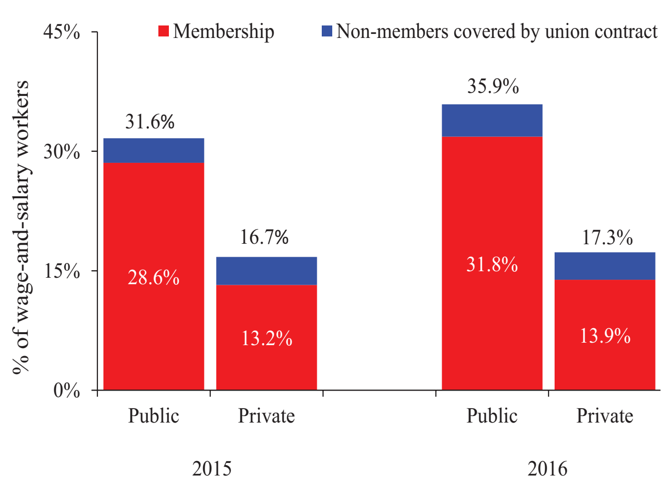
Geographically, four states had an annual union membership rate of more than 30% from 2013 to 2015 (chart 12e). These states, listed in decreasing order, were Hawaii, Illinois, New York, and Minnesota. The five states with the lowest union membership rates, listed in ascending order, were North Carolina, South Carolina, Arkansas, Texas, and Florida.

Unionization estimates from the CPS were based on two questions. The CPS asks *wage-and-salary* employees (*see* Glossary, self-employed workers are excluded from this question) if they are a member of a labor union or an employee association similar to a union. Respondents who answer "no" are asked if they are covered by a union or employee association contract. The numbers in construction reported on this page include both private and government employees. Therefore, the tabulations may vary from the publications of the U.S. Bureau of Labor Statistics, which typically reports union membership by industry for the private sector only (or not including government employees).[4] Since the construction industry is coded as a single category in the CPS, union membership/market share in construction subsectors was estimated indirectly.

12a. Union membership and coverage in construction and other industries, 2015 and 2016

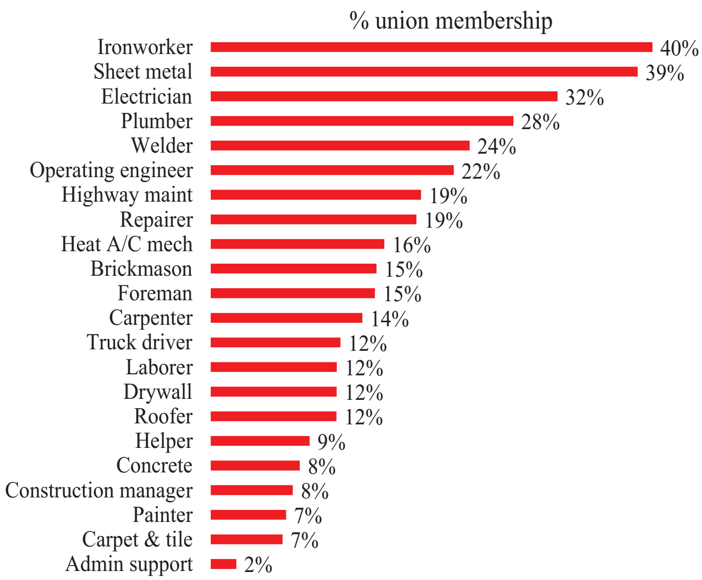


12b. Union membership and coverage in construction, public versus private sector, 2015 and 2016

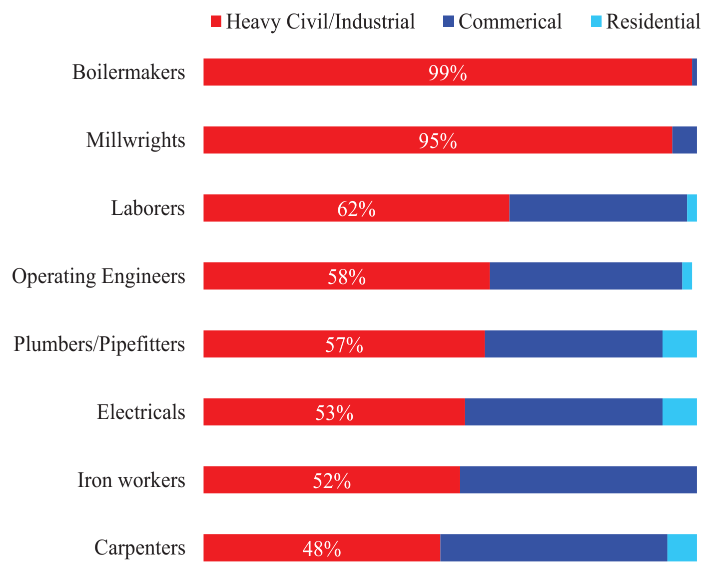


1. U.S. Bureau of Labor Statistics. 2015 and 2016 Current Population Survey. Calculations by the CPWR Data Center.
2. According to the BLS definition, this group includes both union members and workers who report no union affiliation but whose jobs are covered by a union contract.
3. Subject Matter Experts (SMEs) are individuals with extensive experience in, and/or substantial knowledge of, union construction work. The SMEs represent three categories: management, unions, and other.
4. U.S. Bureau of Labor Statistics. 2017. News Release: Union Members – 2016. http://www.bls.gov/news.release/pdf/union2.pdf (Accessed February 2017).

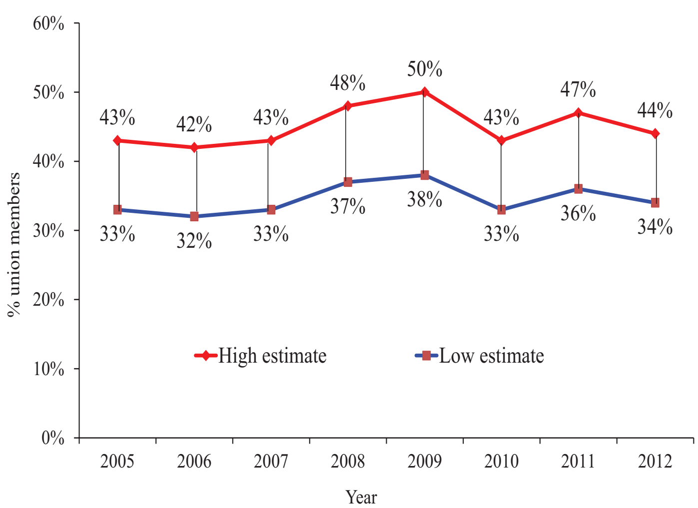
12c. Union membership, selected construction occupations, 2015



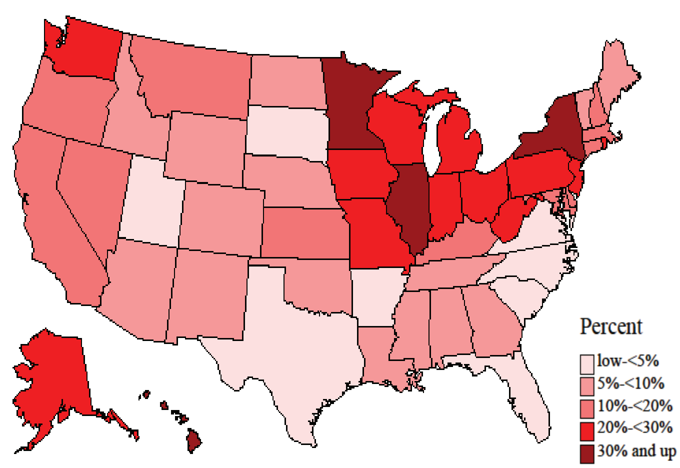
12d. Subject Matter Experts ratings for each union for each sector



12e. Union market share for the Heavy Civil/Industrial sector, 2005-2012



12f. Percentage of construction workers who are union members, by state, 2013-2015 average



Note: Chart 12a—Terms marked with an asterisk (*) were shortened for space as follows: Const.= construction; prod.= production; ind.= industry.
Charts 12a and 12b – Production (or blue collar) occupations, as distinguished from managerial and support staff, are listed as 6200-9750 in the Current Population Survey.
Chart 12c – These figures do not reflect total membership in any given union, which may include more than one occupation. The reported occupations are based on the sample size used for the estimates, not based on the union membership rates. The sample size of some occupations (such as boilermakers and elevator installers) are too small to be reported, though these occupations may have a higher union membership rate. Therefore, only selected occupations are reported.
Chart 12d – Numbers are based on assessments from the Subject Matter Experts.
Chart 12e – According to Market Share Analysis by the Construction Labor Research Council, union market share (or union membership) data for each craft/occupation in construction were acquired from the Current Population Survey. The distribution of the union workforce by construction sector for each craft/occupation (as determined by the SMEs) and the proportion of each sector among the total construction workforce (based on the Economic Census) were factored together for the estimates according to the formula X * Y/Z, where: X = CPS market share results, Y = SME results for unions for heavy civil/industrial, Z = Economic Census results for total industry for heavy civil/industrial.
Chart 12f – Data from three years were pooled together for more reliable estimates at the state level.

Source: Charts 12a and 12b – U.S. Bureau of Labor Statistics. 2015 and 2016 Current Population Survey. Calculations by the CPWR Data Center.
Chart 12c – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
Charts 12d and 12e – Construction Labor Research Council. 2014. Market Share Analysis. Unpublished data.
Chart 12f – U.S. Bureau of Labor Statistics. 2013-2015 Current Population Survey. Calculations by the CPWR Data Center.

Worker Age in Construction and Other Industries

The labor force in the U.S. is steadily and rapidly aging. Between 1985 and 2015, the average age of all U.S. workers increased by 4.9 years, but among construction workers it jumped 6.5 years (chart 13a). Since the economic downturn, the pace of aging in the construction industry has exceeded the pace for all industries combined. The average age of construction workers increased by two years over a seven-year time frame, jumping from 40.5 years in 2008 to 42.5 years in 2015, whereas the average age for all workers increased by less than a year during the same period. In addition, the aging construction workforce was strongly associated with the trend of construction employment. During the housing boom (*see* page 6), a large number of young workers (particularly young Hispanic workers, *see* page 14) entered the construction industry, which expanded the age gap between this industry and the overall workforce (chart 13a). This trend reversed during the economic downturn beginning in 2007, as more than two million construction workers lost their jobs within three years (*see* page 20). While younger construction workers may be more likely to lose their job and less likely to find a job, older workers may stay in the construction industry longer for financial reasons when the economy is not doing well.[1,2]

Self-employed workers are generally older than wage-and-salary workers (*see* page 14). Excluding self-employed workers, the average age of construction workers was 40.8 years in 2015, compared to 41.4 years for wage-and-salary workers in all industries (chart 13b).

The age distribution of the construction labor force has also shifted. From 1985 to 2015, the proportion of workers aged 45 to 64 years increased by 59%, from 25.1% to 39.7% (chart 13c).[3] Over this same time period, the portion of younger construction workers decreased by 67% for workers aged 16 to 19 years, 49% for those aged 20 to 24 years, and 32% for those aged 25 to 34 years.

Changes in the age composition of the labor force are significantly influenced by aging baby boomers (those born between 1946 and 1964). The youngest baby boomers will be at least 55 years by 2020, which will make those aged 55 years and older a larger share of the labor force than in the past.[4] Moreover, people are living longer, and as a result, are working past the "traditional" retirement age of 65.[5] At the same time, the age for collecting Social Security retirement benefit has been gradually increasing, which encourages people to work longer.[6] Furthermore, increasing competition has led companies to shift from defined benefit to defined contribution pension plans (*see* page 27), and to reduce or eliminate health care benefits for retirees (*see* page 26).[7] For these and other reasons, older workers have increased their labor force participation and full-time employment. By 2024, 25% of all U.S. workers will be 55 years or older, and 8% will be 65 years or older (chart 13d).

These demographic shifts have made the issue of ensuring healthier workers, especially those of advanced age, much more pressing.[8] To address this issue, research and policies are urgently needed to identify and promote effective programs and intervention techniques and strategies that can meet the safety and health needs of older workers.[5,9]

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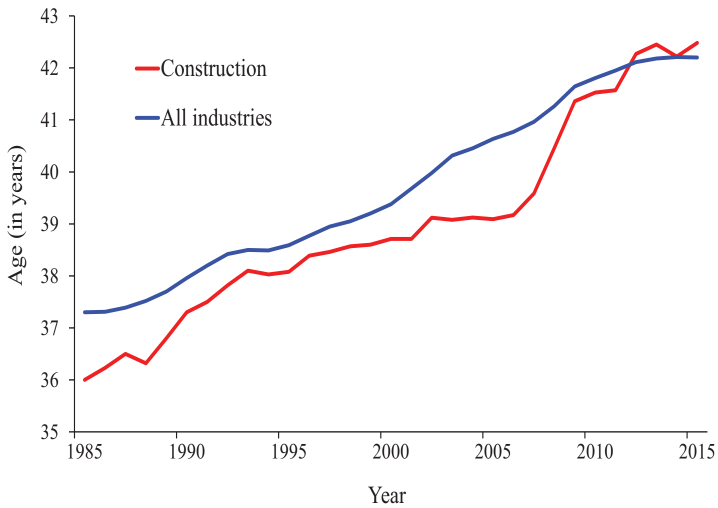
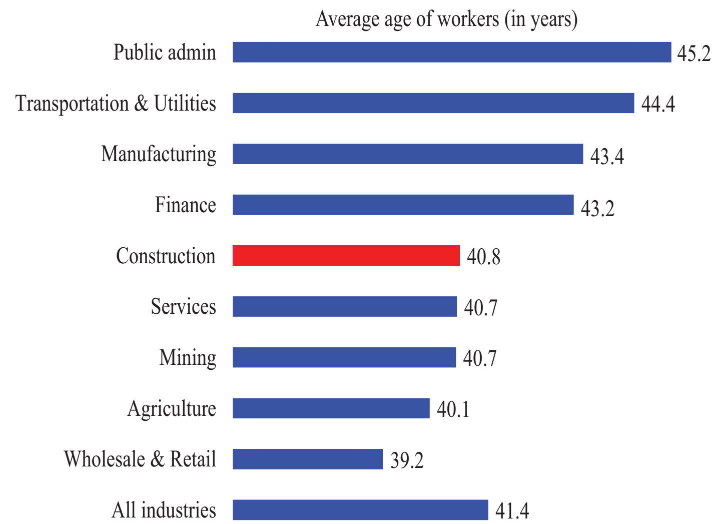
1. Ondrich J, Falevich A. 2016. The great recession, housing wealth, and the retirement decisions of older workers. Public Finance Review 44(1): 109–131.
2. Szinovacz ME, Davey A, Martin L. 2015. Did the great recession influence retirement plans? Research on Aging 37(3): 275–305.
3. All numbers cited in the text, except where noted, are from the 2015 Current Population Survey. Calculations by the CPWR Data Center.
4. Toossi M. 2015. Labor force projections to 2024: The labor force is growing, but slowly. Monthly Labor Review 1-36. http://www.bls.gov/opub/mlr/2015/article/labor-force-projections-to-2024.htm (Accessed February 2016).
5. University of Washington. Designing the age friendly workplace. https://agefriendlyworkplace.squarespace.com/ (Accessed November 2016). The labor force projections are converted from the Census Bureau's population projections using the Census 2010 population weights as the base, considering the size and composition of the population (e.g., deaths and net immigration), as well as the projected composition of GDP (*see p*age 4) and the demand for workers in various industries and occupations. https://www.bls.gov/emp/ep_projections_methods.htm (Accessed January 2017).
6. U.S. Social Security Administration. 2016. Understanding the benefits. https://www.socialsecurity.gov/pubs/EN-05-10024.pdf (Accessed March 2016). The age for collecting full Social Security retirement benefits will gradually increase from 65 to 67 over a 22-year period beginning in 2000. By 2033, there will be 2.1 workers for each beneficiary. https://www.socialsecurity.gov/OACT/TR/2015/II_D_project.html#132991 (Accessed March 2016).
7. Levy H, Buchmueller T, Nikpay S. 2015. The effect of health reform on retirement. University of Michigan Retirement Research Center, Research Paper No. 2015-329. http://ssrn.com/abstract=2697092 (Accessed January 2017).
8. Vatsalya V, Karch R. 2013. Evaluation of health determinants for sustaining workability in aging US workforce. Advances in Aging Research 2(3): 106–108.
9. The National Institute for Occupational Safety and Health. 2016. Productive aging and work. http://www.cdc.gov/niosh/topics/productiveaging/ (Accessed November 2016).

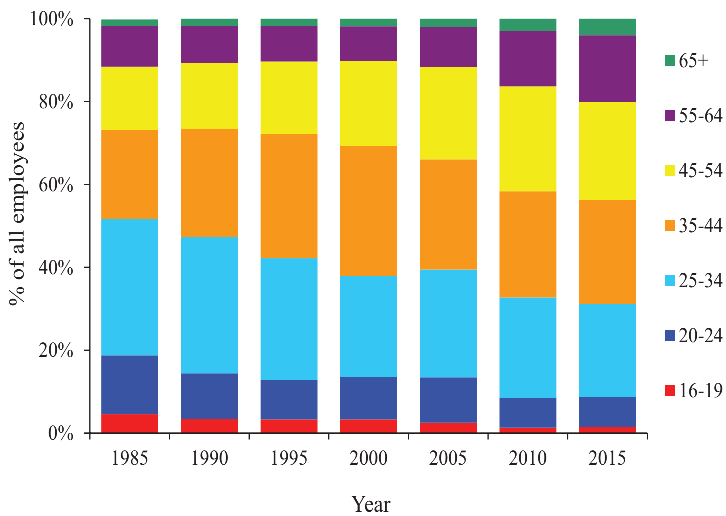
13a. Average age of workers, construction versus all industries, 1985-2015 (All employment)



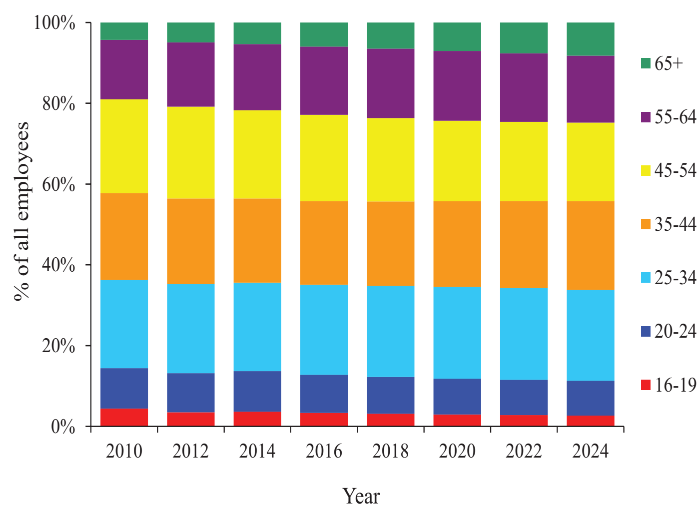
13b. Average age of workers, by industry, 2015 (Wage-and-salary workers)



13c. Age distribution in construction, selected years, 1985-2015 (All employment)



13d. Age distribution in all industries, projected through 2024 (All employment)



Note: Chart 13b – Excludes self-employed workers.

Source: Charts 13a and 13c – U.S. Bureau of Labor Statistics. 1985-2015 Current Population Survey. Calculations by the CPWR Data Center.
Chart 13b – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
Chart 13d – U.S. Bureau of Labor Statistics. Employment Projections: Civilian Labor Force, 2014-24. http://www.bls.gov/emp/ep_data_labor_force.htm (Accessed February 2016).

Age of Construction Workers by Union Status, Hispanic Ethnicity, Type of Employment, and Occupation

Construction workers in *production* (blue-collar, *see* Glossary) occupations are generally younger than those in managerial and professional occupations.[1] The average age of construction production workers in 2015 was 41.2 years, compared to 45.8 years for managerial and administrative employees.[2]

On average, union members in construction are older than nonunion workers. Among production workers in 2015, the average age of union members was 42.3 years, compared to 39.2 years for nonunion workers. The difference in the *median* (*see* Glossary) age for the two groups was even greater (42 years versus 38 years). Only 16.6% of union members who performed production work were younger than 30 years old, compared with 25.4% of nonunion workers (chart 14a). About 56.7% of union members in production occupations were 40 years or older, while 45.9% of nonunion workers were in this age group.

Hispanic construction workers tend to be younger than their non-Hispanic counterparts. In 2015, the median age for Hispanic workers was 38 years, compared to 44 years for non-Hispanic workers. Almost one-quarter (23%) of Hispanic workers were less than 30 years old in 2015, compared to 17% of non-Hispanic workers in this age group (chart 14b). However, Hispanic workers have been getting older on average. When comparing 2010 data with 2015 data, the largest age group within Hispanic construction workers shifted from 30 to 34 years up to 35 to 39 years. This indicates that fewer young people (particularly young Hispanics) entered the construction industry in recent years, even as the industry began to recover after the economic downturn (*see* pages 13, 16, and 20).

Age distributions in construction also vary by employment type. Wage-and-salary workers were on average seven years younger than self-employed workers, with average ages of 41 years and 48 years, respectively. More than one quarter (27.3%) of wage-and-salary workers were at least 50 years old, whereas close to half (46.5%) of self-employed workers were in the same age range (chart 14c). Among wage-and-salary workers, those who worked in private companies were younger, with an average age of 40 years, compared to 46 years for government employees.

In 2015, about one in five construction workers were 55 years or older (20.5%; chart 14d). The proportion of construction workers in that age group primarily reflects differences in the physical demands of construction jobs. Nearly one-third of managerial workers were aged 55 or older. Among production occupations, operating engineers had the largest proportion (26.0%) of workers aged 55 and older, followed by foremen (24.6%), truck drivers (24.4%), and ironworkers (23.0%). Except for a handful of occupations (e.g., drywall installers, roofers), most construction jobs are likely to be impacted by the aging workforce in the near future. The bump in baby boomers will result in increased retirements, and skilled workers will be in high demand to replace them. It is expected that the need for occupational training and safety and health training for new workers will increase in construction in the next decade (*see* pages 30 and 31).

On the other hand, baby boomers (*see* page 13) expect to work longer than their predecessors.[3] Given the high physical demands of construction jobs, ergonomic and other specific interventions to reduce physical stressors among workers are necessary.[4,5] Accumulated knowledge, experiences, and other advancements of older workers can benefit employers and businesses.[6,7] Moreover, opportunities for learning and re-training, flexibility in scheduling, and the option to transition gradually to retirement through part-time or bridge work should also be available for older workers.[3,8]

1. Production workers are all workers, except managerial and administrative support staff, and include the self-employed.
2. All numbers cited in the text are from the 2015 Current Population Survey. Calculations by the CPWR Data Center.
3. Dong XS, Wang X, Ringen K, Sokas R. 2016. Baby boomers in the United States: Factors associated with working longer and delaying retirement. American Journal of Industrial Medicine (in press).
4. National Institute for Occupational Safety and Health. 2016. Productive aging and work. http://www.cdc.gov/niosh/topics/productiveaging/ncpaw.html (Accessed November 2016).
5. Rempel D, Barr A. 2015. A universal rig for supporting large hammer drills: Reduced injury risk and improved productivity. Safety Science 78: 20-24.
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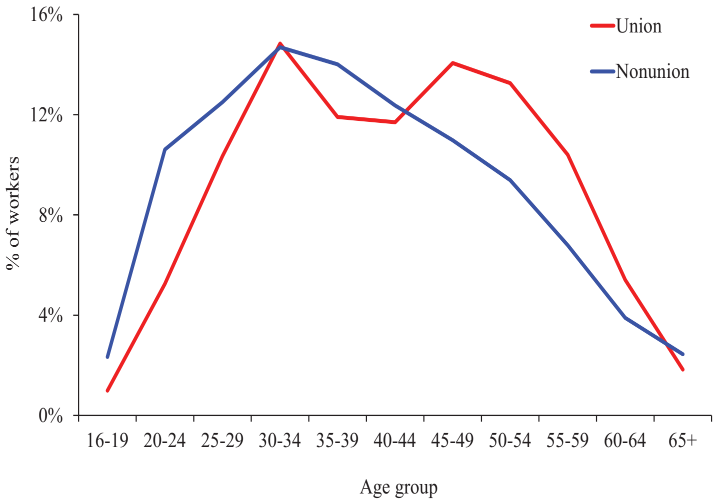
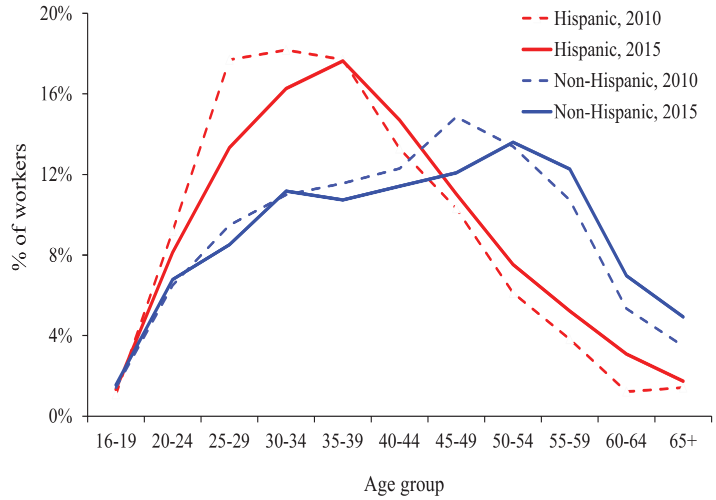
7. Stanimira KT, Arnold J, Nicolson R. 2016. The experience of being an older worker in an organization: A qualitative analysis. Work, Aging and Retirement 2(4): 396-414.
8. McFall BH, Sonnega A, Willis RJ, Hudomiet P. 2015. Occupations and work characteristics: Effects on retirement expectations and timing. University of Michigan Retirement Research Center, Working Paper 2015-331. http://www.mrrc.isr.umich.edu/publications/papers/pdf/wp331.pdf (Accessed November 2016).

14a. **Age distribution in construction, by union status, 2015 (Production workers)**

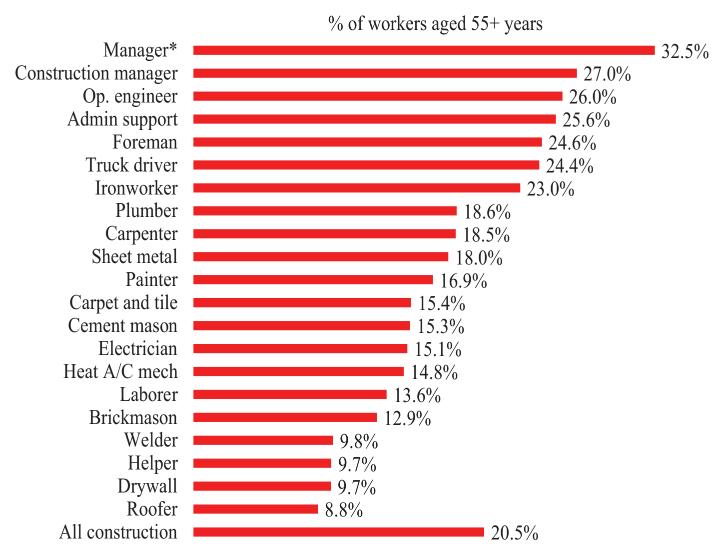


14b. **Age distribution in construction, by Hispanic ethnicity, 2010 versus 2015 (All employment)**



14c. **Age distribution in construction, wage-and-salary versus self-employed workers, 2015 (All employment)**

14d. **Construction workers aged 55+ years, selected construction occupations, 2015 (All employment)**



Note: All charts – Includes self-employed workers.
Chart 14a – Production workers are all workers, except managerial and administrative support staff, and include the self-employed.
Chart 14d – The asterisk (*) denotes the exclusion of construction managers (*see* page 11).

Source: Charts 14a, 14c, and 14d – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
Chart 14b – U.S. Bureau of Labor Statistics. 2010 and 2015 Current Population Survey. Calculations by the CPWR Data Center.

Foreign-born Workers in Construction and Other Industries

In 2015, there were 25.7 million *foreign-born* (*see* Glossary) workers in the U.S., making up 17.1% of the U.S. workforce.[1] Among the major industrial sectors, the construction industry employed the highest percentage of foreign-born workers outside of agriculture. About 2.4 million construction workers, nearly a quarter (24.7%) of the industry workforce, were born in foreign countries (chart 15a).

The majority (84.3%) of foreign-born workers in construction were born in Latin American countries (chart 15b) in which 53.1% were born in Mexico, 6.6% in El Salvador, 5.4% in Guatemala, 4.7% in Honduras, 2.4% in Cuba, 2.1% in Ecuador, and a small percentage in other countries in that area. Workers who identify their origin as Latin American are categorized as *Hispanic* (*see* Glossary) under ethnicity. Hispanics are the fastest growing ethnic group in the U.S. (*see* pages 16 and 17). Europeans made up 7.3% of foreign-born workers in construction, and 6.4% came from Asia (chart 15b). About 74% of foreign-born construction workers reported they were not U.S. citizens when the survey was conducted.

In 2015, nearly 30% of construction workers spoke a language other than English at home (chart 15c). Among foreign-born construction workers, about 86% reported they spoke Spanish at home. Other languages spoken at home among foreign-born construction workers included Portuguese (1.8%), Polish (1.5%), and Russian (1.1%). In fact, less than 9% of foreign-born construction workers spoke English at home. Overall, more than 33 million workers in the U.S. spoke languages other than English at home in 2015.

The foreign-born population grew rapidly through the late 1990s and early 2000s, but slowed down after the *Great Recession* (*see* Glossary) started in December 2007. More than half (51.3%) of immigrant construction workers in 2015 reported entering the U.S. between 1995 and 2007 (chart 15d). Following the economic slump that started in 2007, fewer foreign-born workers were employed in the construction industry. Only 6% of foreign-born construction workers currently in the U.S. reported they arrived during the period of 2008 and 2010, whereas 10% entered between 2005 and 2007.

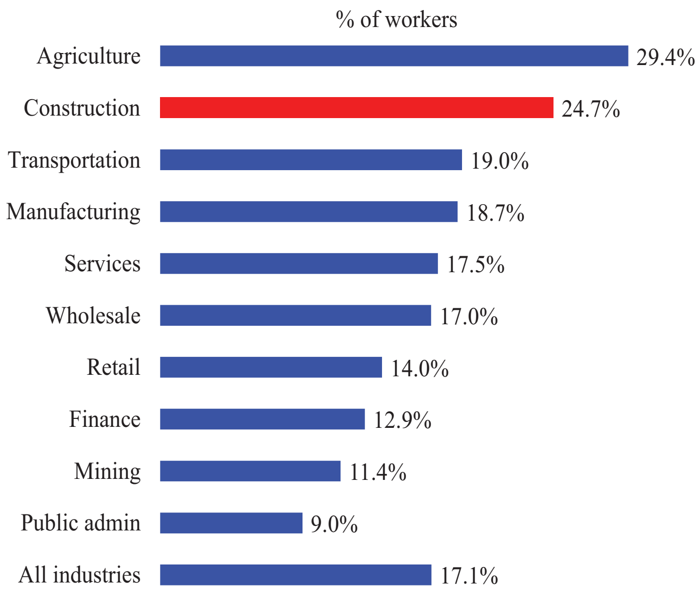
The aforementioned statistics are from the American Community Survey (ACS), the largest household survey in the nation, with an annual sample size of about three million households. The ACS is a Census Bureau survey designed to gather accurate and timely demographic information such as age, gender, race, and ethnicity, as well as socioeconomic indicators, including education, residence, birthplace, language spoken at home, employment, and income on an annual basis for both large and small geographic areas within the U.S. However, the ACS does not provide information on undocumented workers.

Although there is no universally accepted method for estimating the number of *unauthorized* (undocumented) *immigrant workers* (*see* Glossary), the Pew Research Center (PRC) reported that about eight million unauthorized immigrants in the U.S. were working or looking for work in 2014, making up 5% of the *civilian labor force* (*see* Glossary).[2] The unauthorized immigrant workforce was slightly smaller in 2014 than in 2007, but has been stable since 2009. This PRC estimate was consistent with the most recent estimates by the U.S. Department of Homeland Security.[3]

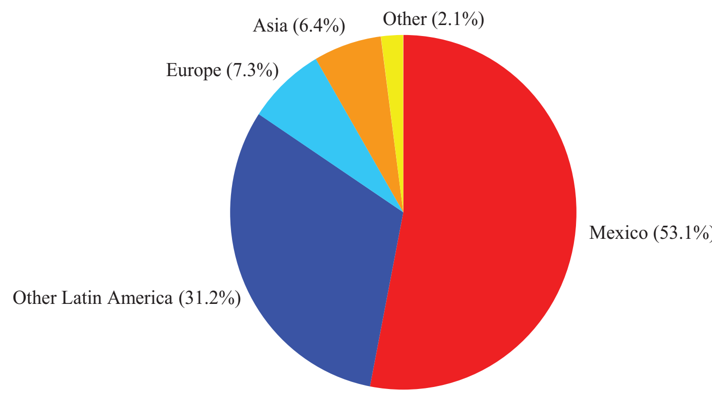
Despite the overall declining trend of unauthorized immigrant workers, the number of those workers in the construction industry remains sizable. Compared with the 5% portion of the overall workforce, about 13% of construction workers were unauthorized immigrants.[2] The percentage of undocumented workers may be even higher among Hispanic *migrant workers* (*see* Glossary). Estimates using data from the Mexican Migration Project (MMP), a collaborative research project between Princeton University and the University of Guadalajara,[4] indicate that nearly 75% of workers migrating from Mexico to the U.S. were undocumented or had false documentation on their first trip.[5]

1. All numbers cited in the text, except where noted, were from the 2015 American Community Survey. Calculations by the CPWR Data Center.
2. Passel JS, Cohn D. 2016. Size of U.S. Unauthorized Immigrant Workforce Stable After the Great Recession. Pew Research Center. http://www.pewhispanic.org/2016/11/03/size-of-u-s-unauthorized-immigrant-workforce-stable-after-the-great-recession/ (Accessed November 2016).
3. Baker B, Rytina N. 2013. Estimates of the Unauthorized Immigrant Population Residing in the United States: January 2012. U.S. Department of Homeland Security. Office of Immigration Statistics. https://www.dhs.gov/immigration-statistics/population-estimates/unauthorized-resident (Accessed November 2016).
4. Princeton University, Office of Population Research. 2016. What is the MMP? http://mmp.opr.princeton.edu/ (Accessed November 2016).
5. Mexican Migration Project (MMP). 2016. Calculations by the CPWR Data Center.

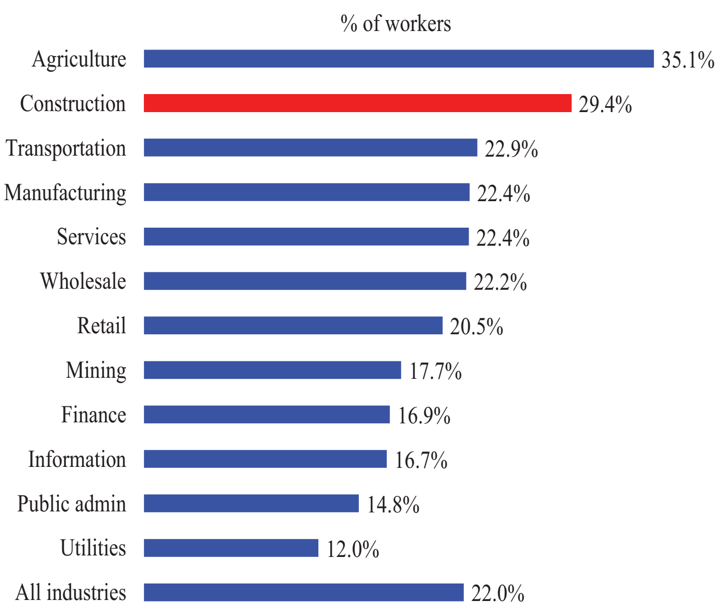
15a. Percentage of foreign-born workers, by industry, 2015 (All employment)



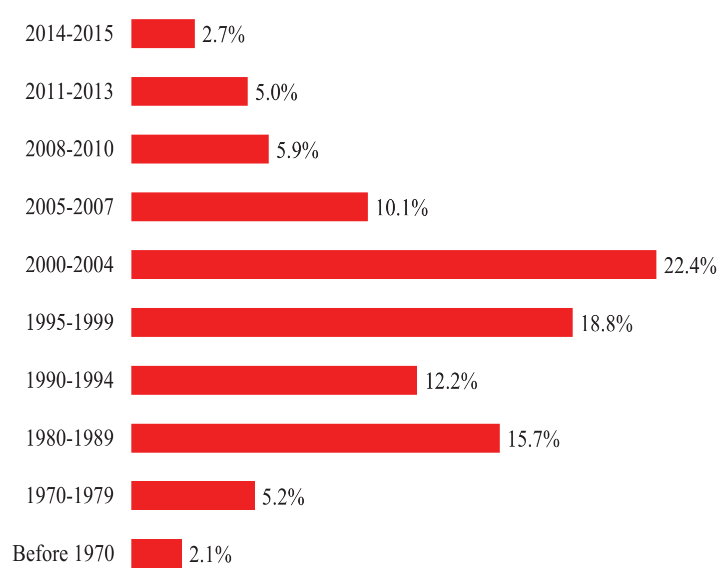
15b. Birthplace of foreign-born construction workers, 2015 (All employment)



15c. Percentage of workers who spoke a language other than English at home, by industry, 2015 (All employment)



15d. Year of entry for immigrant construction workers in the U.S., 2015 (All employment)



Note: Chart 15b – "Other" world areas include North America, Africa, and Oceania (islands in the Pacific Ocean and its vicinity). Total may not add to 100% due to rounding.

Source: All charts – U.S. Census Bureau. 2015 American Community Survey. Calculations by the CPWR Data Center.

Hispanic Workers in Construction and Other Industries

The share of Hispanic[1] workers within the U.S. labor force has increased significantly since the 1990s, particularly in the construction industry. From 1990 to 2015, the proportion of workers in all industries that identified themselves as Hispanic more than doubled, jumping from 7.0% to 16.4%, and more than tripled in the construction industry, climbing from 9.0% to 28.6% in the same time period (chart 16a). However, since the onset of the *Great Recession* (*see* Glossary) in 2007, the pace of growth of the U.S. Hispanic population has slowed given fewer immigrants and a falling birth rate, bringing the annual average growth rate down from 4.4% to 2.8%.[2] This change is reflected in employment trends; the number of Hispanic workers in construction dropped to 2.2 million in 2010 from its peak at nearly three million in 2007 (chart 16b). With the recent economic recovery, Hispanic employment in construction increased to 2.8 million in 2015, but was still lower than its peak level in 2007.

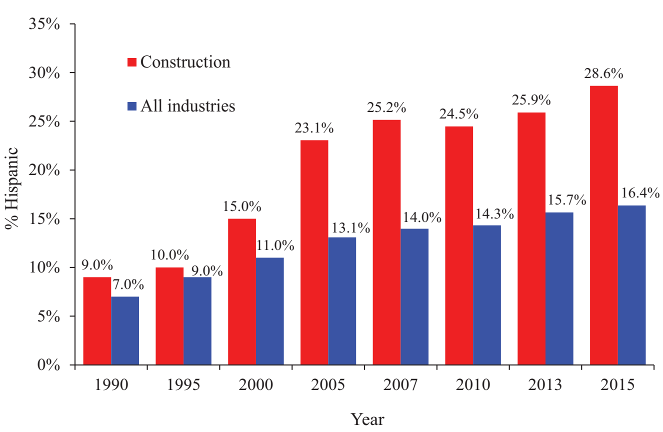
Most Hispanic workers are new immigrants (*see* page 15). About 73% of the 2.8 million Hispanics working in construction in 2015 were born outside the U.S., and nearly 1.7 million (59%) were not U.S. citizens. A majority of Hispanic workers are employed in *production*, or blue-collar, occupations (*see* pages 11 and 17). In 2015, 34.3% of production workers in construction were Hispanic, higher than the proportion among production workers in any other industry (chart 16c).

The Hispanic population is overrepresented in the South and West *regions* (*see* Glossary).[3] In 2015, 48% of Hispanic construction workers resided in the South, 35% in the West, 10% in the Northeast, and 7% in the Midwest. At the state level, more than half (54.5%) of Hispanics in the United States lived in California, Florida, and Texas.[4] In construction, Hispanic workers accounted for more than half of all construction workers in California, New Mexico, and Texas, but less than 3% in Vermont, West Virginia, North and South Dakota, Montana, and Maine (chart 16d).

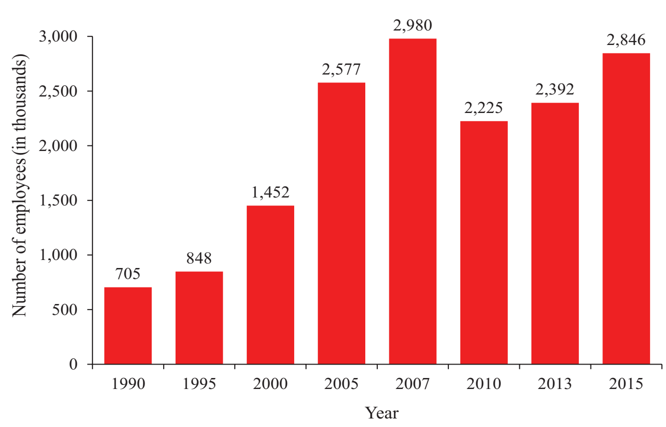
In this Chart Book, detailed demographic information for sub groups (such as language spoken among foreign-born workers) and state-level data are from the American Community Survey (ACS; *see* page 15), while data on employment trends, occupation, and unionization are from the Current Population Survey (CPS; *see* page 10). Both the ACS and the CPS provide a Spanish language version of their survey instruments and identify people as Hispanic only if self-reported by the respondent. The number of Hispanic workers is suspected to be underestimated since the majority of Hispanic workers are immigrants, and the undercount rates in household surveys for the foreign-born population are significantly higher than for the U.S.-born population.[5]

The ACS sample size is much larger than that of the CPS, but the CPS has more detailed labor force questions. For example, the CPS collects information on union status, while the ACS does not. The CPS sample is designed to achieve a high degree of reliability for monthly estimates nationwide, but its sample is spread too thin geographically to provide reliable computations for state-level estimates within the construction industry. Therefore, the two surveys were used for distinct purposes in this Chart Book.

16a. Hispanic workers as a percentage of the workforce, construction versus all industries, selected years, 1990-2015 (All employment)

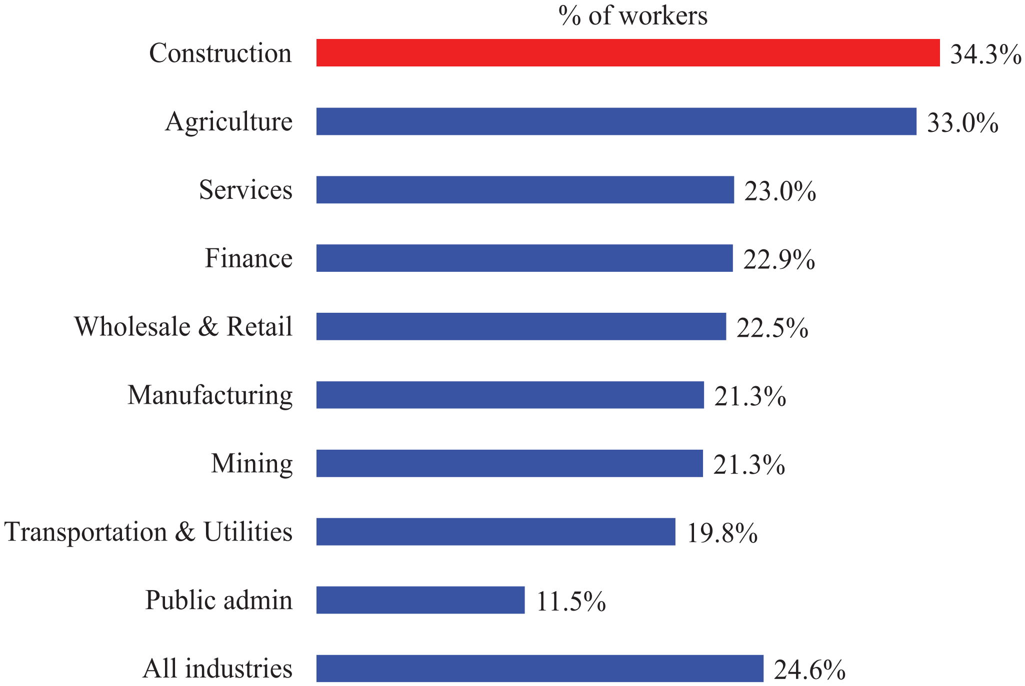


16b. Number of Hispanic workers in construction, selected years, 1990-2015 (All employment)

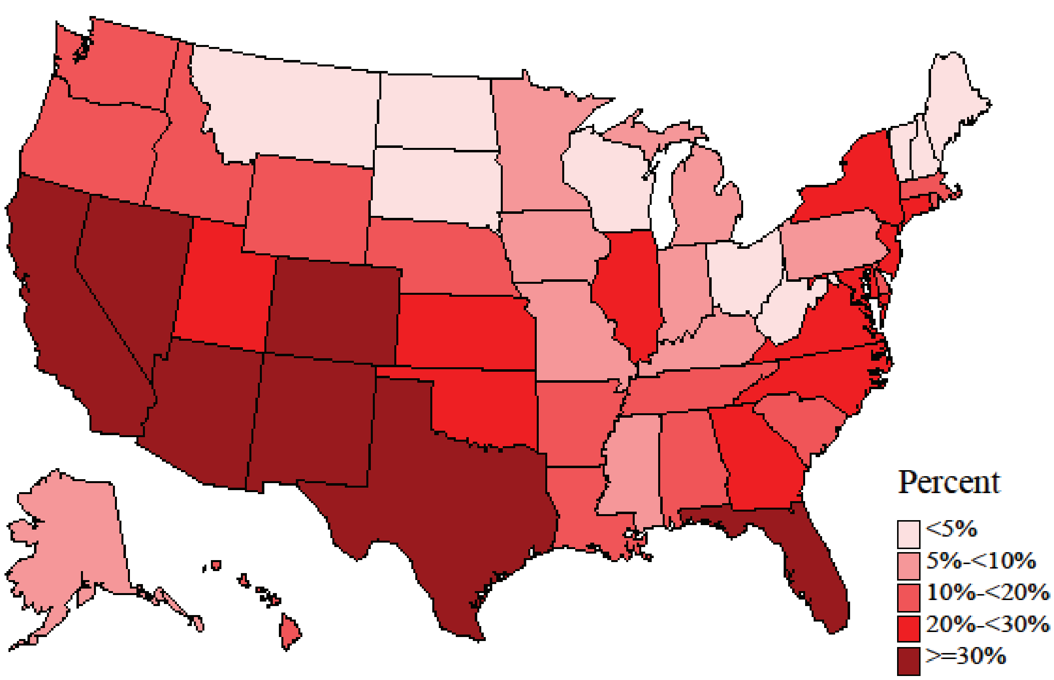


1. Hispanic refers to any individual whose origin is Mexican, Puerto Rican, Cuban, South or Central American, Chicano, or other Latin American. Hispanics can be any race (*see* racial minorities in the Glossary and page 18). The term Latino is used in place of Hispanic in many publications. However, to maintain consistency, Hispanic is used throughout this Chart Book, as it is used by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics.
2. Krogstad JM. 2016. Key facts about how the U.S. Hispanic population is changing. Pew Research Center. http://www.pewresearch.org/fact-tank/2016/09/08/key-facts-about-how-the-u-s-hispanic-population-is-changing/ (Accessed November 2016).
3. U.S. Census Bureau. 2016. Census regions and divisions are groupings of states that subdivide the United States, including Northeast, Midwest, South, and West. https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf (Accessed November 2016).
4. U.S. Census Bureau. 2016. Vintage 2015 population estimates. https://www.census.gov/programs-surveys/popest/data/tables.2015.html (Accessed November 2016).
5. Pew Research Center. 2015. Hispanic Trends. Modern immigration wave brings 59 million to U.S., driving population growth and change through 2065. http://www.pewhispanic.org/2015/09/28/modern-immigration-wave-brings-59-million-to-u-s-driving-population-growth-and-change-through-2065/ (Accessed November 2016).

16c. Percentage of Hispanic workers, by industry, 2015 (Production workers)



16d. Percentage of Hispanic construction workers, by state, 2015 (All employment)



Note: Charts 16a and 16b – The numbers of Hispanics before 2005 were adjusted by the parameters provided by the U.S. Bureau of Labor Statistics.

Source: Charts 16a and 16b – U.S. Bureau of Labor Statistics. 2015 and previous years Current Population Survey. Calculations by the CPWR Data Center.
Chart 16c – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
Chart 16d – U.S. Census Bureau. 2015 American Community Survey. Calculations by the CPWR Data Center.

Hispanic Workers in Construction Occupations

Hispanic (*see* Glossary) workers play a large role in the construction industry (*see* page 16), particularly among *production* (blue-collar) occupations (*see* page 11). In 2015, about 88% of Hispanic workers had jobs in production occupations, compared to 67% of non-Hispanic workers (chart 17a). Hispanic workers are less likely to work in a managerial or professional position than non-Hispanic workers. Only 8% of Hispanic workers were employed in managerial or professional occupations in 2015, while 25% of non-Hispanic workers were in such occupations that year.

When examining detailed occupation categories, about 27% of Hispanic workers were employed as construction laborers (chart 17b) compared to 16% of all construction workers (*see* page 11). Within some construction occupations, more than half of the workers were of Hispanic origin; this includes drywall installation (61.2%), roofing (54.4%), and painting (51.7%; chart 17c).

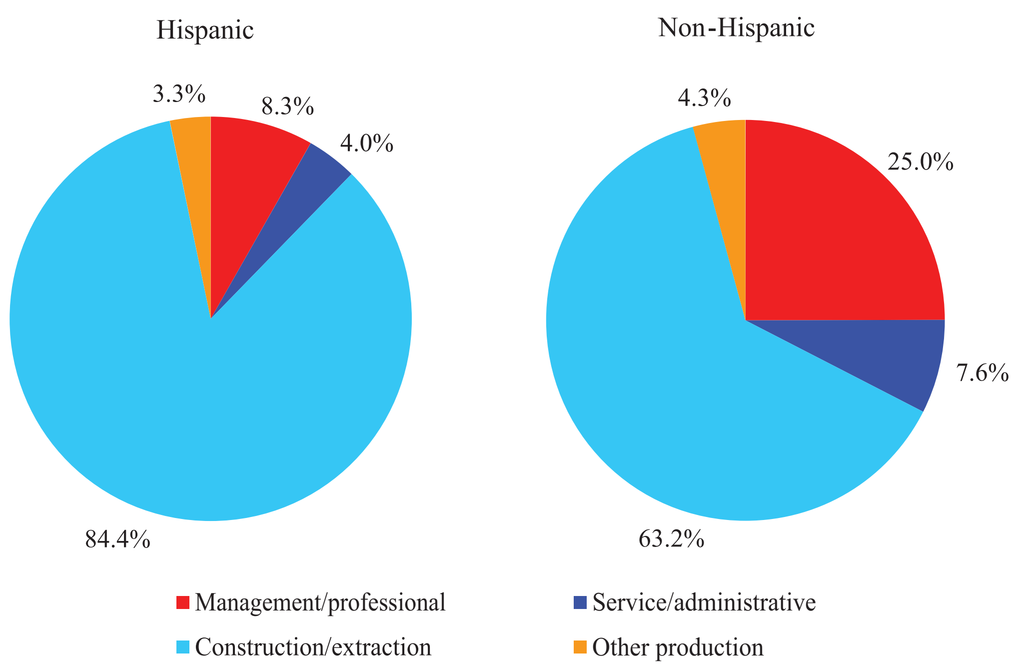
Many Hispanic workers in construction are new immigrants. In 2015, nearly half (48%) of Hispanic construction workers reported entering the U.S. after 2000. About 40% of Hispanic immigrant workers reported that they cannot speak English very well, and 21% reported they cannot speak English at all.[1] However, the percentage in each of the categories was lower than in 2010 (*see* the fifth edition of the Chart Book, page 18), corresponding to a decrease in immigration after the recession (*see* page 15).[2]

Hispanic construction workers are less likely to be unionized. In 2015, only 8.2% of Hispanic workers in construction were union members, compared to 16.6% among non-Hispanic construction workers (chart 17d). Since union members tend to have higher wages and benefits, non-unionized Hispanic workers were more likely to report lower wages and less likely to have health insurance, pensions, and other benefits than their unionized counterparts (*see* pages 24, 26-27).

Hispanic women are underrepresented in the construction workforce. In 2015, less than 5% of Hispanic construction workers were women,[3] compared to 9% of all construction workers (*see* page 19). In addition, Hispanic construction workers were less likely to hold government jobs than non-Hispanic workers (1.5% versus 4.8%).[3]

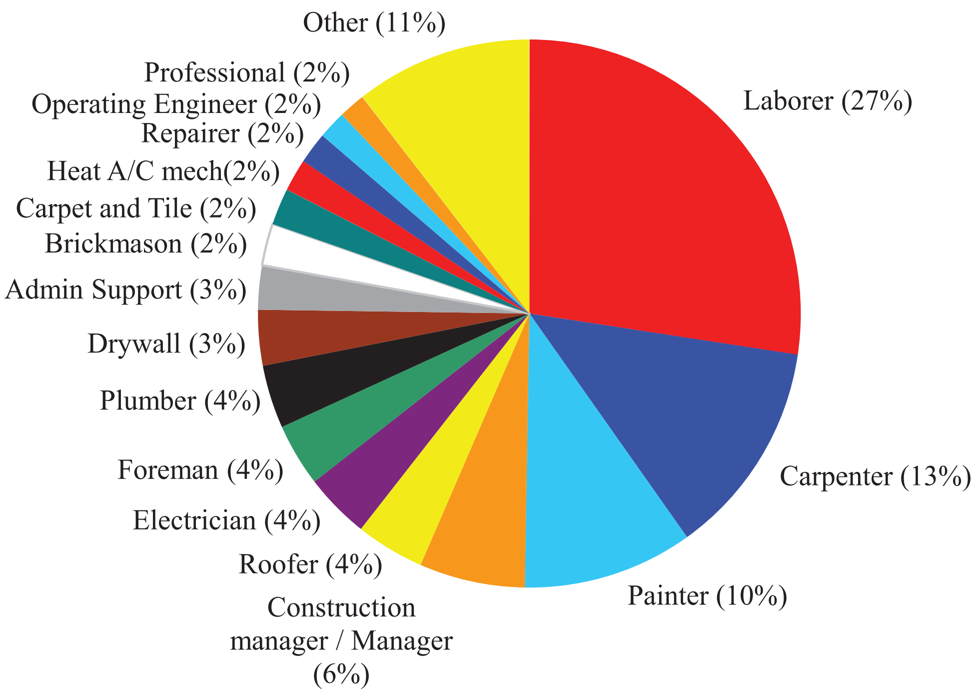
In general, Hispanic construction workers are also younger (*see* page 14), less educated (*see* page 29), receive less training (*see* page 30), earn lower wages (*see* page 24), and work in smaller construction companies. Many of these factors make Hispanic workers more vulnerable to work-related injuries and illnesses.[4]

17a. Occupational distribution in construction, by Hispanic ethnicity, 2015 (All employment)

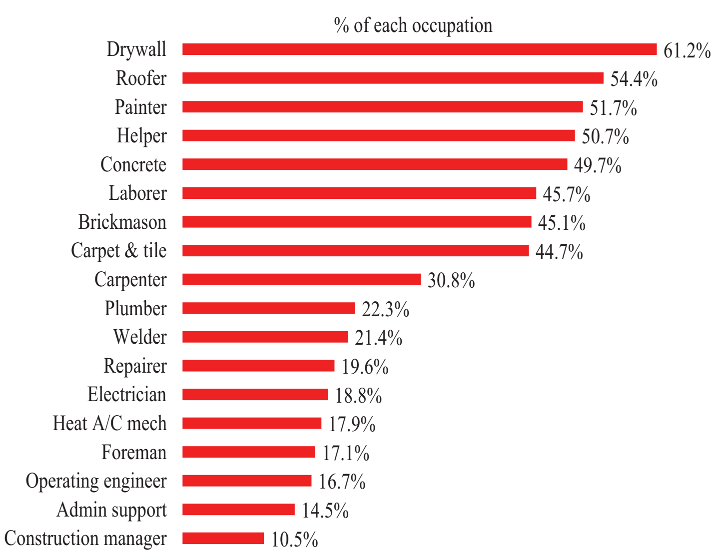


1. Numbers were estimated from the Current Population Survey. Calculations by the CPWR Data Center.
2. Kochhar R. 2014. Latino Jobs Growth Driven by U.S. Born: Immigrants No Longer the Majority of Hispanic Workers. Pew Research Center. http://www.pewhispanic.org/2014/06/19/latino-jobs-growth-driven-by-u-s-born/ (Accessed November 2016).
3. Numbers were estimated from the American Community Survey. Calculations by the CPWR Data Center.
4. National Institute for Occupational Safety and Health. 2015. Overlapping Vulnerabilities: The Occupational Health and Safety of Young Immigrant Workers in Small Construction Firms. http://www.asse.org/assets/1/7/NIOSHreport_FinalDraft.pdf (Accessed November 2016).

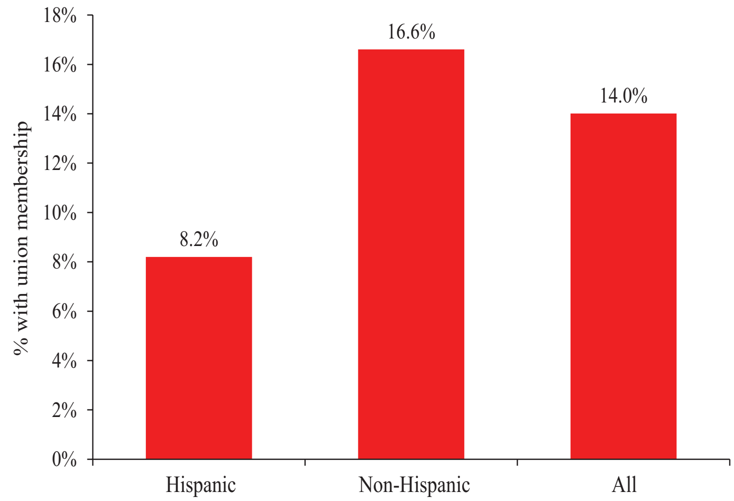
17b. Distribution of Hispanic workers among construction occupations, 2013-2015 average (All employment)



17c. Hispanic workers as a percentage of the workforce, selected construction occupations, 2013-2015 average (All employment)



17d. Union membership among construction workers, by Hispanic ethnicity, 2015 (Wage-and-salary workers)



Note: All charts – Total of 2.8 million Hispanic construction workers (all types of employment) in 2015 (*see* page 16).
Charts 17a and 17b – Totals may not add to 100% due to rounding.
Charts 17b and 17c – Data are averaged over three years to attain statistically valid numbers. Concrete workers include cement masons, cement finishers, and terrazzo workers (*see* page 11).

Source: Charts 17a and 17d – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
Charts 17b and 17c – U.S. Bureau of Labor Statistics. 2013-2015 Current Population Survey. Calculations by the CPWR Data Center.

Racial Minorities as a Worker Group in Construction and Other Industries

More than 1.8 million *racial minorities* (*see* Glossary) were employed (including self-employed) in the construction industry in 2015, accounting for 19% of construction workers.[1] For only wage-and-salary workers, the proportion of construction workers categorized as racial minorities is higher, but is still lower than in most other industries (20.3%; chart 18a). Racial minorities on this page refer to a combined group including all racial categories except "white only."

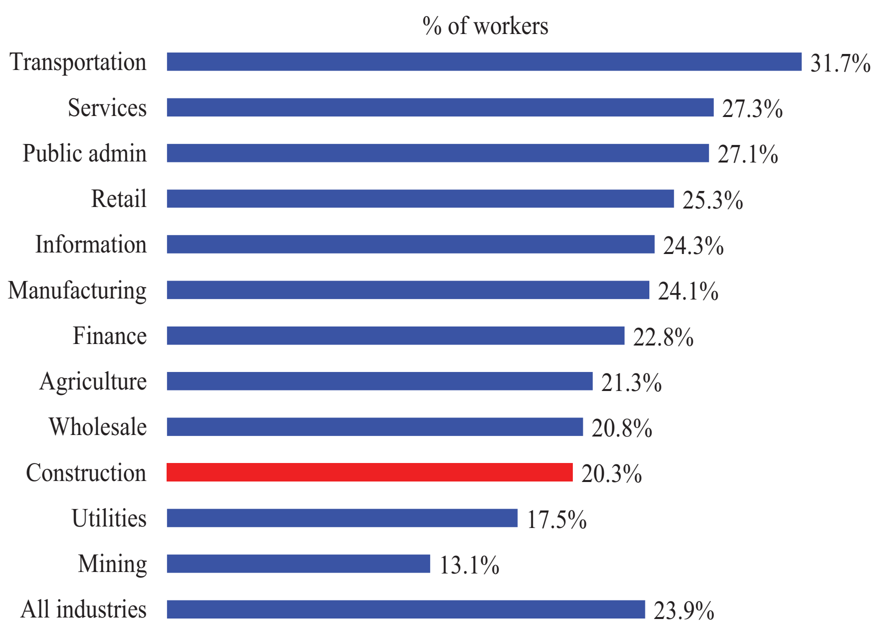
Employment patterns in construction suggest ongoing racial disparities in this industry. In 2015, minority construction workers were more likely to work for private companies than their white counterparts (77.7% versus 71.0%), but were less likely to be self-employed (18.0% versus 24.3%). In addition, women accounted for 8% of construction workers who were racial minorities, similar to the proportion among all construction workers (9%; *see* page 19).

Minority workers are also more likely to take *production* (blue-collar, *see* Glossary) jobs. Overall, 84% of racial minorities in construction worked in blue-collar occupations in 2015, while 76% of the construction workforce was employed in such occupations (*see* page 11). This difference is more pronounced among certain construction occupations. For example, among painters, laborers, drywall installers, and roofers, more than a quarter of workers were of racial minority status, yet only 11% of construction managers were a minority (chart 18b). Among minority construction workers, 26% were laborers (chart 18c), 63% higher than the proportion of laborers among the overall construction workforce (16%, *see* page 11).

Data provided on this page were from the American Community Survey (ACS, *see* page 15), which classifies race as white, black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, "some other race," or "two or more major race groups." "Some other race" includes all other responses not included in the race categories described above. "Two or more race groups" refers to multiracial individuals. The survey respondents were given the option of selecting one or more race categories to indicate their racial identities. According to ACS estimates, nearly 10 million Americans reported themselves as a member of two or more races in 2015, accounting for 3% of all Americans.[2] Race characterizes the population based on physical characteristics, whereas *ethnicity* (*see* Glossary) considers cultural, linguistic, or national origin traits.[2] For instance, people of Hispanic origin (*see* pages 16 and 17) may be any race, and may or may not be included in racial minorities. Thus, racial minorities and Hispanics can be counted in each subgroup or overlap.

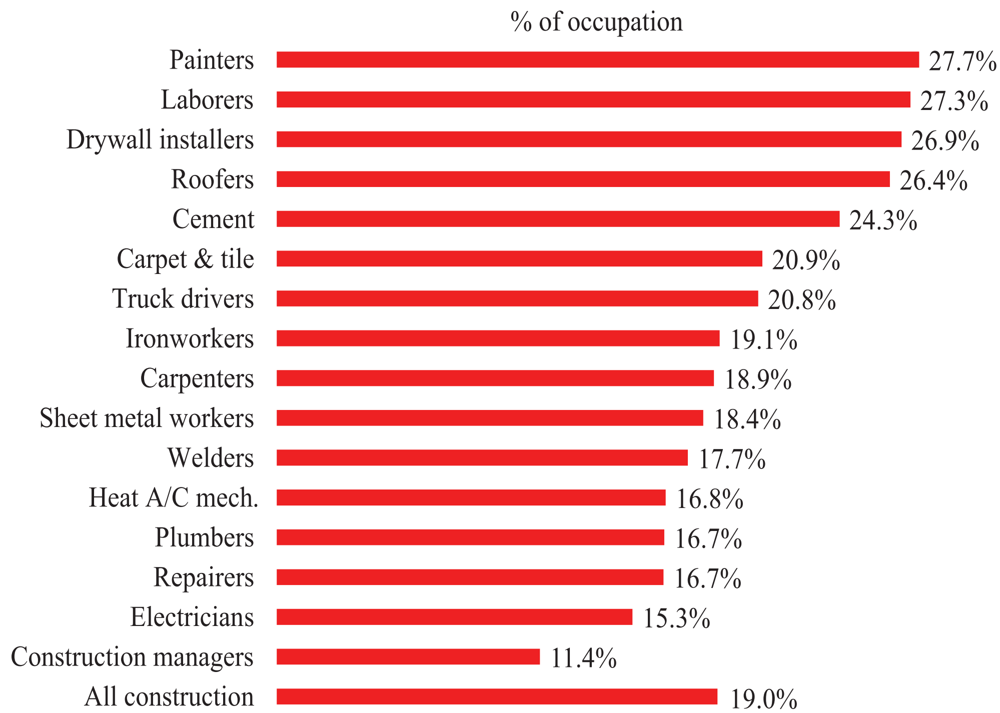
The ACS revised the questions on race in 2008 to make them consistent with the Census 2010 question wordings.[2] Therefore, data showing race in this Chart Book are not directly comparable with data on race in previous editions of this book. Caution must be used when interpreting changes in the racial composition of construction employment over time.

18a. Members of racial minorities as a percentage of workers, by industry, 2015 (Wage-and-salary workers)

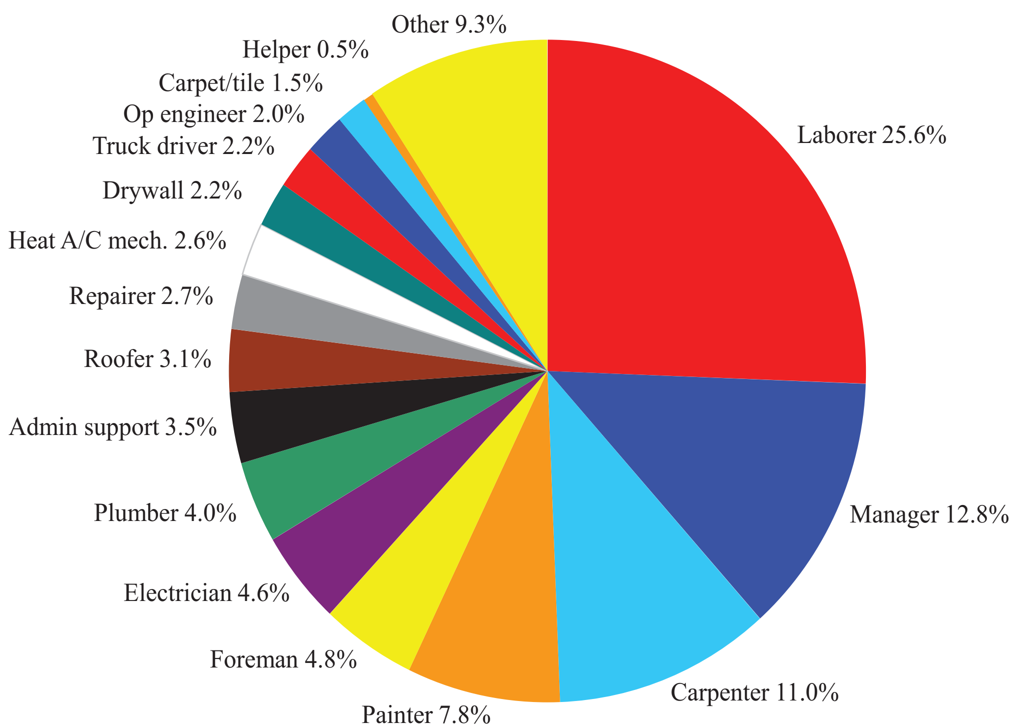


1. Numbers cited in the text were from the 2015 American Community Survey and may not match numbers from the Current Population Survey used for other pages. Calculations by the CPWR Data Center.
2. U.S. Census Bureau. ACS 1-year supplemental estimates with a population threshold of 20,000 or more, 2015. https://www.census.gov/acs/www/data/data-tables-and-tools/supplemental-tables/ (Accessed October 2016).

18b. Members of racial minorities as a percentage of workers, by selected construction occupations, 2015 (All employment)



18c. Occupational distribution among racial minority workers in construction, 2015 (All employment)



Note: All charts – Averages include all occupations from managerial through clerical/administrative support. "Racial minorities" are those who chose to identify themselves as black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, or some race other than white.
Chart 18a – Excludes self-employed workers.
Chart 18b – Other management occupations in construction were not listed.
Chart 18c – Total may not add to 100% due to rounding. "Manager" includes construction managers as well as other management occupations in construction.

Source: All charts – U.S. Census Bureau. 2015 American Community Survey. Calculations by the CPWR Data Center.

Women Workers in Construction and Other Industries

The number of women employed in construction has grown over the last 30 years, peaking at 1.1 million in 2007. However, it dropped by 28% during the economic downturn, and while it climbed back to 917,000 by 2015, women employment in construction is still 18% lower than the 2007 peak (chart 19a).[1] Despite overall growth, women continue to be underrepresented in construction, accounting for around 9% of the construction workforce in 2015 (chart 19b), only up one percentage point from 1985. In contrast, almost half (46.8%) of all workers in the U.S. were women in 2015, up five percentage points from 1985. These numbers reflect both the increase of women in the overall labor force over time,[2] as well as continual gender segregation in the labor market.[3,4]

Gender imbalance is more pronounced among *production* (blue-collar, *see* Glossary) occupations. In 2015, only 2.4% of production workers in construction were women, which was significantly lower than in manufacturing (23.6%) and in all industries (14.1%; chart 19c). By detailed occupation, almost 43,200 women worked as unskilled construction laborers and helpers in 2015. About 179,000 women were employed in skilled trades, including painters, foremen, carpenters, electricians, truck drivers, repair workers, heating and air-conditioning mechanics, and operating engineers (listed in order of decreasing percentages of women; 3% of women construction workers were painters and 0.5% of women were operating engineers).[5] The small share of women in the construction trades has been the target of federal policies for a number of years, such as setting goals for women enrollment in apprenticeship programs.[6] However, women may still face many barriers to entering and staying in the construction field, such as gender stereotypes in certain occupations, harassment, and differential treatment on job sites.[7]

Although gender differences in construction remain, the proportion of women in production occupations increased from 16.5% in 1985 to 19.6% in 2015 (chart 19d). In manager and professional positions, women's share has more than doubled, from 15.8% to 34.6% during the same period. Meanwhile, the proportion of women with clerical and support jobs has decreased. These changes may be partially due to advanced technologies and innovative management that have reduced the need for administrative support while increasing the demand for managerial and professional skills in construction.[8] Improvements in education and job competency among women may also have contributed to this shift.[3]

Within construction, a smaller proportion of women (20%) than men (25%) were self-employed in 2015. Only 9% of the women in construction were unincorporated self-employed, compared to 17% of men in this employment category.[9] However, a slightly larger proportion of women in construction were incorporated self-employed (11%) compared to men (8%). Men and women in construction appear to have similar patterns in terms of whom they work for; roughly 75% of women and 71% of men work for private employers, while about 4-5% of each were government employees. In addition, less than 1% of women worked without payment (usually for family businesses) in 2015.

Women's labor force participation rates are expected to remain high in the overall workforce. It is projected that the number of women employees in the U.S. will increase by more than 4.2 million between 2014 and 2024, accounting for 47.2% of all employment.[10]

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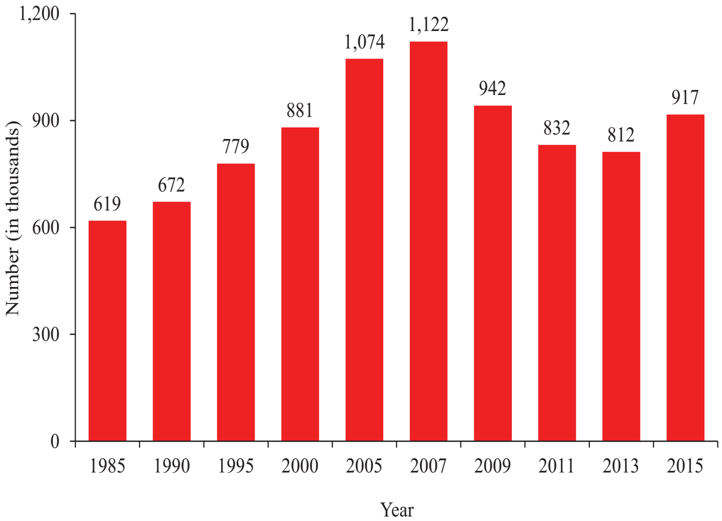
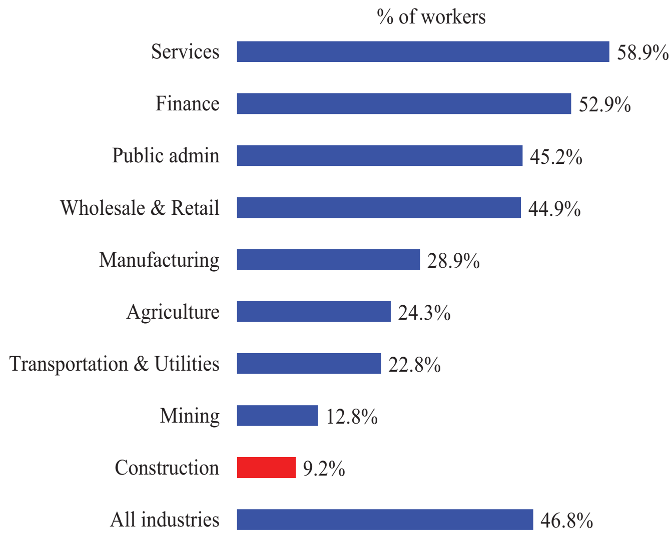
1. All numbers cited in the text, except for those where noted, were from the Current Population Survey. Calculations by the CPWR Data Center.
2. U.S. Department of Labor. 2015. Civilian labor force by sex. https://www.dol.gov/wb/stats/NEWSTATS/facts/women_lf.htm#one (Accessed November 2016).
3. U.S. Bureau of Labor Statistics. 2015. BLS Reports. Women in the labor force: a databook. https://www.bls.gov/opub/reports/womens-databook/archive/women-in-the-labor-force-a-databook-2015.pdf (Accessed November 2016).
4. Catalyst. 2015. Women in male-dominated industries and occupations. http://www.catalyst.org/knowledge/women-male-dominated-industries-and-occupations (Accessed January 2017).
5. When broken down into specific occupations, the sample size is too small to be statistically valid. Therefore, use these numbers with caution.
6. Hegewisch A, O'Farrell B. 2015. Women in the construction trades: Earnings, workplace discrimination, and the promise of green jobs. http://www.iwpr.org/publications/pubs/women-in-the-construction-trades-earnings-workplace-discrimination (Accessed November 2016).
7. National Women's Law Center. 2014. Women in construction still breaking ground. https://nwlc.org/resources/women-construction-still-breaking-ground/ (Accessed November 2016).
8. Wright S. 2016. 6 ways construction technology has transformed the industry. http://blog.capterra.com/6-ways-construction-technology-has-transformed-the-industry/ (Accessed November 2016).
9. This Chart Book counts both incorporated and unincorporated workers (independent contractors, independent consultants, and freelance workers) as self-employed. However, "self-employed" in the U.S. Bureau of Labor Statistics' (BLS) publications generally refers to unincorporated self-employed, while incorporated self-employed workers are considered wage-and-salary workers on their establishments' payrolls.
10. U.S. Bureau of Labor Statistics. 2015. Employment projections – 2014-24. Table 1: Civilian labor force, by age, gender, race, and ethnicity, 1994, 2004, 2014, and projected 2024. http://www.bls.gov/news.release/pdf/ecopro.pdf (Accessed November 2016).

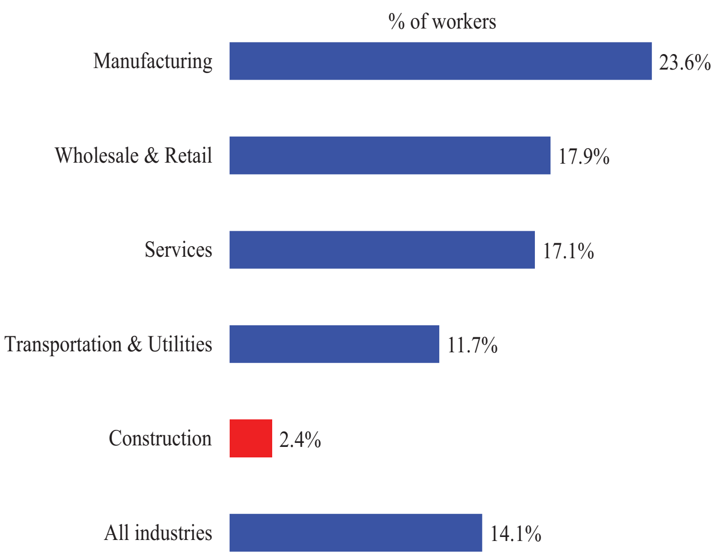
19a. Number of women workers in construction, selected years, 1985-2015 (All employment)



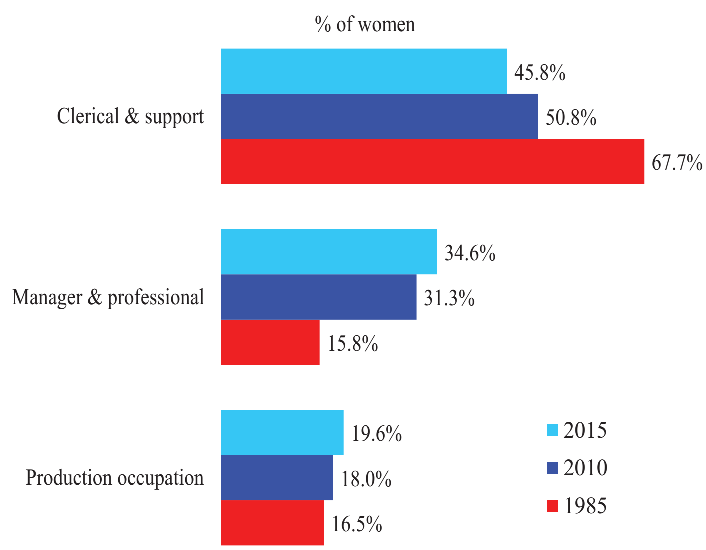
19b. Women as a percentage of workers, by industry, 2015 (All employment)



19c. Women as a percentage of workers, selected industries, 2015 (Production occupations)



19d. Distribution of women workers in construction, by occupation type, 1985, 2010, and 2015 (All employment)



Note: Chart 19c – Industries not shown in the chart include Agriculture, Mining, Finance, and Public Administration since the statistical samples were too small.
Chart 19d – *See* page 11 for occupations. Figures are 12-month averages. Totals may not add to 100% due to rounding.

Source: Charts 19a and 19d – U.S. Bureau of Labor Statistics. 2015 and previous years Current Population Survey. Calculations by the CPWR Data Center.
Charts 19b and 19c – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.

Employment and Unemployment in Construction and Other Industries

Total construction employment (including construction workers in the private and public sectors, the self-employed, and unpaid family members) fluctuated over the last two decades.[1] After reaching a peak of 11.8 million in 2007 and falling to 8.9 million in 2012 due to the recession, the total employment in construction recovered to 9.9 million by 2015 (chart 20a). Payroll employment (wage-and-salary workers only) in construction parallels these trends,[2] peaking at 7.7 million in 2006, dropping to 5.5 million in 2010, and then rising to nearly 6.5 million by the end of 2015.

Payroll employment in construction has experienced greater expansion and contraction than overall nonfarm industries on average. From 1992 to 2006, payroll employment in construction grew at 4.8% annually (except during the short recession period in the early 2000s), compared to 2.2% average annual growth across nonfarm industries (chart 20b). From 2008 to 2009, payroll employment dropped by 16% in construction, but decreased by 4% for overall nonfarm industries. Payroll employment started to recover after 2011; from 2014 to 2015, the year-over-year increase was 5% in construction and 2% in all nonfarm industries.

Payroll employment in construction subsectors followed the overall industry trend. Employment in the Specialty Trade Contractors sector (NAICS 238; *see* page 1 for NAICS codes and definitions) grew most rapidly, increasing by 82% from 1992 to 2006, but decreasing quickly over the following years, and at the close of 2011 was just 29% higher than in 1992 (chart 20c). Employment in this subsector rebounded; by 2015, the level was 53% higher than in 1992. In the Construction of Buildings sector (NAICS 236), employment increased by 52% through 2006, and fell to near the 1992 level in 2011 before rising to 19% above the 1992 level in 2015. Heavy and Civil Engineering Construction (NAICS 237) was the subsector least affected by the economic cycle. By 2015, its employment had climbed 27% above the 1992 level.

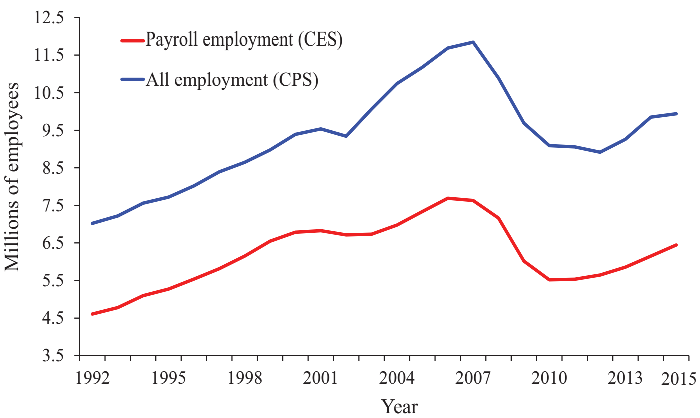
Payroll employment data by detailed NAICS are available from 2001 onward. Employment in the Residential Building Construction sector (NAICS 23611) increased rapidly — by 29% from 2001 to 2006 — but fell by 28% below the 2001 level in 2011 (chart 20d). In contrast, employment in Nonresidential Building Construction (NAICS 23621 and 23622) decreased over the same period, with small increases during 2007 and 2008 that were quickly lost by 2011. By 2015, both Residential and Nonresidential Building Construction sectors were rising again but neither had recovered to 2001 levels.

Residential Specialty Trade Contractors (NAICS 238001) followed a similar arc. From 2001 to 2006, employment in this subsector increased from 1.8 million to nearly 2.4 million, and then dropped below 1.5 million by the end of 2011 (chart 20e). It rose again after the recession, and reached 1.8 million by 2015. The expansion, decline, and subsequent rebound of employment in residential construction mirrors the boom and bust of the U.S. housing market during the same period (*see* page 6).

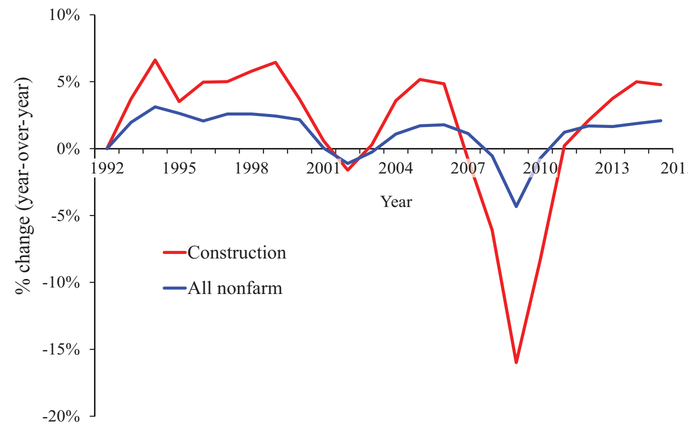
Unemployment statistics also reflect the cyclical fluctuation of construction employment.[3] The unemployment rate reached its highest point in early 2010, and the gap in unemployment between construction and other nonfarm industries increased during the recession (chart 20f). In February 2010, the unemployment rate in the construction industry reached 27.1%, more than double the average rate for all nonfarm industries. After 2011, the unemployment rate in the construction industry began declining. At 7.5% by the end of 2015, it was the lowest monthly rate since 2007. The unemployment rate in construction also reflects the seasonal nature of the industry, which results in greater fluctuations on a monthly basis, as illustrated in the chart.

1. Total employment data were calculated using the Current Population Survey (*see* page 10).
2. Data on payroll employment were obtained from the Current Employment Statistics (CES). CES is a monthly survey conducted by the U.S. Bureau of Labor Statistics, providing employment, hours, and earnings estimates based on payroll records of business establishments. Employment data refer to persons on establishment payrolls who worked or received pay for any part of the pay period that includes the 12th day of the month. The data excludes proprietors, the unincorporated self-employed, unpaid volunteer or family employees, farm employees, and domestic employees. Government employment covers only civilian employees. More information on the CES is available online at https://www.bls.gov/web/empsit/cestn.htm#section4d.
3. Unemployed workers are those who had no employment during a given week, were available for work (except for being temporarily ill), and had tried to find employment (or were waiting to be recalled from temporary layoff) during the four-week period ending with the reference week (*see* page 10 for more information).

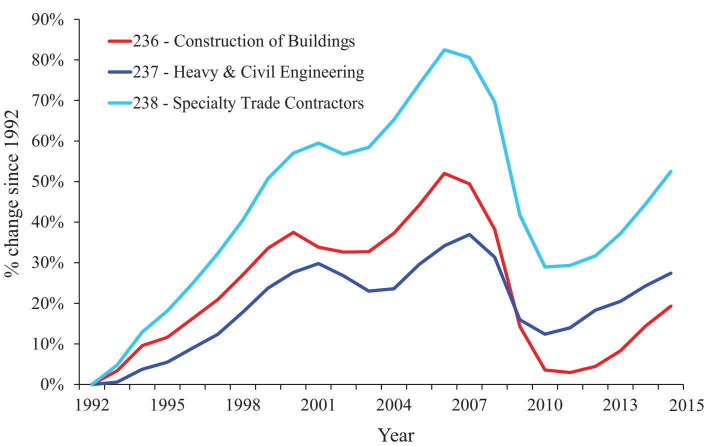
20a. **Construction employment, payroll employment versus all employment, 1992-2015**



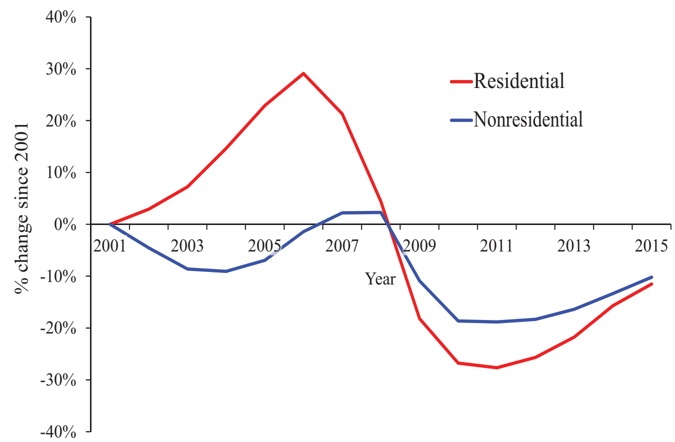
20b. **Year-over-year change in payroll employment, construction versus all nonfarm industries, 1992-2015**



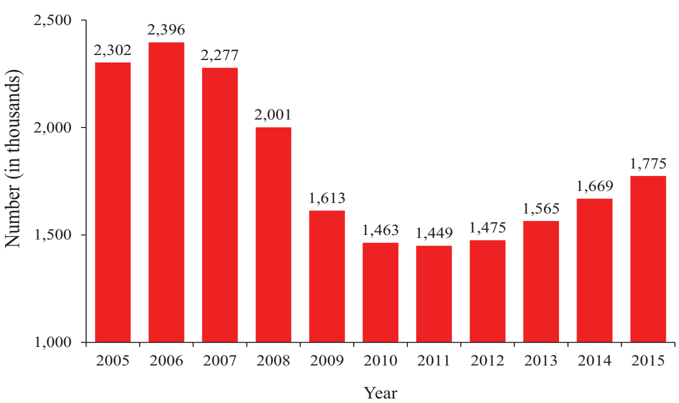
20c. **Percent change in payroll employment since 1992, by construction sector, 1992-2015**



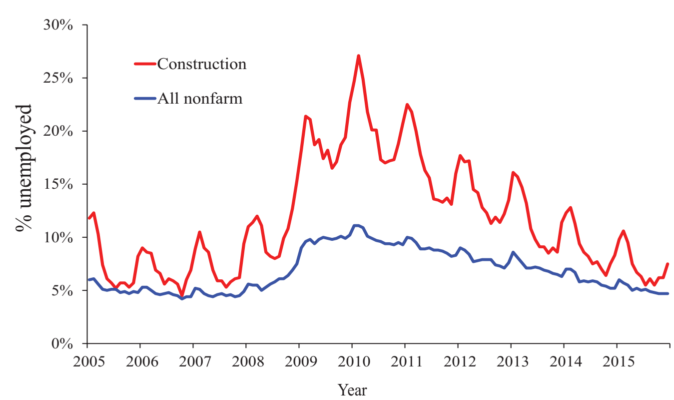
20d. **Percent change in payroll employment since 2001, residential versus nonresidential building construction, 2001-2015**



20e. **Number of payroll employees in residential specialty trade, 2005-2015**



20f. **Monthly unemployment rate, construction versus all non-nonfarm industries, 2005-2015 (Not seasonally adjusted; private wage-and-salary workers)**



Note: All charts – Data cover all construction occupations, including managers and clerical staff.
Chart 20f – The tick marks for each year on the x-axis indicate the month of January.

Source: Chart 20a – Data on all types of employment: U.S. Bureau of Labor Statistics. 2015 and previous years Current Population Survey. Calculations by the CPWR Data Center. Data on payroll employment: U.S. Bureau of Labor Statistics. 2015 and previous years Current Employment Statistics.
Charts 20b-20e – U.S. Bureau of Labor Statistics. 2015 and previous years Current Employment Statistics. Employment, Hours, and Earnings – National. http://data.bls.gov/ (Accessed March 2016).
Chart 20f – U.S. Bureau of Labor Statistics. 2015 and previous years Current Population Survey. Unemployment Rates. http://www.bls.gov/webapps/legacy/cpsatab14.htm (Accessed March 2016).

Temporary Workers in Construction and Other Industries

Temporary workers (*see* Glossary), as a proportion of the U.S. workforce, have been increasing over the last decade. In 2014, temporary workers made up 15.5% of employees in the construction industry, about 46% higher than in 2003 (chart 21a).[1] Temporary employment in non-construction industries began expanding much later than in construction, remaining at around 7% until 2014, when it jumped to 9.1% of employees. On average, construction had the second highest proportion of temporary workers (13.8%) among the major industry sectors from 2011 to 2014 (chart 21b).

In terms of work arrangements, construction workers were more likely to be freelance workers or independent contractors compared to the overall workforce. In 2015, 23.0% of construction workers were independent contractors or consultants, and another 8.3% were paid by a temporary agency or contracted by another company (chart 21c). Overall, nearly 40% of construction workers had non-traditional work arrangements, compared to 17.2% of workers in all industries.

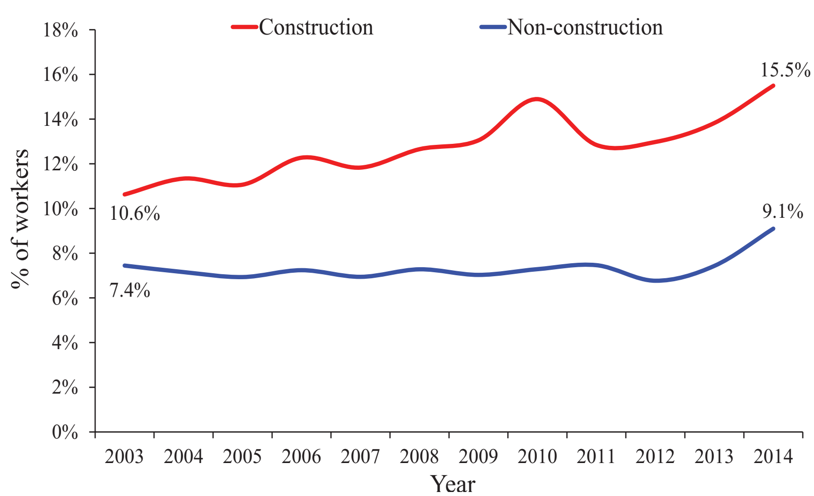
Within construction, the demographics of temporary workers differed from regular employees. Between 2011 and 2014, about 36% of temporary workers were aged 16 to 34 years, while less than 30% of regular workers were in that age group (chart 21d). Nearly half of temporary workers did not finish high school, compared to one in five regular workers. In addition, temporary workers were twice as likely to be Hispanic (44.3% versus 21.0%) and foreign born (40.6% versus 19.2%) when compared to regular workers.

Temporary workers were also more likely to be employed in production occupations (86% versus 70%), and work for establishments with 10 or fewer employees (71% versus 59.5%; chart 21e). In addition, temporary workers were more likely to work part-time than regular employees (26.9% versus 15.0%).

Temporary employment makes it easier for companies to adjust labor while avoiding some of the costs associated with hiring, firing, and workers' benefits. However, it increases job instability and can lead to other adverse effects for temporary workers. Compared to regular employees, temporary workers tend to receive lower earnings and fewer benefits, and are less likely to be given adequate safety and health training.[2,3,4] Consequently, temporary workers are more vulnerable to workplace safety and health hazards than workers in traditional employment arrangements.[5,6]

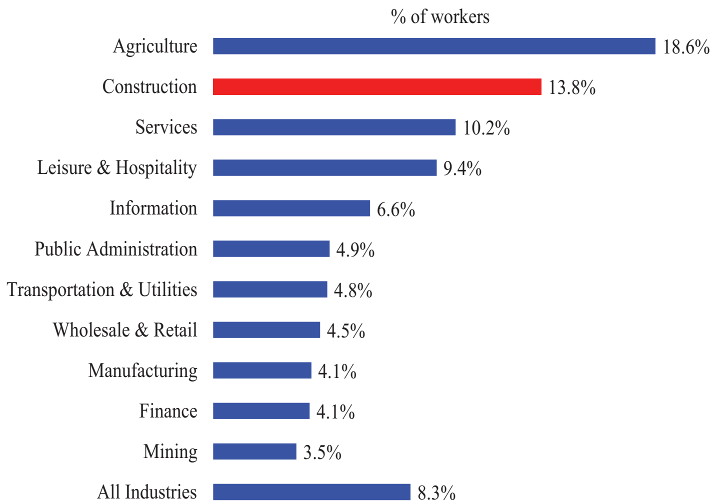
To protect temporary workers, the U.S. Occupational Safety and Health Administration (OSHA) launched the Temporary Worker Initiative (TWI), focusing on issues affecting workers in the temporary help services industry.[4] According to the TWI, both host employers and staffing agencies have a role in complying with workplace health and safety requirements and share responsibility for ensuring worker safety and health. As was stated in the OSHA / NIOSH Recommended Practices guide, *Protecting Temporary Workers*, "Whether temporary or permanent, all workers always have a right to a safe and healthy workplace."[5]

21a. Temporary workers as a percentage of the workforce, construction versus non-construction, 2003-2014

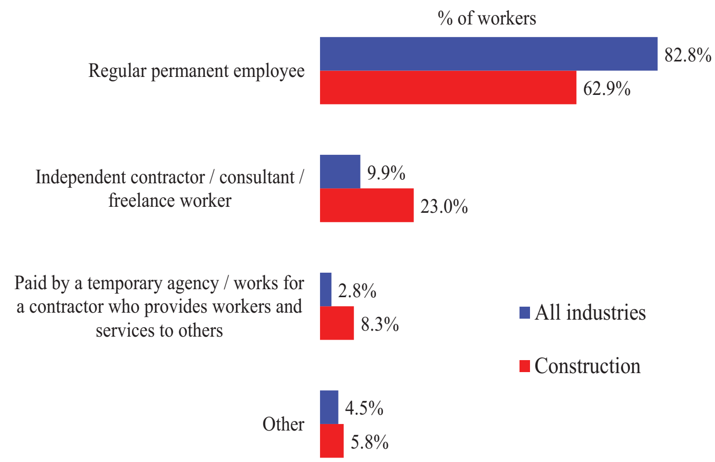


1. Numbers for temporary employment on this page were estimated using data from the Medical Expenditure Panel Survey (MEPS) - Household Component (HC), a sample of families and individuals in selected communities across the United States. Additional information on MEPS is available at https://meps.ahrq.gov/mepsweb/about_meps/survey_back.jsp (Accessed January 2017).
2. U.S. Government Accountability Office. 2015. Contingent workforce: Size, characteristics, earnings, and benefits. GAO-15-168R, http://www.gao.gov/assets/670/669766.pdf (Accessed January 2017).
3. Dong XS, Wang X, Largay JA. 2015. Temporary workers in the construction industry. CPWR Quarterly Data Report, Second Quarter. CPWR - The Center for Construction Research and Training: Silver Spring, MD. http://www.cpwr.com/publications/second-quarter-temporary-workers-construction-industry (Accessed January 2017).
4. Occupational Safety and Health Administration. 2015. Protecting temporary workers. https://www.osha.gov/temp_workers/ (Accessed January 2017).
5. Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH). 2014. Recommended practices: Protecting temporary workers. https://www.osha.gov/Publications/OSHA3735.pdf (Accessed January 2017).

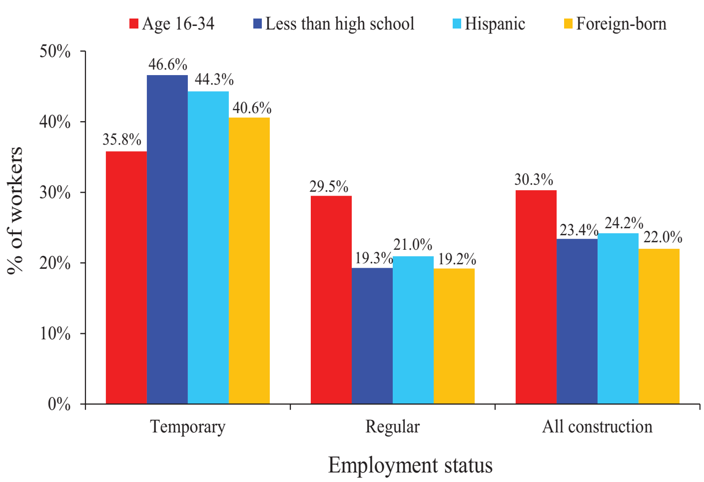
21b. Temporary workers as a percentage of the workforce, by major industry, 2011-2014 average



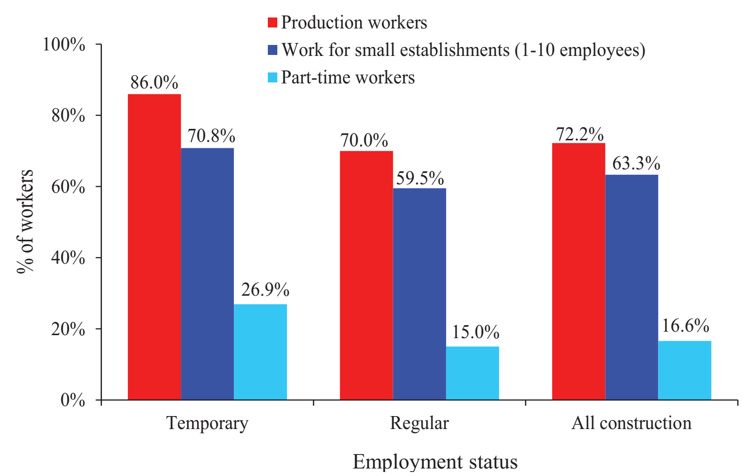
21c. Work arrangements, construction versus all industries, 2015



21d. Demographics of construction workers, temporary versus regular employment, 2011-2014 average



21e. Employment characteristics of construction workers, temporary versus regular employment, 2011-2014 average



Source: Chart 21a – Agency for Healthcare Research and Quality. 2003-2014 Medical Expenditure Panel Survey. Calculations by the CPWR Data Center.
Charts 21b, 21d, and 21e – Agency for Healthcare Research and Quality. 2011-2014 Medical Expenditure Panel Survey. Calculations by the CPWR Data Center.
Chart 21c – National Center for Health Statistics. 2015 Occupational Health Supplement to the National Health Interview Survey. Calculations by the CPWR Data Center.

Self-Employment in Construction and Other Industries

In 2015, 2.4 million construction workers were *self-employed* (*see* Glossary), of which 1.6 million (67%) were *unincorporated* (*see* Glossary).[1] The proportion of unincorporated self-employed workers in construction has been consistently higher than that among all nonfarm industries combined since 1995 (chart 22a). Within construction, the proportion of unincorporated self-employed workers fluctuated with the economic cycles, dipping to 15.7% in 2007, jumping to 19.0% in 2010, and then falling back to 16.3% in 2015. These results are in line with previous findings that self-employment expands during economic downturns due to limited wage-and-salary employment over the course of a recession.[2]

Self-employment varies by occupation. In 2015, 37% of construction managers were self-employed, a higher share than in any other construction occupation (chart 22b). The proportion of *incorporated* (*see* Glossary) self-employment in this occupation was also higher than average for the industry; about 45% of self-employed construction workers were incorporated. The proportion of self-employment was above the industry average among carpet and tile workers (35.7%), carpenters (35.1%), and painters (35.1%) as well, but most self-employed workers in these occupations were unincorporated.

Unincorporated self-employed workers are also known as independent contractors or *individual proprietorships* (*see* Glossary); they are the only owner of the business, pay taxes as personal income, and are within the nonemployer category defined by the U.S. Census Bureau (*see* page 3). Based on the Census data, the number of individual proprietorships jumped by almost 28% from 1.90 million in 2002 to 2.43 million in 2007, fell to 2.12 million in 2012 (the lowest in almost a decade), and then increased to 2.22 million by 2014 (chart 22c). This indicates that the ease of entry into self-employment (e.g., firms with individual proprietorships or nonemployers in construction typically need less capital to start, *see* page 8) may contribute to business cycle dynamics, particularly during economic recoveries.[2]

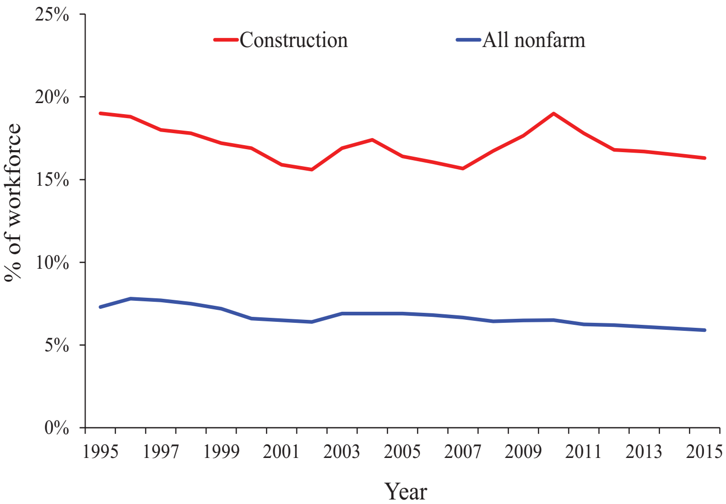
In some cases, employers may intentionally misclassify wage-and-salary employees as independent contractors to avoid paying Social Security, workers' compensation, employee benefits, and other taxes.[3] Worker misclassification in construction tends to be more common than in other industries. This may be explained by a combination of factors such as higher workers' compensation insurance premiums, mobility of employers and the workforce, the temporary nature of the work, and the multiple layers of contractors and subcontractors.[4]

There is a strong economic incentive for employers to misclassify; it has been estimated that in the construction industry alone, employers can save 25% in labor costs through misclassification.[5] Many states have estimated the economic effects of misclassification.[4] Studies in Maine, Massachusetts, Minnesota, and New York have estimated that 15% to 20% of construction employers misclassified their employees during the study period, and one Virginia study estimated that proportion to be 30%.[6] One in-depth analysis by the McClatchy news group found over a third of construction workers in North Carolina and Texas to be misclassified.[7] While these estimates may not be comparable due to differing methods among states, the perception is that these studies are likely underestimations.[6]

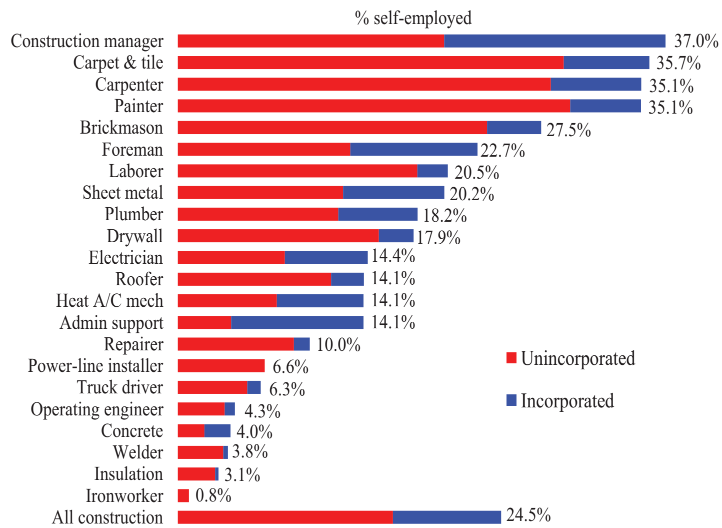
The misclassification of employees as independent contractors incurs a high cost on the government due to unpaid taxes, and on workers in the form of denied protections, insurance, and other compensations.[6,7] Furthermore, underpayment of unemployment, workers' compensation, and Social Security contributions harms the viability of those funds and the competitive position of employers who do not misclassify their workers.[6,7] In light of this, misclassification can be considered a serious problem not only for workers and the government, but for the entire economy. In response to this dilemma, the U.S. Department of Labor (DOL) has worked with the IRS and many states to combat employee misclassification and to ensure that workers receive the wages, benefits, and protections to which they are entitled.[3] Between 2010 and 2016, 35 states passed legislation preventing worker misclassification and increasing penalties for violations (chart 22d). In Fiscal Year 2015, the DOL Wage and Hour Division (WHD) investigations resulted in more than $74 million in back wages for more than 102,000 workers in all industries.[3]

1. Self-employment data are collected monthly as part of the Current Population Survey (CPS) by the U.S. Bureau of Labor Statistics (BLS; *see* page 10). Calculations by the CPWR Data Center.
2. Shapiro AF. 2014. Self-employment and business cycle persistence: Does the composition of employment matter for economic recoveries? https://www.sciencedirect.com/science/article/pii/S0165188914001523 (Accessed January 2017).
3. U.S. Department of Labor. 2016. The DOL misclassification initiative. https://www.dol.gov/whd/workers/misclassification/ (Accessed January 2017).
4. Chicago Regional Council of Carpenters. 2016. Size and cost of payroll fraud: Survey of national and state studies. https://www.carpentersunion.org/news/size-and-cost-payroll-fraud-survey-national-and-state-studies (Accessed January 2017).
5. Leyh C. 2015. Getting a fair shake: Reducing the perils of worker misclassification on federally funded construction projects. Public Contract Law Journal 44(2): 307-325.
6. National Employment Law Project. 2015. Independent contractor misclassification imposes huge costs on workers and federal and state treasuries. http://www.nelp.org/content/uploads/Independent-Contractor-Costs.pdf (Accessed January 2017).
7. The McClatchy Company. 2014. Contract to cheat. http://media.mcclatchydc.com/static/features/Contract-to-cheat/?brand=nao (Accessed January 2017).

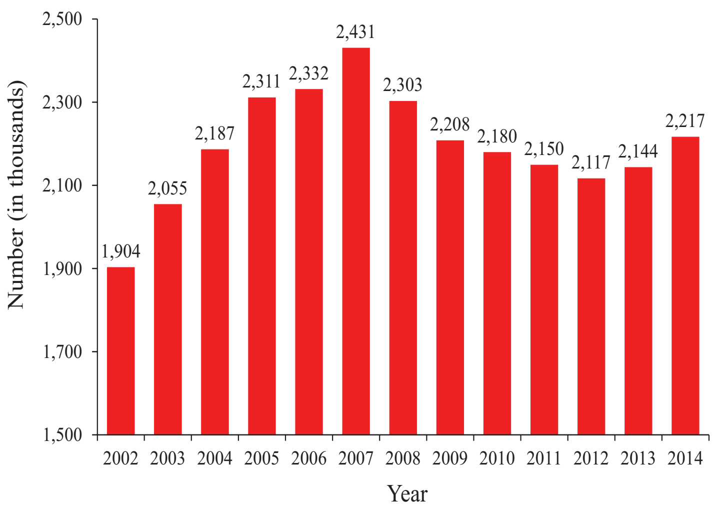
22a. **Unincorporated self-employment as a percentage of the workforce, construction versus all nonfarm industries, 1995-2015**



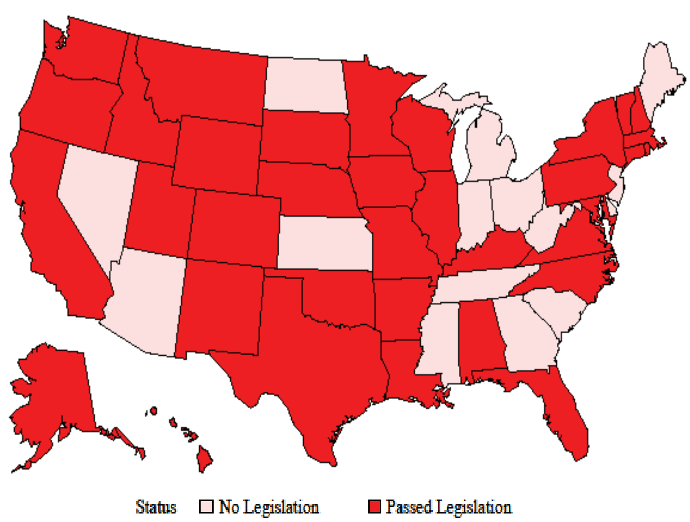
22b. **Percentage of self-employed workers, selected construction occupations, 2015**



22c. **Number of individual proprietorships in construction, 2002-2014**



22d. **Employee misclassification legislation, by state, 2010-2016**



Note: Chart 22b – Due to statistical sample sizes, estimates vary ± 5%, except for power-line installer, insulation, and sheet metal, for which the estimates may vary ± 10%. *See* page 11 for occupational classifications.
Chart 22c – Individual proprietorship data are available from 2002 onward.
Chart 22d – The 35 states that signed memoranda of understanding are: Alabama, Alaska, Arkansas, California, Colorado, Connecticut, Florida, Hawaii, Idaho, Illinois, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Mexico, New York, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, and Wyoming.

Source: Chart 22a – U.S. Bureau of Labor Statistics. 2015 and previous years Current Population Survey. Calculations by the CPWR Data Center.
Chart 22b – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
Chart 22c – U.S. Census Bureau. 2014 and previous years Nonemployer Statistics. https://www.census.gov/programs-surveys/nonemployer-statistics.html (Accessed June 2016).
Chart 22d – U.S. Department of Labor. 2016. The DOL misclassification initiative. http://www.dol.gov/whd/workers/misclassification/ (Accessed January 2017).

Employment Costs in Construction and Other Industries

Employment costs, also known as labor costs, includes wages, salaries, employee benefits, and employer-paid taxes.[1] When such costs were measured by the *Employment Cost Index* (*see* Glossary), the construction industry generally followed the upward trend of all industries over the last decade. However, costs in construction were higher from 2006 through 2010, and lower after 2011 compared with all industries (chart 23a).

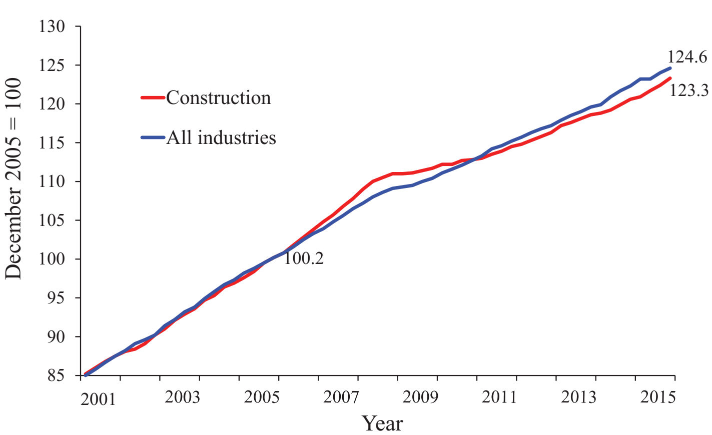
While overall employment costs have grown more than 20% since 2005, workers' earnings have been relatively stagnant. After adjusting for inflation so that wages are comparable over time, average hourly pay for construction workers in 2016 was $28.10, just $1.66 more than their adjusted earnings of $26.44 in 2006 (chart 23b). The wage differential between construction and all industries remained stable over the ten-year period, with construction workers earning $2.48 more than all private workers on average. The higher wages in construction may reflect, in part, higher risks and skills required for most construction occupations, as well as the seasonal nature of the work.

Employee benefits comprise an important part of labor costs, covering paid leave, supplemental pay, insurance (health, life, short-term and long-term disability insurance), retirement and savings benefits, legally required benefits (Social Security and Medicare, workers' compensation, and unemployment insurance), and other benefits such as severance pay. Although costs in construction grew less than in all industries in recent years, total costs in construction were still higher than all industries on average. In December 2015, the largest benefits category was legally required benefits, accounting for nearly 10.5% of total compensation costs in construction, higher than the 8.0% for all private industries since construction has higher workers' compensation and unemployment costs (chart 23c). Paid time off is another major component of benefits for workers, accounting for approximately 23% of the total benefits on average, but around 14% for construction workers. Insurance benefits were also relatively low in construction. For example, insurance benefits were $2.82 per hour for construction workers, but $5.96 per hour for utility workers, who had the highest rate of any industry. This may be partially due to higher unionization rates among utility workers compared to construction workers.[2]

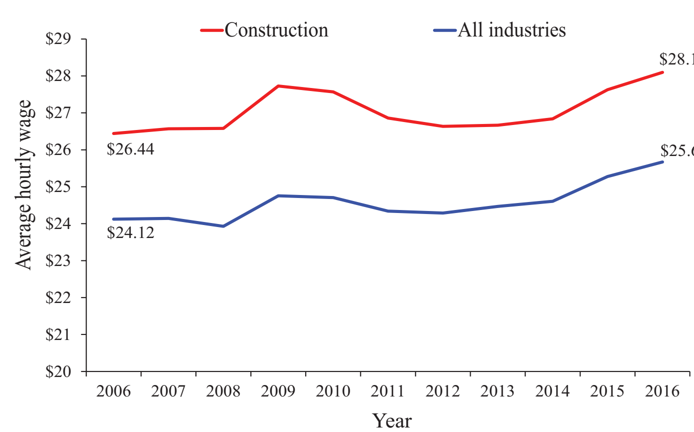
In construction, union members' total compensation was 78% higher than non-union workers ($56.71 versus $31.82; chart 23d). Wages alone were 42% higher among union workers ($33.73 versus $23.76). The biggest difference between union and non-union construction workers was in retirement and savings ($6.85 versus $0.60) and insurance ($7.21 versus $1.69).

Employment costs also varied among construction subsectors. For example, both wages and benefits for nonresidential workers were much higher than for residential workers.[3] While residential workers employed with specialty trade contractors earned $22.70 in wages and salaries, their nonresidential counterparts earned 49% more ($33.78; chart 23e). Nonresidential workers also received more than two times the amount of insurance compared with residential workers ($3.31 versus $1.50). Differences in unionization, establishment size, occupation, and other factors are all associated with these compensation disparities (*see* pages 26 and 27).

23a. Index of labor costs, construction versus all industries, 2001-2015 (Seasonally adjusted; private industry)



23b. Average hourly wage, construction versus all industries, 2006-2016 (Private industry; 2016 dollars)

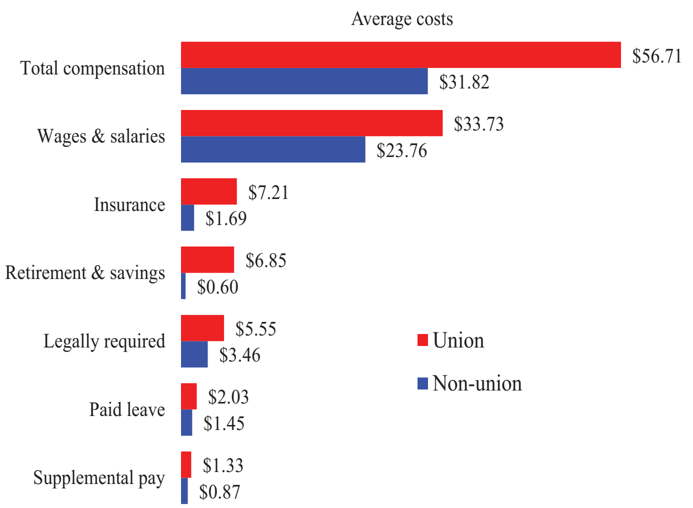


1. Employer-paid taxes include Social Security and Medicare taxes that employers are responsible to pay, but do not include other taxes such as income taxes.
2. U.S. Bureau of Labor Statistics. 2017. News release. Union members – 2016. https://www.bls.gov/news.release/pdf/union2.pdf (Accessed February 2017).
3. U.S. Bureau of Labor Statistics. 2016. Office of Compensation and Working Conditions. Compensation Research and Program Development Group. Unpublished data. Contact: Tom Moehrle.

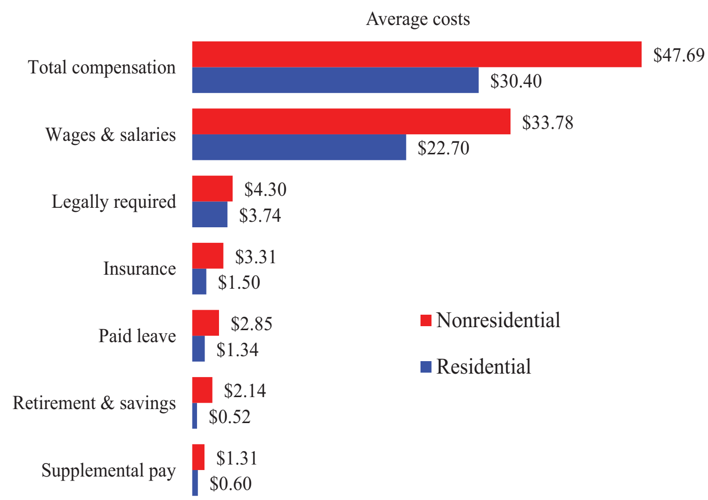
23c. Average hourly labor costs, by industry, December 2015 (Private industry)

Industry	Total Compensation	Wages & Salaries	Benefit Costs							
			Paid Leave	Suppl. Pay	Insurance	Retirement & Savings	Legally Required		Total	
							$	% of Total Comp.	$	% of Total Comp.
Utilities	$58.88	$35.28	$5.07	$2.19	$5.96	$6.18	$4.20	**7.1%**	$23.60	**40.1%**
Information	$53.09	$34.64	$4.87	$2.32	$5.18	$2.54	$3.53	**6.7%**	$18.45	**34.8%**
Finance	$43.87	$29.76	$3.78	$2.03	$3.74	$1.69	$2.87	**6.5%**	$14.11	**32.2%**
Manufacturing	$38.50	$24.98	$2.90	$1.67	$3.89	$2.12	$2.93	**7.6%**	$13.52	**35.1%**
Transportation*	$37.85	$24.04	$2.67	$1.16	$4.22	$2.30	$3.48	**9.2%**	$13.82	**36.5%**
Construction	$37.00	$25.85	$1.57	$0.96	$2.82	$1.91	$3.88	**10.5%**	$11.15	**30.1%**
Wholesale trade	$34.95	$24.74	$2.52	$1.04	$2.80	$1.10	$2.75	**7.9%**	$10.21	**29.2%**
Retail trade	$17.95	$17.95	$0.84	$0.30	$1.20	$0.38	$1.61	**8.9%**	$4.33	**24.1%**
All industries	$31.70	$22.14	$2.18	$1.06	$2.54	$1.25	$2.53	**8.0%**	$9.57	**30.2%**

23d. Average hourly labor costs in construction, by union status, March 2016 (Private industry)



23e. Average hourly labor costs, residential versus nonresidential specialty trades, 2016 (Private industry)



Note: All charts – Self-employed workers were excluded.
Chart 23b – Wages were reported by employers and adjusted by the Consumer Price Index (CPI) for the 2016 dollar value (CPI Inflation Calculator: https://data.bls.gov/cgi-bin/cpicalc.pl).
Chart 23c – Wages were from a payroll survey reported by employers, defined as hourly straight-time wage rates, including total earnings following payroll deductions, and excluding premium pay for overtime and for work on weekends and holidays, shift differentials, and non-production bonuses such as lump-sum payments instead of wage increases. The asterisk (*) represents a shortened industry title for "Transportation and Warehousing."

Source: Chart 23a – U.S. Bureau of Labor Statistics. National Compensation Survey, Employment Cost Index Historical Listing. Table 1: Employment Cost Index for total compensation, by occupational group and industry. http://www.bls.gov/web/eci/echistrynaics.pdf (Accessed February 2017).
Chart 23b – U.S. Bureau of Labor Statistics. 2006-2016 Current Employment Statistics. Calculations by the CPWR Data Center.
Chart 23c – U.S. Bureau of Labor Statistics. 2016. News release. Employer costs for employee compensation – September 2016. http://www.bls.gov/news.release/pdf/ecec.pdf (Accessed February 2017).
Charts 23d and 23e – U.S. Bureau of Labor Statistics. 2016 National Compensation Survey. Unpublished data. Contact: Tom Moehrle.

Wages in Construction, by Demographic Characteristics, Unionization, and Region

Wages (excluding overtime pay, tips, and commissions) of construction workers vary by demographic characteristics (such as age, gender, race, ethnicity, and education), union status, and region, according to data collected by the Current Population Survey (CPS, *see* page 10). CPS wage data are collected directly from workers.

Wage differs by union status. In 2015, the average union wage for production workers in construction was $26.56 per hour, 49% higher than the hourly wage for their non-union counterparts ($17.84).[1] Union members, on average, are slightly older (*see* page 14), more educated (*see* page 29), and more likely to receive apprenticeship training (*see* page 30) than non-union workers, which may partially contribute to the wage differences.

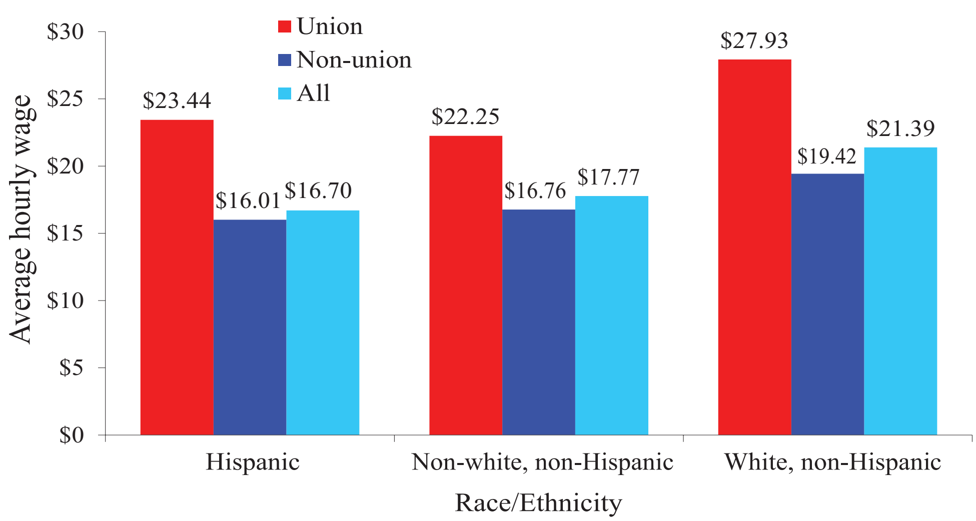
Wage gaps exist across demographic groups as well. Among production workers (*see* page 10) in construction, *non-white, non-Hispanic* (*see* Glossary) workers had a lower average hourly wage than white, non-Hispanic workers ($17.77 versus $21.39; chart 24a), and Hispanic workers (who can be any race) earned less than either group ($16.70). However, union members had higher than average wages in each demographic. Compared to their non-union counterparts, average hourly union wages were $5.49 higher among non-white, non-Hispanic workers, $7.43 higher among Hispanics, and $8.51 higher among white, non-Hispanics.

Age and educational attainment both exert a large influence on workers' wages. In general, older workers earn higher wages. In 2015, the average hourly wage of the youngest construction production workers (ages 16-19 years) was $12.38, more than $7 lower than those in the 35-44 age group ($19.91), and more than $10 lower than those in the 55-64 age group ($22.53). This trend holds until age 65, when wages drop considerably (chart 24b). Educational attainment exerts a similar influence on average hourly wage. Workers that did not graduate high school earned almost $4 less per hour ($15.95) than workers with a high school diploma ($19.88), and more than $5 less than those with some college education ($21.32). Workers with at least a bachelor's degree were paid over $7 more than those with no high school diploma ($23.07), an increase of 45% (chart 24c).

Wages also vary by gender. For production occupations in construction, men earn on average $2.28 more per hour than women. Union status reduces this difference; however, the gender gap is still $1.19 per hour between men and women union members (chart 24d). The wage differential can likely be attributed to the unequal occupational distribution between women and men in construction (*see* page 19).

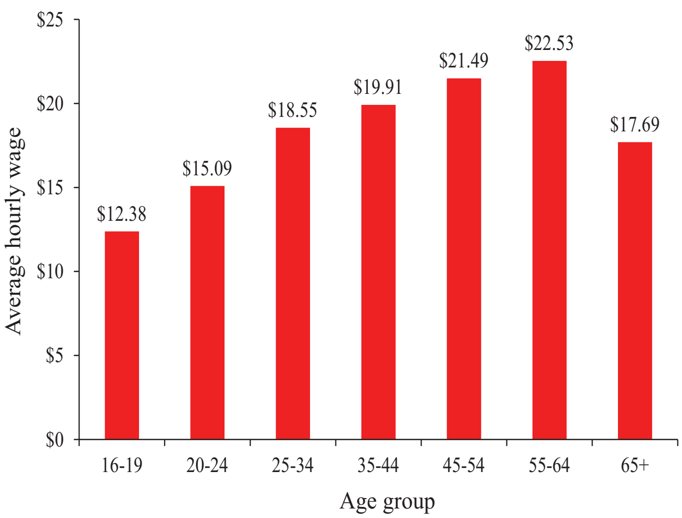
When wages are compared among U.S. *regions* (*see* Glossary), production workers in construction are found to make less on average in the South than in any other region. The average hourly wage in the South is about 18% lower than in the West, and 20% and 21% less than in the Midwest and the Northeast, respectively (chart 24e). Variations in unionization, age, educational attainment, training, occupation, and diverse ethnic and regional differences, all contribute to wage differentials in the construction industry (*see* pages 12-19).

24a. Average hourly wage in construction, by race/ethnicity and union status, 2015 (Production workers)

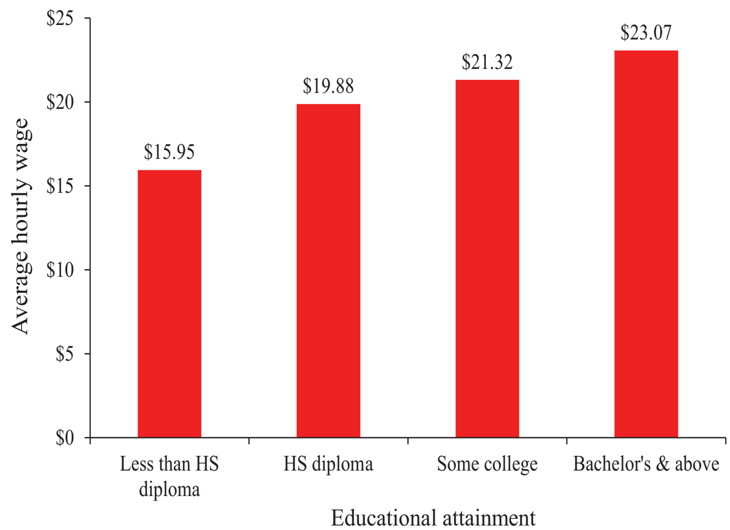


1. All numbers on this page were estimated using data from the Current Population Survey. Calculations by the CPWR Data Center.

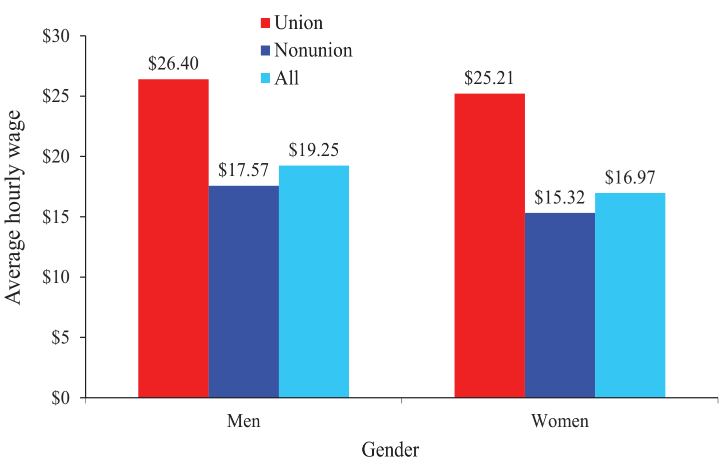
24b. Average hourly wage in construction, by age group, 2015 (Production workers)



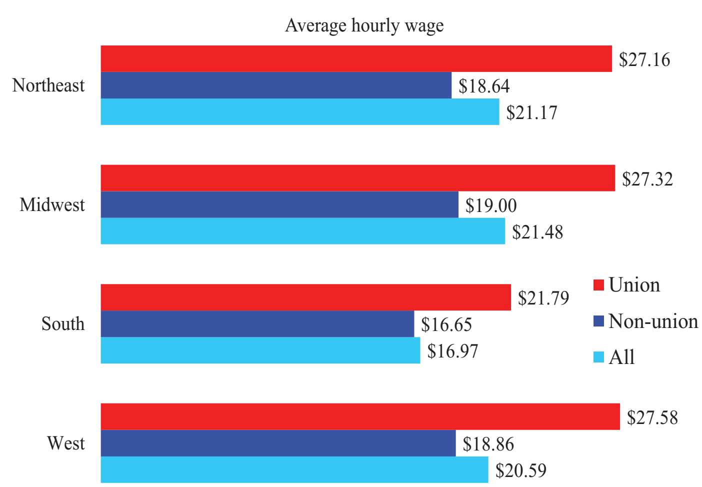
24c. Average hourly wage in construction, by educational attainment, 2015 (Production workers)



24d. Average hourly wage in construction, by gender and union status, 2013-2015 average (Production workers)



24e. Average hourly wage in construction, by region and union status, 2015 (Production workers)



Note: All charts – Production workers are blue-collar workers; all workers except managerial, professional (architects, accountants, etc.), and administrative support staff. Data include all hourly wage earners who reported their pay on an hourly basis and whose wages were greater than zero. Self-employed workers were excluded.
Chart 24a – The minimum sample size was 109; standard errors of wages were within ± 5%; ranges between upper and lower levels (95% CI) were within $4.30; p-value < 0.001.
Chart 24b – The minimum sample size was 121 for the 65+ age group; standard errors of wages were within ± 5%; ranges between upper and lower levels (95% CI) were within $2.50; p-value < 0.001.
Chart 24c – The minimum sample size was 262 for the bachelor's and above education group; standard errors of wages were within ± 5%; ranges between upper and lower levels (95% CI) were within $2.50; p-value < 0.001.
Chart 24d – Wages were averaged across three years (2013–2015) in 2015 dollars; wages in 2013 and 2014 were adjusted using the Urban Wage Consumer Price Index (CPI-W, *see* Annex). The minimum sample size was 57; standard errors of wages were within ± 5%; ranges between upper and lower levels (95% CI) were within $5.50; p-value < 0.001.
Chart 24e — The minimum sample size was 150, standard errors of wages were within ± 3%; ranges between upper and lower levels (95% CI) were within $3.20; p-value < 0.001.

Source: Charts 24a-24c, and 24e – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
Chart 24d – U.S. Bureau of Labor Statistics. 2013-2015 Current Population Survey. Calculations by the CPWR Data Center.

Standard Occupational Classification and Wage Estimates in Construction

Wages in the construction industry vary significantly by occupation and subsector. In 2015, construction managers earned more than 2.5 times the earnings of construction laborers on average ($46.29 versus $17.84; chart 25a). Similarly, workers employed in Nonresidential Building Construction (NAICS 236200, *see* page 1) earned an average annual wage of $60,570, compared to $42,280 for workers in Painting and Wall Covering (NAICS 238320; chart 25b). Even within the same occupation, wage rates differ by construction subsector. For example, the average hourly wage in 2015 for electricians in Heavy and Civil Engineering Construction was $29.82, 17% higher than that in the Construction of Buildings ($25.41; chart 25c). Wage differences may be associated with many factors, including work experience, unionization, demographics and region (*see* page 24), education (*see* page 29), and apprenticeship training (*see* page 30).

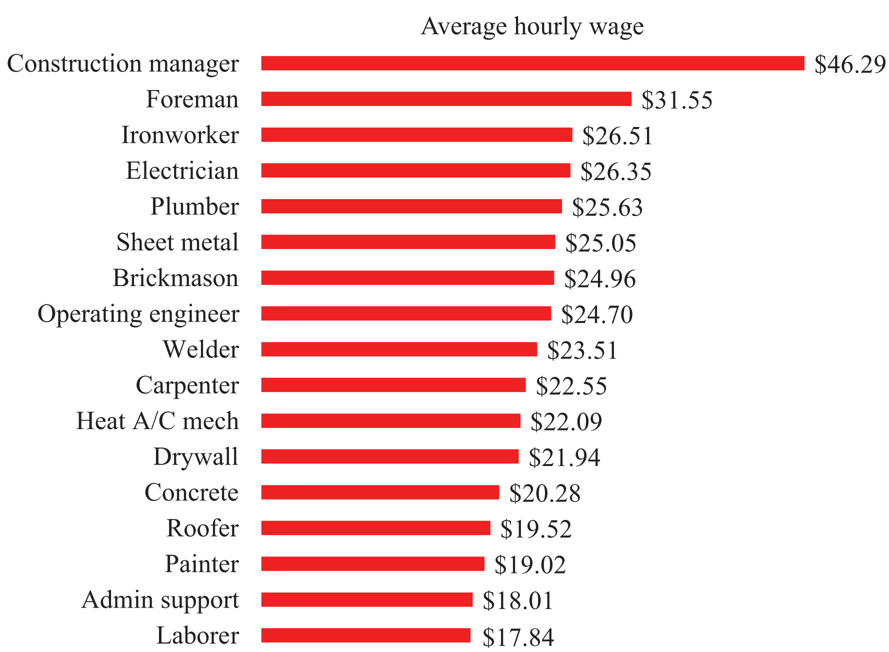
Wage data on this page were obtained from the Occupational Employment Statistics (OES) program, a cooperative effort of the U.S. Bureau of Labor Statistics (BLS) and state workforce agencies.[1] The OES collects data from employers and provides wage and salary information for a larger range of occupations and geographical areas than other data sources. Like other establishment surveys, the OES classifies industries by the North American Industry Classification System (NAICS, *see* page 1), and occupations by the Standard Occupational Classification (SOC) system. Currently, the 2010 SOC is used by federal statistical agencies.[2] Occupations are organized by six-digit numeric codes in the 2010 SOC. For example:

- 47-0000 - Construction and Extraction Occupations
  - 47-2000 - Construction Trades Workers
    - 47-2040 - Carpet, Floor, and Tile Installers and Finishers
      - 47-2041- Carpet Installers
      - 47-2042 - Floor Layers, Except Carpet, Wood, and Hard Tiles
      - 47-2043 - Floor Sanders and Finishers
      - 47-2044 - Tile and Marble Setters

The first two digits of the SOC code represent the major group, the third digit refers to the minor group, the fourth and fifth digits indicate the broad occupation, and the sixth digit denotes the detailed occupation. The SOC is revised periodically to respond to changes in occupational structures due to new technology and the economic environment. The 2018 SOC codes have been proposed (with minor changes in construction occupations) and the revision process is ongoing.[3]

The OES data are based on a three-year average, including the year when data are released. The OES excludes self-employed workers and does not collect demographic data. Due to differences in survey methodologies, wage data reported on this page may differ from wage estimates in previous publications and on other pages in this chart book.

25a. Average hourly wage, by construction occupation, 2015 (Wage-and-salary workers)



1. U.S. Bureau of Labor Statistics. 2016. Occupational Employment Statistics overview. https://www.bls.gov/oes/oes_emp.htm (Accessed April 2016). OES national industry-specific data are available from http:www.bls.gov/oes/current/oessrci.htm (Accessed January 2017). OES data by state and metropolitan / nonmetropolitan area are available from https://www.bls.gov/oes/current/oessrcst.htm and http://www.bls.gov/oes/current/oessrcma.htm (Accessed January 2017).
2. U.S. Bureau of Labor Statistics. 2016. Standard Occupational Classification. All SOC definitions are available online from https://www.bls.gov/soc/ (Accessed January 2017).
3. U.S. Bureau of Labor Statistics. 2014. Revising the Standard Occupational Classification. https://www.bls.gov/soc/revising_the_standard_occupational_classification_2018.pdf (Accessed January 2017).

25b. Hourly and annual wages, by construction subsector, 2015 (Wage-and-salary workers)

NAICS	NAICS Description	Hourly Wage		Annual Wage
		Average	Median	Average
236100	**Residential Building Construction**	**$23.66**	**$19.39**	**$49,210**
236200	**Nonresidential Building Construction**	**$29.12**	**$24.85**	**$60,570**
237100	**Utility System Construction**	**$24.80**	**$21.31**	**$51,570**
237130	Power and Communication Line and Related Structures Construction	$26.00	$22.61	$54,070
237200	**Land Subdivision**	**$29.05**	**$21.51**	**$60,420**
237300	**Highway, Street, and Bridge Construction**	**$25.36**	**$21.78**	**$52,750**
237900	**Other Heavy and Civil Engineering Construction**	**$25.77**	**$21.76**	**$53,610**
238100	**Foundation, Structure, and Building Exterior Contractors**	**$22.29**	**$18.75**	**$46,360**
238110	Poured Concrete Foundation and Structure Contractors	$21.68	$18.32	$45,090
238140	Masonry Contractors	$22.26	$19.11	$46,310
238160	Roofing Contractors	$21.62	$18.18	$44,980
238200	**Building Equipment Contractors**	**$25.75**	**$22.42**	**$53,560**
238210	Electrical Contractors and Other Wiring Installation Contractors	$26.01	$22.79	$54,110
238220	Plumbing, Heating, and Air-Conditioning Contractors	$25.26	$21.93	$52,550
238300	**Building Finishing Contractors**	**$22.27**	**$18.58**	**$46,320**
238310	Drywall and Insulation Contractors	$23.78	$20.08	$49,450
238320	Painting and Wall Covering Contractors	$20.33	$17.46	$42,280
238900	**Other Specialty Trade Contractors**	**$22.15**	**$18.64**	**$46,070**

25c. Hourly wage, by construction subsector and occupation, 2015 (Wage-and-salary workers)

SOC	SOC Description	Construction of Buildings		Heavy and Civil Engineering Construction		Specialty Trade Contractors	
		Average	**Median**	**Average**	**Median**	**Average**	**Median**
00-0000	All Occupations	$26.47	$22.02	$25.28	$21.53	$23.89	$20.31
11-9021	Construction Manager	$46.32	$41.18	$47.68	$43.47	$45.68	$40.02
43-0000	Administrative Support	$18.54	$17.30	$18.99	$17.55	$17.61	$16.34
47-0000	Construction & Extraction	$22.67	$20.02	$22.93	$20.18	$22.78	$19.87
47-1011	Foreman	$32.13	$30.08	$31.91	$30.31	$30.96	$28.72
47-2021	Brickmason	$27.85	$26.44	$27.57	$26.50	$24.67	$22.83
47-2031	Carpenter	$22.31	$20.38	$25.55	$22.60	$22.52	$19.75
47-2051	Concrete	$22.02	$18.73	$21.36	$18.94	$19.75	$18.00
47-2061	Laborer	$17.43	$15.61	$18.89	$16.22	$17.45	$15.16
47-2073	Operating Engineer	$25.22	$23.45	$25.48	$23.12	$23.77	$21.20
47-2081	Drywall	$21.68	$19.44	$18.73	$17.05	$21.98	$18.85
47-2111	Electrician	$25.41	$23.28	$29.82	$28.08	$26.31	$24.08
47-2141	Painter	$18.92	$17.49	$21.36	$19.34	$18.98	$17.11
47-2152	Plumber	$25.84	$24.70	$25.25	$23.66	$26.77	$24.16
47-2181	Roofer	$22.98	$17.59	N/A	N/A	$19.34	$17.65
47-2211	Sheet Metal	$20.84	$18.58	$22.21	$22.08	$25.27	$22.80
47-2221	Ironworker	$24.43	$23.38	$26.58	$24.79	$27.35	$25.23
49-0000	Installation, Maintenance, & Repair	$21.81	$20.38	$24.25	$22.58	$22.18	$20.62
49-9021	Heat A/C Mechanic	$24.37	$24.44	N/A	N/A	N/A	N/A
51-4121	Welder	$23.68	$21.84	$27.44	$24.54	$21.01	$19.51
53-0000	Transportation & Material Moving	$19.92	$17.66	$20.96	$18.67	$19.56	$17.72

Note: Chart 25b – This table includes industry groups (in bold) and selected industry subsectors.
Charts 25b and 25c – The median is the midpoint; half of the reported wages are larger and half are smaller.

Source: Chart 25a – U.S. Bureau of Labor Statistics. May 2015 national occupational employment and wage estimates. http://www.bls.gov/oes/current/oes_nat.htm (Accessed April 2016).
Charts 25b and 25c – U.S. Bureau of Labor Statistics. May 2015 national industry-specific occupational employment and wage estimates. http://www.bls.gov/oes/current/oessrci.htm (Accessed April 2016).

Health Insurance Coverage in Construction and Other Industries

In 2015, 89.9% of wage-and-salary workers in the United States had health insurance coverage, up from 83% in 2010 (chart 26a). This is likely due to Medicaid expansion, insurance marketplaces, changes to private insurance, and other provisions that were enacted after the Affordable Care Act (ACA) was signed into law in 2010.[1] More than half (54.8%) of wage earners were covered by health insurance through their own employment and another 35.0% obtained health insurance from other sources such as a family member's employer, by direct purchase, or through public sources. Industries with higher proportions of seasonal and cyclical employment, such as construction, generally provide less access to insurance. In 2015, 78.3% of wage earners in construction had health insurance, a lower proportion than any other industry except agriculture. Just 49.1% of construction wage-and-salary workers had health insurance provided by their employer or union, 22.2% purchased health insurance themselves or received it through a family member's employer, and another 7.1% were insured by a public source. Among self-employed construction workers, 74% were covered by some type of health insurance in 2015, including a personal plan, a family member's plan, or from other sources such as public coverage.[2]

Both the number and rate of health insurance coverage in construction have fluctuated over time (chart 26b). The proportion of uninsured among construction workers peaked at 36% in 2005, and then declined until 2008, indicating construction workers who lacked health insurance were more likely to lose their job during the housing market collapse.[3] Following the overall trends after the ACA, the rate of uninsured in construction has precipitously dropped to 22% in 2015; a record low over the last two decades.

In 2015, only a third (33.7%) of Hispanic construction workers who were wage earners had health insurance through their employment, while the percentage was 56.3% among their white, non-Hispanic counterparts (chart 26c). Although women are less likely than men to have health insurance through their own employment,[4] women construction workers were more likely to have employer-provided insurance in general (including through their spouse's employer) than male construction workers in 2015 (53.8% versus 48.6%, respectively).[2]

Unionization greatly improves the likelihood of receiving employment-based health insurance. Among production construction workers who were union members, 72.2% had health insurance through employment in 2015, compared to 38.3% among non-union workers (chart 26d). This is likely because contributions to cover health insurance in the union sector are negotiated into construction collective bargaining agreements, and contractors typically pay into a multiemployer fund. Construction workers may change employers frequently, but unionized construction workers are able to retain coverage as they move from one employer and project to the next through these funds.

The likelihood of a company providing health insurance increases with size. In 2015, only 26.4% of construction workers in companies with fewer than 10 employees received employment-based health insurance, compared to more than 70% of their counterparts working in companies with 500 or more employees (chart 26e). In general, the construction industry is comprised mostly of small companies (*see* page 2).

Employment-based health insurance coverage varied by occupation, ranging from 26.7% for carpet and tile installers to 75.2% for ironworkers (chart 26f). This variation reflects differences in occupational composition, such as ethnicity, unionization rates, average firm size, and independent contracting practices.

The Patient Protection and Affordable Care Act (PPACA) signed into law by President Obama in 2010 can be credited with significant decreases in the uninsured rate among construction workers.[5] However, disparities in health insurance coverage still exist in the construction industry.

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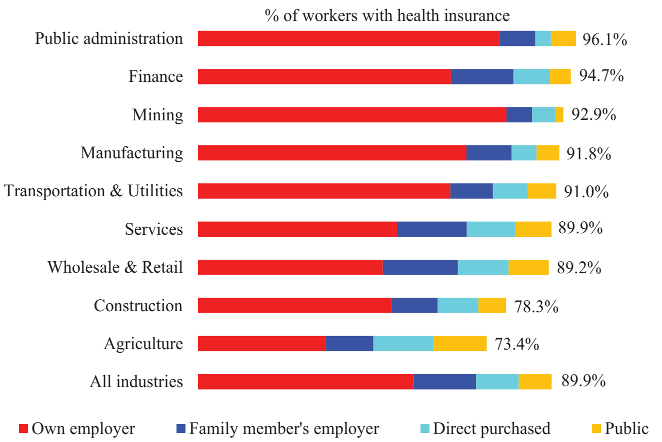
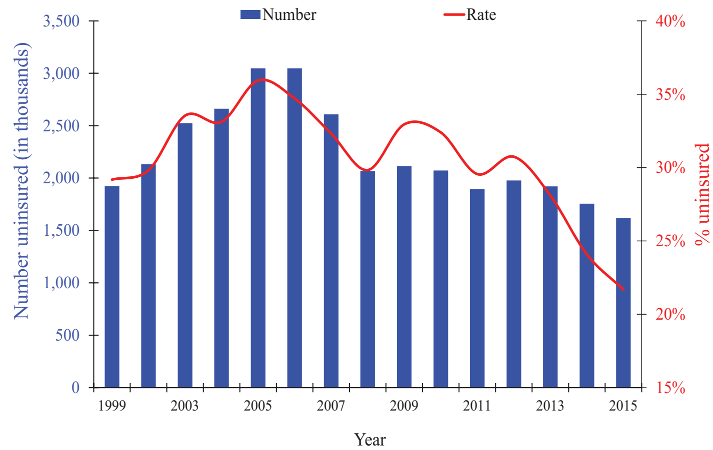
1. U.S. Department of Health & Human Services. 2016. 20 million people have gained health insurance coverage because of the Affordable Care Act, new estimates show. https://www.hhs.gov/about/news/2016/03/03/20-million-people-have-gained-health-insurance-coverage-because-affordable-care-act-new-estimates (Accessed January 2017).
2. All numbers cited on this page are from the U.S. Bureau of Labor Statistics, 2016 Current Population Survey, Annual Social and Economic Supplement (or March Supplement). Calculations by the CPWR Data Center. The survey asks respondents whether they were covered by a private health insurance plan in the last calendar year. If they said "yes," they were then asked, "Was this health insurance plan in your own name?" and "Was this health insurance plan offered through your current or former employer or union?" Respondents are also asked about health insurance coverage from public sources, such as Medicare, Medicaid, CHAMPUS (Civilian Health and Medical Program of the Uniformed Services), TRICARE (for retired members of the military), and CHAMPVA (for dependents or survivors of military veterans).
3. CPWR – The Center for Construction Research and Training. 2009. Hispanic employment in construction. CPWR Data Brief, 1(1). http://www.cpwr.com/publications/vol-1-no-1-hispanic-employment-construction (Accessed January 2017).
4. Kaiser Family Foundation. 2016. Women's health insurance coverage. http://kff.org/womens-health-policy/fact-sheet/womens-health-insurance-coverage-fact-sheet/ (Accessed January 2017).
5. CPWR – The Center for Construction Research and Training. 2015. Impact of the Affordable Care Act on health insurance coverage and healthcare utilization among construction workers. Quarterly Data Report: Fourth Quarter. http://www.cpwr.com/sites/default/files/publications/4th%20Quarter%20QDR.pdf (Accessed January 2017).

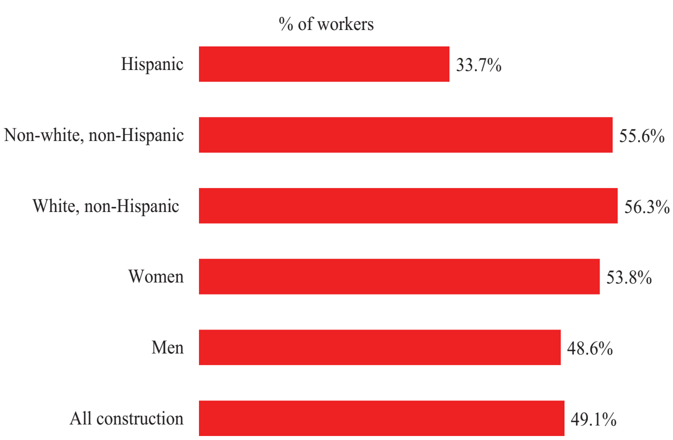
26a. Percentage of workers with health insurance, by source and industry, 2015



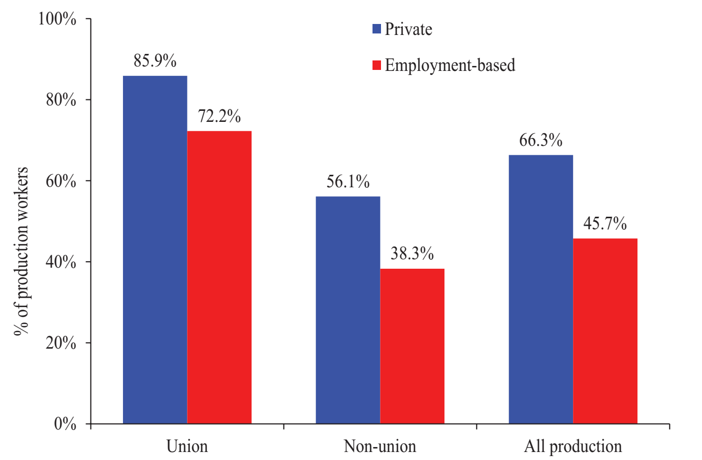
26b. Number and rate of uninsured construction workers, selected years, 1999-2015



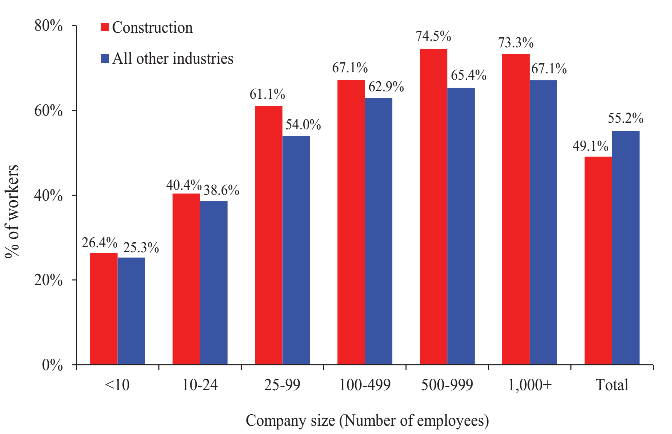
26c. Percentage of construction workers with employment-based health insurance, by demographic characteristics, 2015



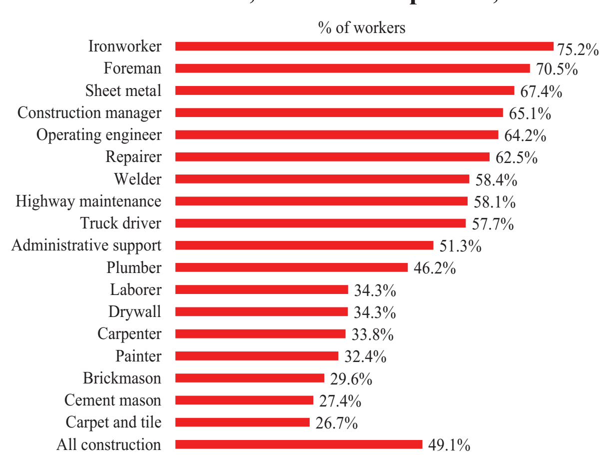
26d. Percentage of construction workers with private and employment-based health insurance, by union status, 2015



26e. Percentage of workers with employment-based health insurance, by company size, 2015



26f. Percentage of construction workers with employment-based health insurance, selected occupations, 2015



Note: Charts 26a-26c, 26e, and 26f – Cover wage-and-salary workers only.
Chart 26c – "Non-white, non-Hispanic" includes all racial groups except "white only," and excludes those who are Hispanic. Hispanics can be of any race (*see* pages 16 and 18).
Chart 26d – Covers production workers only. Self-employed workers are excluded from the estimates.
Chart 26f – Sample sizes > 30, except ironworkers (n = 20).

Source: Charts 26a, 26c-26f – U.S. Bureau of Labor Statistics. 2016 Current Population Survey, Annual Social and Economic Supplement (or March Supplement). Calculations by the CPWR Data Center.
Charts 26b – U.S. Bureau of Labor Statistics. 2000-2016 Current Population Survey, Annual Social and Economic Supplement (or March Supplement). Calculations by the CPWR Data Center.

Retirement Plans in Construction and Other Industries

Construction workers are less likely than workers in most other industries to be eligible for, or participate in, a retirement plan through their employment. In 2015, about a third (33.7%) of wage-and-salary construction employees were eligible to participate in an employment-based retirement plan, and only 27.4% actually participated (chart 27a).[1] These rates have been continuously declining; eligibility and participation were at 38% and 33% in 2010, and 46% and 39% in 2000.[2]

Older workers are more likely to have retirement plans. In 2015, 36% of construction workers age 50 years and over participated in retirement plans, compared to 22% among workers under age 50. Similar patterns were found in other industries; about 45.0% of workers age 50 years and over participated in retirement plans; while only 32.6% of workers under age 50 did so. Participation in a retirement plan is generally lower among construction workers employed in production occupations than those in white-collar occupations (25.3% versus 34.1%).[1] However, construction production workers who belonged to a union were eligible for and participated in retirement plans at a much higher rate than did non-union workers (55.1% versus 25.9% for eligibility, and 47.4% versus 20.9% for participation; chart 27b). Construction occupations with higher unionization rates also had higher rates of participation in retirement plans. Participation was highest among sheet metal workers (55.4%), highway maintenance workers (49.9%), ironworkers (47.9%), and welders (47.9%; chart 27c; *see* chart 12c for union membership by occupation).

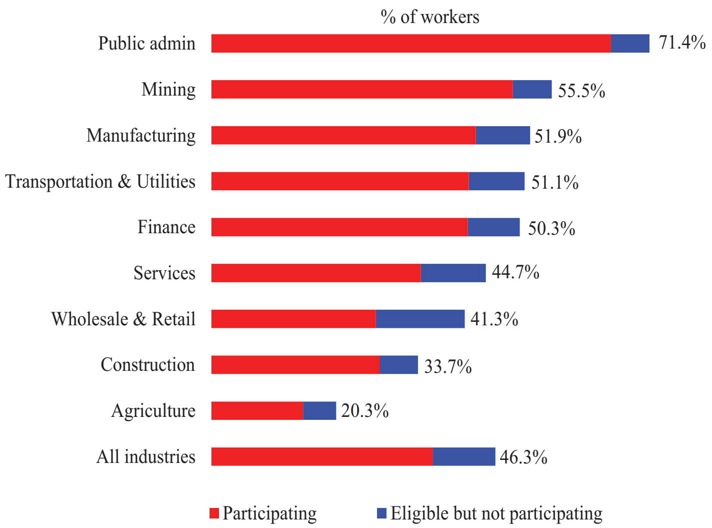
Retirement plan participation varies by company size. In 2015, only 10% of construction workers who worked for companies with fewer than 10 employees participated in retirement plans.[1] In contrast, 49% of construction workers employed by companies with 500 or more employees participated in retirement plans.[1] Unionized construction trades typically use a *multiemployer plan* (*see* Glossary) model to fund retirement. Contractors that have signed a collective bargaining agreement with a building trades union pay into a fund that is managed jointly by trustees from the union and the employers, using investment advisors to guide their decisions. Multiemployer retirement plans may take the form of a *defined benefit pension plan* (*see* Glossary), which guarantees a level of income at retirement. There are about 1,400 multiemployer defined benefit pension plans, covering about 10 million participants. Many of these participants are employed by small companies in the building and construction industries.[3] Another type of retirement plan is a *defined contribution retirement plan* (*see* Glossary), such as a 401(k) plan. Multiemployer retirement plans are common among unionized workers in other industries where workers are more likely to change employers frequently, such as trucking, grocery stores, and garment manufacturing businesses.[3]

Retirement information is collected by the U.S. Department of Labor (DOL) through Form 5500.[4] According to the DOL, 4.42 out of 7.14 million, or 62% of retirement plan participants in construction were enrolled in multiemployer retirement plans (including both defined benefit pension plans and defined contribution retirement plans) in 2014 (chart 27d). The data also show that 96% of the 51,260 retirement plans in construction were defined contribution plans, and 61.9% of construction workers that had retirement plans participated in that type of plan.[4] Overall, 93.5% of the retirement plans in the U.S. were defined contribution plans, and 71.5% of participants had such plans.

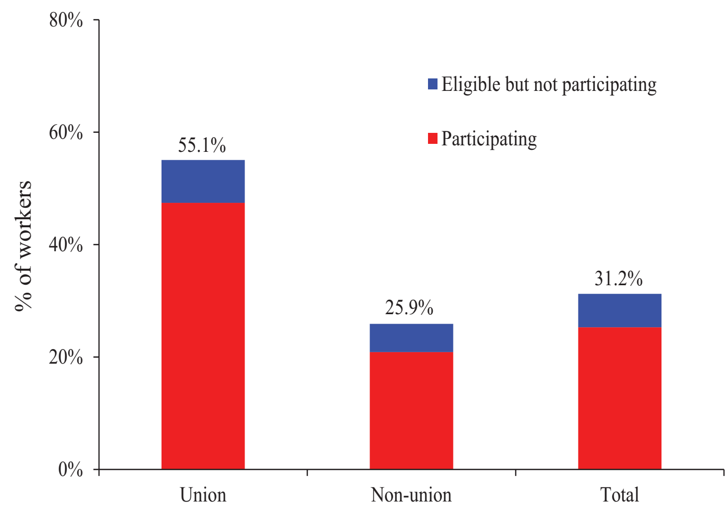
The retirement plan system in the U.S. has shifted away from defined benefit plans in favor of defined contribution plans (primarily the 401(k) plan) over the past several decades.[5,6] This means that employers have shifted their responsibility for workers' retirement onto the workers. Information on retirement plans is also available from other data sources (*see* page 23). Estimates are generally consistent across sources; construction employers are less likely to provide retirement benefits to their employees than all industries on average.

1. Unless otherwise noted, numbers used in the text are from the U.S. Bureau of Labor Statistics, 2016 Current Population Survey (CPS), Annual Social and Economic Supplement (or March Supplement). Calculations by the CPWR Data Center. The survey asks respondents if they are offered a retirement plan at their workplace, if they are eligible to join, and if they participate. Since information on the type of plan is not available from the CPS, estimates based on the CPS data may include plans with employer contributions and plans funded solely by an employee's personal contributions (such as a 401(k)). The CPS does not ask reasons for non-participation in such plans. In general, non-participation may result if: 1) an employee is not eligible because the job or position is not covered or the employee has not been on the job long enough, or 2) an employee chooses not to participate because the plan requires employee contributions.
2. CPWR – The Center for Construction Research and Training. 2013. The Construction Chart Book, The U.S. Construction Industry and Its Workers, fifth edition. CPWR: Silver Spring, MD. http://www.cpwr.com/publications/construction-chart-book (Accessed January 2017).
3. Pension Benefit Guaranty Corporation. Introduction to multiemployer plans. http://www.pbgc.gov/prac/multiemployer/introduction-to-multiemployer-plans.html (Accessed January 2017).
4. U.S. Department of Labor, Employee Benefits Security Administration. 2016. Private Pension Plan Bulletin, Abstract of 2014 Form 5500, Annual Reports. The DOL requires that retirement plans having 100 or more participants must submit Form 5500 annually.
5. Works R. 2016. Trends in employer costs for defined benefit plans. Beyond the Numbers: Pay & Benefits, 5(2). https://www.bls.gov/opub/btn/volume-5/trends-in-employer-costs-for-defined-benefit-plans.htm (Accessed January 2017).
6. Dong XS, Wang X, Ringen K, Sokas R. 2017. Baby boomers in the United States: Factors associated with working longer and delaying retirement. American Journal of Industrial Medicine (in press).

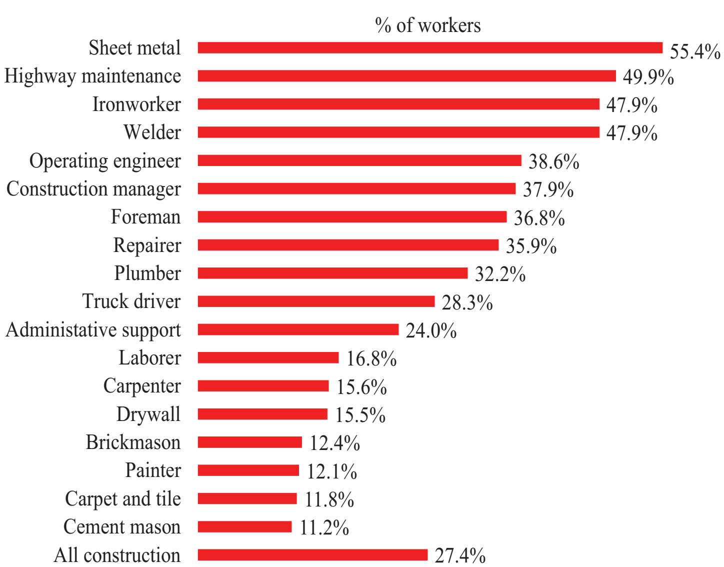
27a. Participation level in employment-based retirement plans, by industry, 2015 (Wage-and-salary workers)



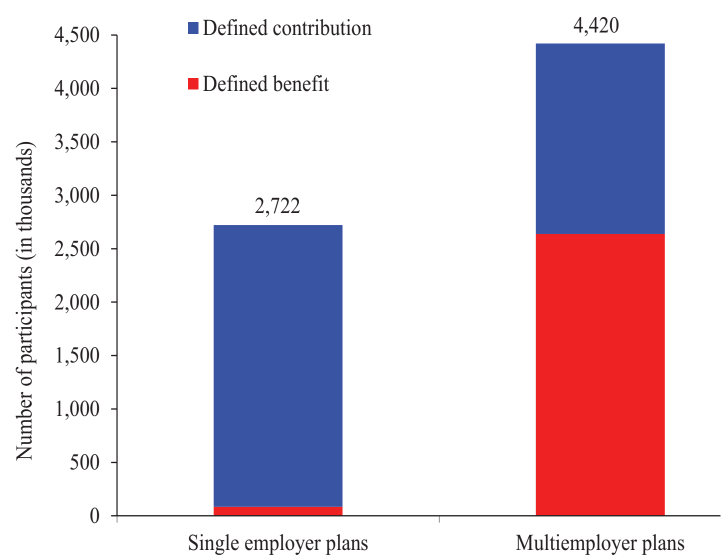
27b. Participation level in employment-based retirement plans in construction, by union status, 2015 (Production workers)



27c. Participation level in employment-based retirement plans, selected construction occupations, 2015 (Wage-and-salary workers)



27d. Distribution of participants in single employer and multi-employer retirement savings plans in construction, 2014



Note: Charts 27a-27c – Retirement plan coverage includes eligibility for an employer or union and if the employee was included during the previous calendar year.
Chart 27b – The percentages for non-union workers were adjusted by the CPS annual data.
Chart 27d – Participants include active, retired, and separated vested participants not yet in pay status. Beneficiaries of the participants are excluded. The number of participants includes double counting of workers who are in more than one plan. Plans are divided into defined benefits and defined contributions.

Source: Charts 27a-27c – U.S. Bureau of Labor Statistics. 2016 Current Population Survey, Annual Social and Economic Supplement (or March Supplement). Calculations by the CPWR Data Center.
Chart 27d – U.S. Department of Labor, Employee Benefits Security Administration. 2016. Private Pension Plan Bulletin, Abstract of 2014 Form 5500, Annual Reports.

Hours Worked, Overtime, and Time Use in Construction and Other Industries

The two major data sources for hours worked in the United States are the Current Employment Statistics (CES; *see* page 10) and the Current Population Survey (CPS; *see* page 10). The measures employed by these two surveys differ, but they show similar trends.

According to the CES data, production workers in construction worked consistently more hours per week on average than employees on private nonfarm payrolls from 1985 to 2015. Hours worked per week among production workers increased slightly after the recession, but the gap between construction and the overall nonfarm workforce widened, from 5.0 hours in 2010 (38.4 hours versus 33.4 hours) to 5.9 hours in 2015 (39.6 hours versus 33.7 hours; chart 28a). It should be noted that the CES data are collected from employers about their employees' paid hours, and do not reflect the total number of working hours of individuals holding more than one job. For example, if an employee worked 25 hours per week at one job and 15 hours per week at another, the CES counted these as two jobs rather than a single employee working 40 hours per week.

In contrast, the CPS data are collected from individual workers regarding the total number of hours worked on all jobs held during the survey reference period. The CPS data indicate that construction workers worked an average of 39.7 hours per week in 2015 compared to 37.7 hours per week in 2010, suggesting greater access to full-time employment after the economic recovery.[1] Nearly a quarter (24.8%) of construction workers reported working overtime in 2015, higher than all industries combined (21.5%), but less than mining and agriculture workers (chart 28b).

Within construction, a higher proportion of self-employed workers than wage-and-salary workers worked more than 40 hours a week (32% versus 23%; chart 28c). On the other hand, about 20% of construction workers worked less than 35 hours in 2015, down from 25% in 2010.[1]

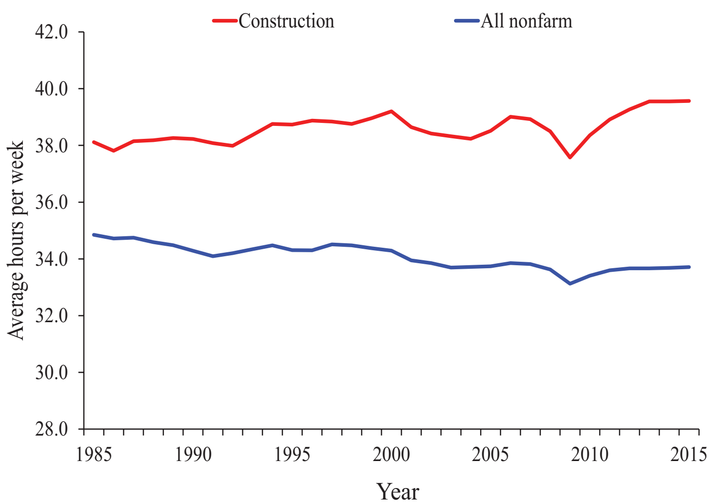
In addition to hours worked, the CPS asks respondents every March about the total number of hours and weeks they worked in the previous calendar year. Overall, construction workers reported working 47.7 weeks or 1,823 hours in 2015, compared to 47.2 weeks or 1,729 hours for workers in all industries the same year.[2]

The American Time Use Survey (ATUS), which asks randomly selected respondents from the CPS to report their activities during a 24-hour period, provides insight on how, where, and with whom Americans spend their time. The ATUS data from 2013 to 2015 showed that construction workers devoted slightly more time (7.9 hours) to work and related activities than the average worker (7.6 hours), and spent less time on sleeping, leisure and sports, and household activities (chart 28d).

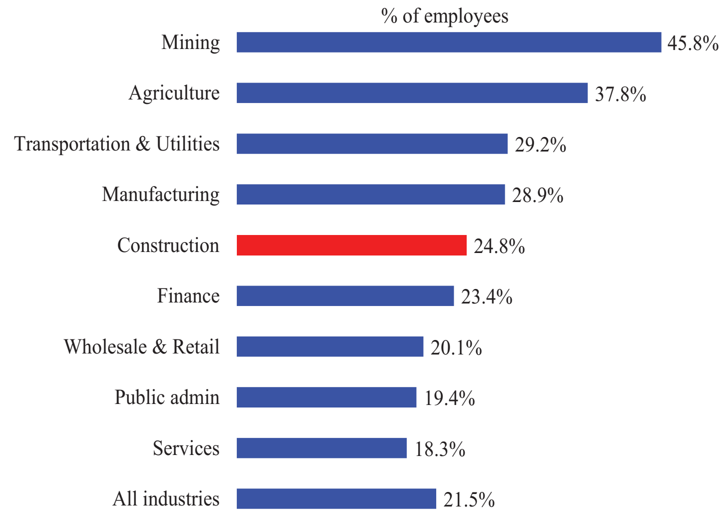
While working overtime is a common way to speed up schedule-driven projects or to address labor shortages in construction when the economy is rebounding, working longer hours does not necessarily yield higher productivity,[3] and may increase health and safety-related risks.[4,5]

1. U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
2. U.S. Bureau of Labor Statistics, 2011 and 2016 Current Population Survey, Annual Social and Economic Supplement (or March Supplement). Calculations by the CPWR Data Center. The estimated hours and weeks worked annually are less accurate than hours worked per week reported on this page. Information on hours worked per week is collected monthly, and the estimates were an average of 12 months. Information on hours and weeks worked annually is only collected in every March, and the estimates were based on a one-time report for a long recall period (a calendar year), which largely reduces data reliability. Moreover, construction jobs are seasonal. Since March is a slow month in construction, data collected in March may only capture year-round core construction workers and not the seasonal workers that work fewer weeks per year. As a result, hours worked per year reported among construction workers may be overestimated.
3. Hanna AS, Taylor CS, Sullivan KT. 2005. Impact of extended overtime on construction labor productivity. Journal of Construction Engineering and Management, 131(6): 734-739.
4. NIOSH Workplace Safety & Health Topics. 2015. Work schedules: Shift work and long work hours. http://www.cdc.gov/niosh/topics/workschedules/ (Accessed October 2016).
5. Kivimaki M, Jokela M, Nyberg S, Singh-Manoux A, Fransson E, Alfredsson L, et al. 2015. Long working hours and risk of coronary heart disease and stroke: a systematic review and meta-analysis of published and unpublished data for 603,838 individuals. The Lancet, 386(10005): 1739-1746.

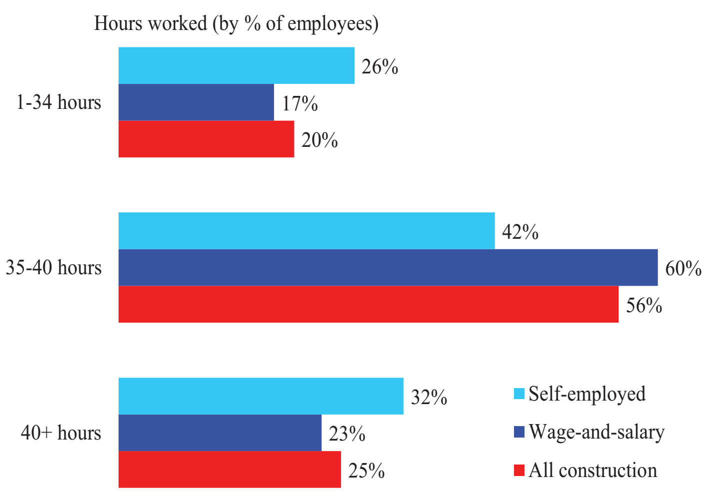
28a. Average hours worked per week, construction versus all nonfarm industries, 1985-2015 (Private production workers)



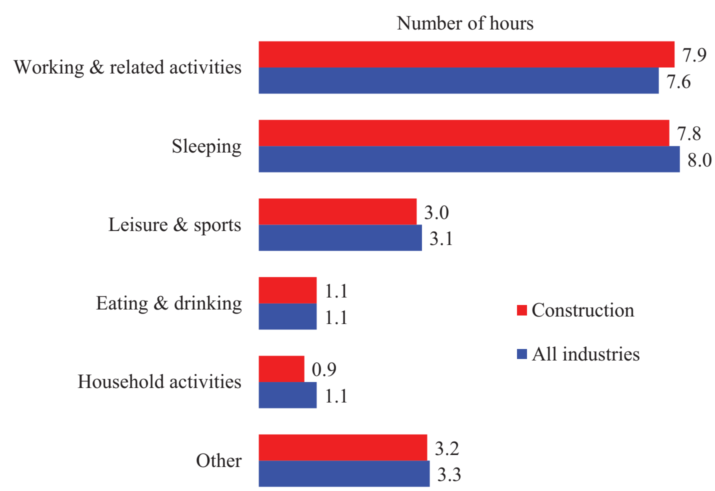
28b. Percentage of employees working overtime, by industry, 2015 (All employment)



28c. Hours worked per week in construction, self-employed and wage-and-salary workers, 2015 (All employment)



28d. Time use in a 24-hour period, construction versus all industries, 2013-2015 average (All employment)



Note: Chart 28a – Data cover the private sector nonfarm payrolls and exclude the self-employed.

Source: Chart 28a – U.S. Bureau of Labor Statistics. Employment, Hours, and Earnings. Table B-7: Average weekly hours and overtime of production and non-supervisory employees on private nonfarm payrolls by industry sector, seasonally adjusted. http://www.bls.gov/webapps/legacy/cesbtab7.htm (Accessed June 2016).
Charts 28b and 28c – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
Chart 28d – U.S. Bureau of Labor Statistics. 2013–2015 American Time Use Survey. Calculations by the CPWR Data Center

Educational Attainment and Internet Usage in Construction and Other Industries

Construction workers have the lowest levels of education among all industries except for agriculture (chart 29a). In 2015, about 40% of construction workers had some post-secondary education, in contrast to 65% of the total workforce.[1] In addition to formal education, most construction knowledge is learned on the job or from special courses, licensing and certification processes, and apprenticeships (*see* page 30).

Production (blue-collar, *see* Glossary) workers have a lower level of educational attainment than the overall workforce in general, and the proportion of production workers in construction with formal education is even lower than among production workers in other industries. In 2015, 24% of construction production workers had less than a high school diploma, compared to 15% of their counterparts in other industries.[1] Historically, formal educational requirements were uncommon for most production occupations. However, today most construction trades need a high school diploma or its equivalent.[2] Workers are often encouraged or required to attend an apprenticeship program, trade or vocational school, association training class, or community college to further their trade-related training (*see* page 30).

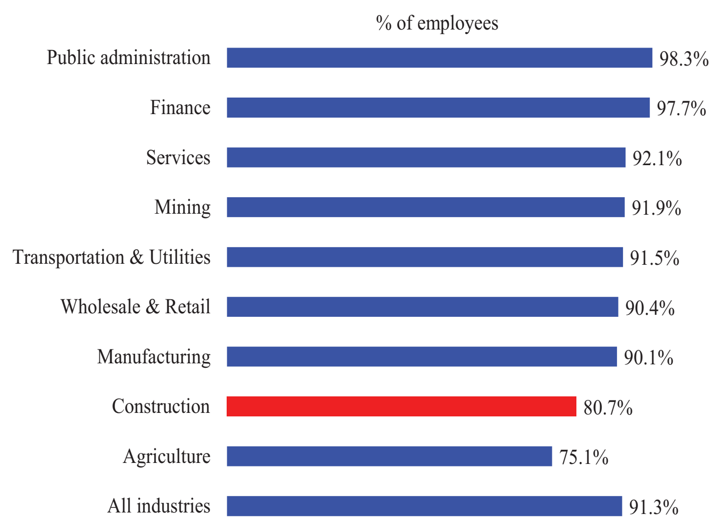
In construction, union members (*see* page 12) tend to have higher levels of educational attainment than non-union workers. In 2015, nearly one in three non-union production workers (28.5%) lacked a high school diploma or equivalent compared to only one in ten union workers (10.9%; chart 29b). Similarly, a larger portion of union members had post-secondary education (41.3%) — including some college or a bachelor's degree — than non-union workers (26.9%).

Educational attainment also differs among demographic groups. Hispanic construction workers, who are more likely to be foreign-born (*see* pages 15 and 16), are much less likely to have a high school diploma or post-secondary education than non-Hispanic workers. Nearly half (46.0%) of Hispanic construction workers had less than a high school diploma, compared to 8.6% of their non-Hispanic counterparts (chart 29c). Women workers, who typically have non-production jobs in construction, have higher educational attainment than male workers. Between racial groups in construction, there is no significant difference in educational attainment.[1]

With the rapid adoption of information technology, access to computers and the internet is increasingly widespread. In 2003, only 39% of construction workers had internet at home and 20% at work.[3] By 2015 these proportions nearly doubled, with 68.2% of construction workers accessing internet at home and 38.7% at work (chart 29d). However, lower proportions of construction workers have internet access at home or work compared to the overall workforce. In 2015, 77.4% of workers in all industries had access to internet at home, and 55.9% had access to internet at work.

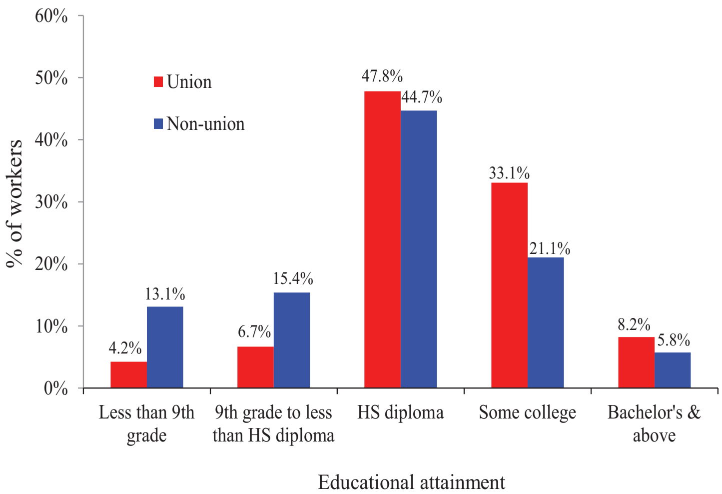
With the availability of tablets, smartphones, and other internet-connected devices, the internet is accessible via more devices than ever before. In 2015, 79.0% of construction workers used smartphones, 43.4% had laptops, and 32.1% used desktop computers (chart 29e). Although construction still lags behind most other industries with regard to information technology usage, the increasing access to handheld devices and the internet among construction workers will present new opportunities for communicating with and providing information to the construction workforce.

29a. Percentage of employees who have at least a high school diploma, by industry, 2015 (All employment)

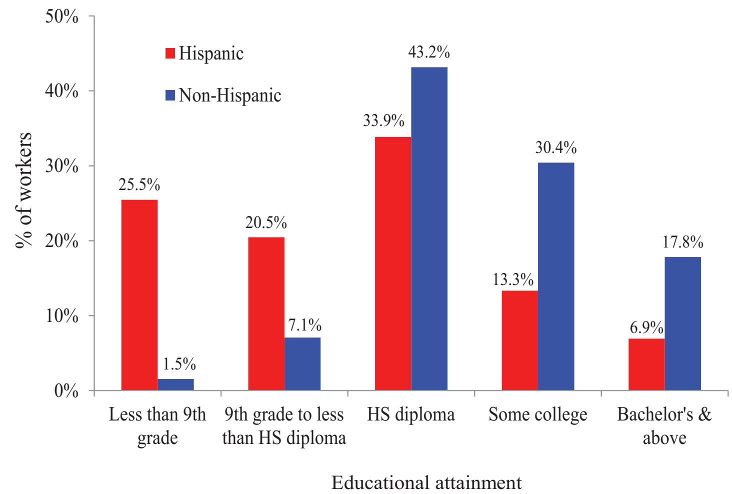


1. The numbers for education are from the U.S. Bureau of Labor Statistics, 2015 Current Population Survey (CPS). Calculations by the CPWR Data Center.
2. U.S. Bureau of Labor Statistics. Occupational Outlook Handbook. https://www.bls.gov/ooh/construction-and-extraction/home.htm (Accessed March 2016).
3. CPWR - The Center for Construction Research and Training. The Construction Chart Book, fourth edition (chart 28d). CPWR: Silver Spring, MD.

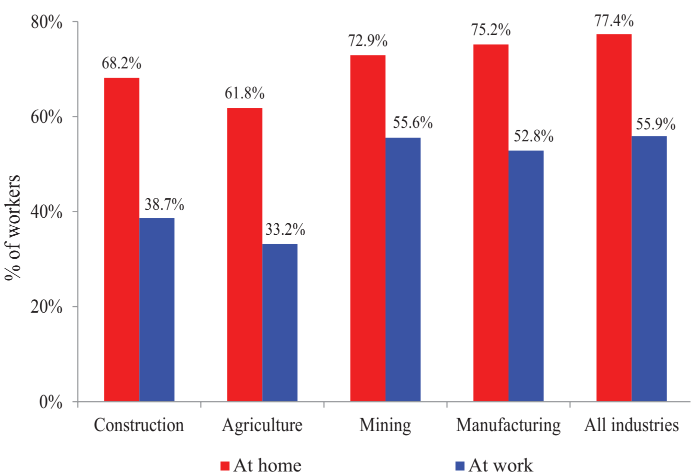
29b. Distribution of educational attainment among construction workers, by union status, 2015 (Production workers)



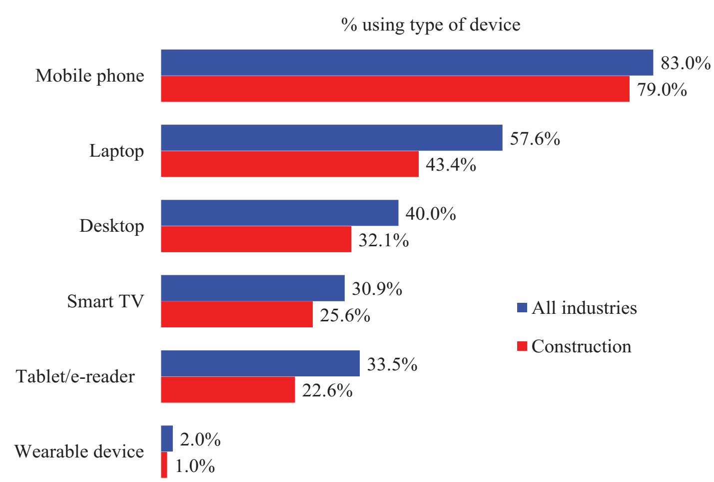
29c. Distribution of educational attainment among construction workers, by Hispanic ethnicity, 2015 (All employment)



29d. Percentage of workers with access to the internet, by industry, 2015 (All employment)



29e. Household computer use in construction versus all industries, by type of device, 2015



Note: Chart 29b – Production workers include all workers except managerial, professional, and administrative support staff, and include the self-employed. Totals may not add to 100% due to rounding.
Chart 29c – Totals may not add to 100% due to rounding.
Charts 29d and 29e – Computer access includes all individuals living in households in which the respondents answered "yes" to the question, "Do you or any member of this household own or use a personal computer, a handheld computer, or a smartphone?" Internet access was for respondents using the internet at home or in the workplace.

Source: Charts 29a, 29b, and 29c – U.S. Bureau of Labor Statistics. 2015 Current Population Survey. Calculations by the CPWR Data Center.
Charts 29d and 29e – U.S. Bureau of Labor Statistics. 2015 Computer and Internet Use Supplement to the Current Population Survey. Calculations by the CPWR Data Center.

Apprenticeships and Occupational Training in Construction

An apprenticeship offers a well-established career path in the construction industry.[1] According to the Federal Apprenticeship Data, of the 202,817 active apprentices (including registered, suspended, and reinstated) in fiscal year 2016, 144,583 were in construction, accounting for more than 70% of the total in all industries (excluding military).[2,3]

The U.S. Department of Labor Employment and Training Administration (ETA) establishes quality standards for apprenticeship programs through a federal registration system—ApprenticeshipUSA.[4] A registered program can last anywhere from one to six years, though most are four years in length. Registered programs must offer both on-the-job training and formal classroom instruction, and can be sponsored either jointly by a labor-management committee or independently by non-union contractors. Joint labor-management programs are major providers of the training for construction workers. Such programs are established at the national, state, and local levels. In 2016, joint programs accounted for the largest share of apprenticeship programs in Hawaii (81.6%), and at least 60% of programs in Nevada, Delaware, Montana, California, and Louisiana (chart 30a). Overall, 70.9% of apprentices in construction were enrolled in joint labor-management programs.

Apprenticeship registrations tend to coincide with economic cycles. The overall number of new apprentices in construction was highest at 74,164 (55,372 union and 18,792 non-union) in 2007 during the construction boom, plunged to 35,551 (22,783 union and 12,768 non-union) in 2010 due to the recession, and rebounded to 57,306 in 2016 (40,640 union and 16,666 non-union) with the economic recovery (chart 30b). Despite economic cycle variations, union programs consistently had higher apprenticeship enrollments over time.

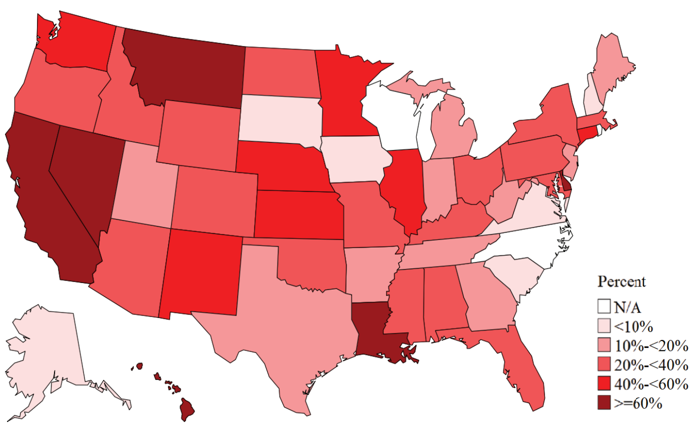
Hispanic apprenticeships experienced more losses and gains than the entire construction industry during the recession and recovery (chart 30c). Overall, new registrations in construction fell 44.3% from 2007 to 2012, but new registrations for Hispanics (union and non-union combined) fell 62.5% over the same time period. Between 2012 and 2016, construction registration experienced a 38.8% increase, while the gain among Hispanics was 66.0%. In 2016, among all new registrations in construction, 17.3% were identified as Hispanic; and black and other minorities who were non-Hispanic accounted for 6.5% and 4.5%, respectively (chart 30d). However, information on ethnicity was not available for more than a quarter (26.4%) of the construction registrations.

Among construction occupations, the electrician trade has the highest number of active apprentices, followed by plumbers and carpenters (chart 30e). Different occupational requirements may influence this variation. Generally, employer-only programs are concentrated in a few occupations, whereas joint apprenticeship training programs cover a wider variety of occupations. For example, structural iron and steel as well as operating engineer registrations are almost exclusively in joint labor-management programs. Unionization may partially contribute to the differences in apprenticeships among construction occupations (*see* page 12).

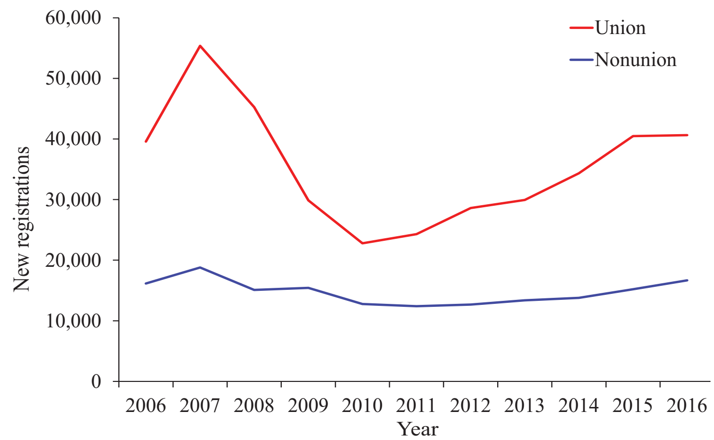
The earn-as-you-learn apprenticeship model helps workers to enter a career path and meet employers' needs for skilled labor. However, women's enrollment in registered construction apprenticeship programs has been consistently low.[5] In 2016, less than 3% (1,672) of the enrollments in construction apprenticeships were women; the proportion of women was even smaller (1.5%; 258) in non-union programs (chart 30f). Women are also less likely than men to complete apprenticeships. A national analysis found that 70% of women registrants in federal carpenter apprenticeship programs in a one-year period were canceled, compared to 53% of men registrants.[6] Studies have pointed to barriers unique to women such as difficulty finding childcare, instances of sexual harassment, discrimination, and other individual and institutional obstacles (e.g., work culture in a male-majority industry).[6,7] Enforcing federal regulations regarding equal employment, improving outreach and recruitment to women and other underrepresented groups regarding apprenticeship opportunities, and reducing barriers for women and other vulnerable worker groups to apprenticeship and employment, are all essential to combat such disparities in the construction industry.[6-9]

1. Wolf M. 2016. Apprenticeship: A path to good jobs in construction. U.S. Department of Labor Blog. https://blog.dol.gov/2016/08/23/apprenticeship-a-path-to-good-jobs-in-construction/ (Accessed October 2016).
2. U.S. Department of Labor, Employment and Training Administration. 2016. ApprenticeshipUSA: Data and statistics. https://www.doleta.gov/oa/data_statistics.cfm (Accessed January 2017).
3. This number only includes RAPIDS data (see the note section) and therefore does not capture the total number of active apprentices nationwide.
4. U.S. Department of Labor, Office of Apprenticeship. Apprenticeship. https://www.dol.gov/featured/apprenticeship (Accessed January 2017).
5. U.S. Department of Labor, Employment and Training Administration. 2016. ApprenticeshipUSA Fact Sheet: Women in apprenticeship. https://www.doleta.gov/oa/eeo/pdf/Women_Fact_Sheet.pdf (Accessed January 2017).
6. Helmer M, Altstadt D. 2013. Apprenticeship: Completion and cancellation in the building trades. https://www.ceacisp.org/news/apprenticeship-completion-and-cancellation-building-trades (Accessed January 2017).
7. U.S. Department of Labor, Employment and Training Administration. 2016. ApprenticeshipUSA Fact Sheet: Access to registered apprenticeship – a proven path to in-demand skills and the middle class. https://www.doleta.gov/oa/eeo/pdf/EEO_Rule_Overview_Fact_Sheet.pdf (Accessed January 2017).
8. Moir S, Thomson M, Kelleher C. 2011. Unfinished business: Building equality for women in the construction trades. Labor Resource Center Publications. http://scholarworks.umb.edu/lrc_pubs/5 (Accessed February 2017).
9. U.S. Department of Labor, Employment and Training Administration. 2016. Apprenticeship programs; equal employment opportunity (29 CFR parts 29 and 30). https://www.gpo.gov/fdsys/pkg/FR-2016-12-19/pdf/2016-29910.pdf#page=83 (Accessed January 2017).

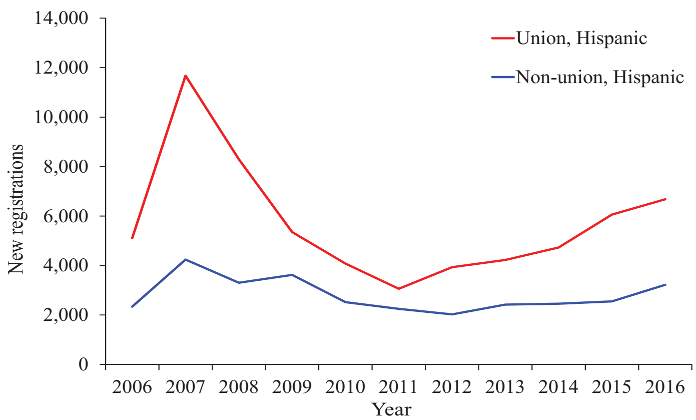
30a. Joint labor-management apprenticeship programs, by state, 2016 (Share of all active programs)



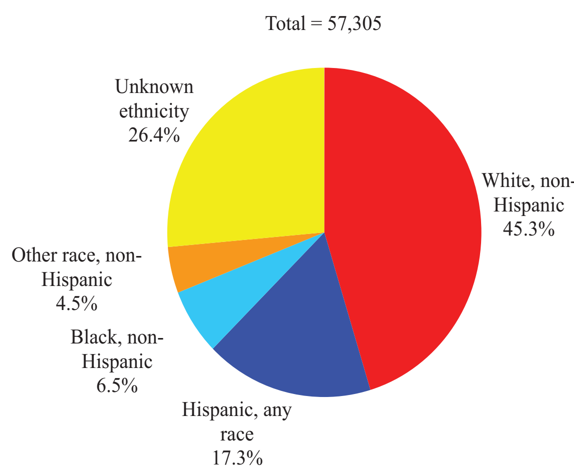
30b. New registrations in construction apprenticeship programs, union versus non-union programs, 2006-2016



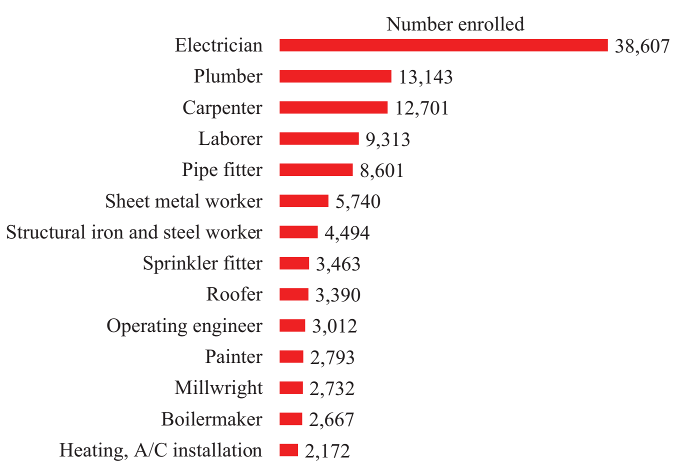
30c. Number of Hispanic construction workers among new apprenticeship registrations, union versus non-union programs, 2006-2016



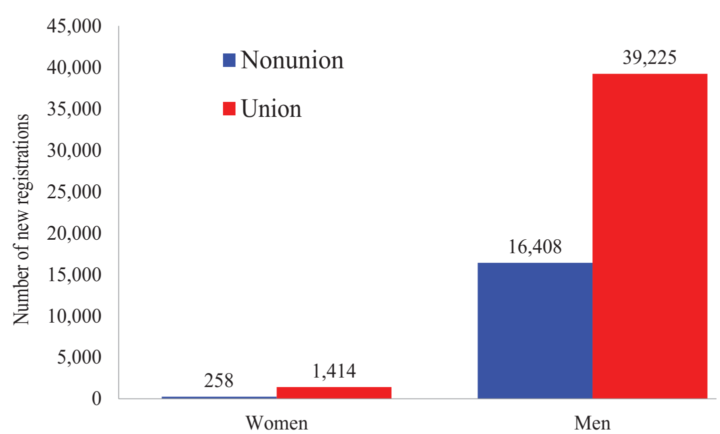
30d. Number of new registrations in construction apprenticeship programs, by race and ethnicity, 2016



30e. Number of active apprentices, selected construction occupations, 2016



30f. Number of new registrations in construction apprenticeship programs, by gender and union status, 2016



Note: U.S. Department of Labor's (DOL) Office of Apprenticeship uses a combination of individual records and aggregate state reports to calculate national totals as depicted on this page. The Registered Apprenticeship Partners Information Management Data System (RAPIDS) captures individual record data from 25 Office of Apprenticeship states and 9 of the 27 State Apprenticeship Agency (SAA) states/territories. For SAA states that manage their data outside of RAPIDS, information is provided in the aggregate to the DOL on a quarterly basis.

Source: All charts – U.S. Department of Labor, Employment and Training Administration. Contact: Alexander Jordan.

Employment Projections and Current Unfilled Jobs in Construction

Construction employment is expected to grow by 12.9%, with 790,400 wage-and-salary jobs likely to be added between 2014 and 2024, according to the employment projections generated biennially by the U.S. Bureau of Labor Statistics (BLS; chart 31a).[1] While employment is not expected to exceed pre-recession levels (*see* page 20),[1] the growth rate in construction is predicted to be one of the highest of all industries and twice the overall average growth (6.5%). In contrast, employment in manufacturing is expected to decline by 6.7%, a loss of 814,100 jobs over the ten-year period.[1]

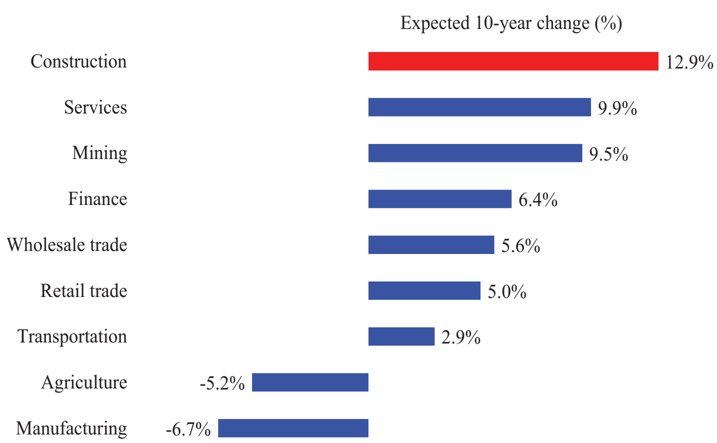
Within construction, employment growth is expected to vary by trade. For example, employment in brickmasons is projected to increase by 23.6%, adding almost 15,400 new jobs (chart 31b). In addition, the demand for electricians is estimated to create about 81,200 new jobs — a growth rate of 19.0%. Overall, about 519,600 new wage-and-salary jobs are estimated to be added to construction trades (Standard Occupational Classification [SOC] code 47-0000; *see* page 25).

Workers who retire or leave the industry will also generate employment demand. In particular, welders, sheet metal workers, laborers, and ironworkers are expected to have the largest worker replacement needs in the ten-year period (chart 31c). Other occupations are projected to be relatively stable; replacement demand is projected to be less than 10% for brickmasons (8.4%), foremen (7.9%), and drywall installers (6.1%).

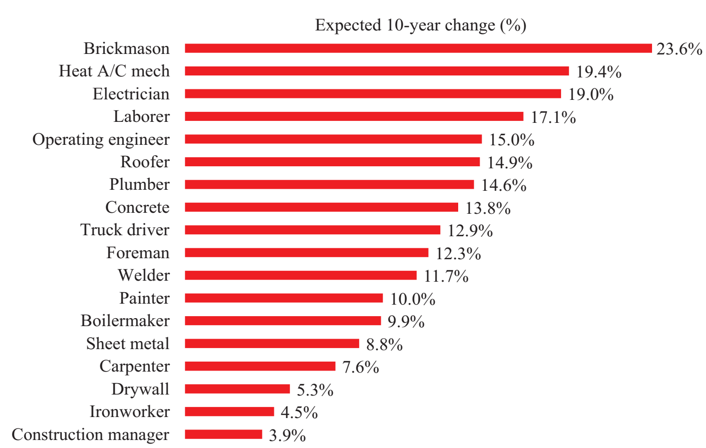
Replacement needs are estimated for each occupation by age cohort using the replacement rates in previous years.[2] After combining job growth and replacement needs, it is estimated that from 2014 to 2024, the highest demand in construction will be for laborers and electricians, with 378,600 and 181,900 job openings, respectively (chart 31d). Given the number of new entrants expected in the construction industry in the next decade, and the industry's elevated separation rate (including quits, layoffs, discharges, retirements, and disabilities), there will likely be a high demand for both occupational skills training as well as safety and health training.

The BLS also tracks current employment trends with the Job Openings and Labor Turnover Survey (JOLTS), which provides important information on the number of people at each company who were hired, how many left (separations), and the number of unfilled positions at the end of each month (openings). Based on JOLTS data for the period January 2006 to December 2016, between 55% and 81% (about 3.4 to 5.1 million) of wage-and-salary construction workers left their employer voluntarily or involuntarily each year, compared to between 36% and 45% for all nonfarm industries.[3] Construction workers typically work for multiple employers in a year, which may explain the high number of separations in this industry. The number of job openings was highest (273,000) in February 2007 during a time of strong construction employment, and lowest (25,000) in April 2009 during the recession. By July 2016, the number of job openings in construction was up to 225,000 as the economy recovered (chart 31e). The number of job openings is an important measure of the tightness of labor markets; a lower number of job openings during a recession may represent temporary or cyclical change, whereas a higher number of job openings can be expected during economic recovery.

31a. Percentage of projected employment change, by industry, 2014-2024

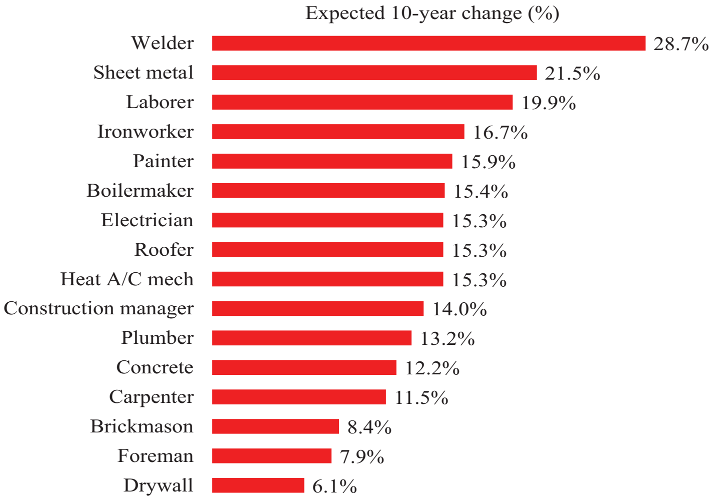


31b. Percentage of projected employment change, selected construction occupations, 2014-2024

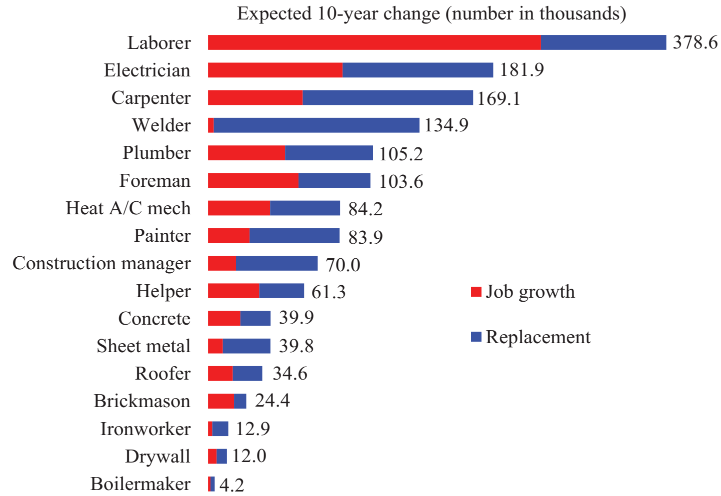


1. U.S. Bureau of Labor Statistics. 2015. Employment projections: 2014-24 summary. http://www.bls.gov/news.release/ecopro.nr0.htm (Accessed March 2016).
2. U.S. Bureau of Labor Statistics. 2015. Estimating occupational replacement needs. http://www.bls.gov/emp/ep_replacements.htm (Accessed March 2016).
3. U.S. Bureau of Labor Statistics. 2006-2016 Job Openings and Labor Turnover Survey (JOLTS). http://www.bls.gov/jlt/data.htm (Accessed March 2017)

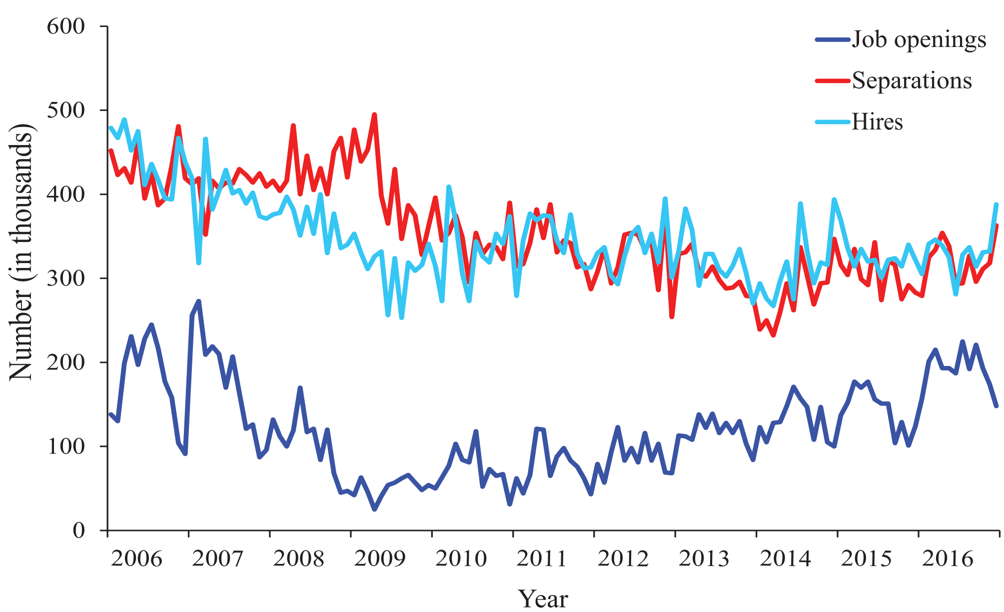
31c. **Percentage of projected replacement needs, selected construction occupations, 2014-2024**



31d. **Projected numbers of job growth and replacement needs, selected construction occupations, 2014-2024**



31e. **Job openings, separations, and hires in construction, 2006-2016 (Seasonally adjusted)**



Note: All charts – Cover wage-and-salary employment only.
Charts 31a-31d – Employment projections include all occupations, but exclude the self-employed.

Source: Chart 31a – U.S. Bureau of Labor Statistics. 2015. Employment projections: 2014-24 summary. http://www.bls.gov/news.release/ecopro.nr0.htm (Accessed March 2016).
Chart 31b – U.S. Bureau of Labor Statistics. 2014-2024 industry-occupation matrix data, construction. http://www.bls.gov/emp/ep_table_108.htm (Accessed March 2016).
Chart 31c – U.S. Bureau of Labor Statistics. 2014-2024 replacement needs. http://www.bls.gov/emp/ep_table_110.htm (Accessed March 2016).
Chart 31d – U.S. Bureau of Labor Statistics. 2014-2024 replacement needs, http://www.bls.gov/emp/ep_table_110.htm (Accessed March 2016) and 2014-2024 industry-occupation matrix data, construction, http://www.bls.gov/emp/ep_table_108.htm (Accessed March 2016). Calculations by the CPWR Data Center.
Chart 31e – U.S. Bureau of Labor Statistics. 2006-2016 Job Openings and Labor Turnover Survey (JOLTS). http://www.bls.gov/jlt/data.htm (Accessed March 2017).

O*NET Database and Occupational Exposures in Construction

The Occupational Information Network (O*NET) is a program sponsored by the U.S. Department of Labor's Employment and Training Administration. O*NET provides detailed standardized information for approximately 1,000 occupations based on the Standard Occupational Classification (SOC; *see* page 25).[1] The exposure data are selected from O*NET's Work Context –Work Conditions, which rates various work conditions and hazards measured by exposure frequency scores for each occupation. A score of zero means that workers are never exposed to a given hazard, whereas a score of 100 is assigned when exposure occurs on a daily basis or continually.[2]

According to the O*NET measures, many construction occupations require working at heights on a daily basis, which increases the risk of falls to a lower level (*see* pages 43-45). Elevator installers, roofers, ironworkers, and power-line installers are exposed to heights on the job almost every day (chart 32a). Painters, sheet metal workers, electricians, and ironworkers spend at least half of their work time climbing ladders, scaffolds, or poles (chart 32b). Ironworkers and insulation workers are routinely required to maintain their balance while working at heights (chart 32c). It is estimated that more than 76% of workers in construction production occupations work at heights at least once a month, and 37% climb ladders or scaffolds during at least half of their work time.[2]

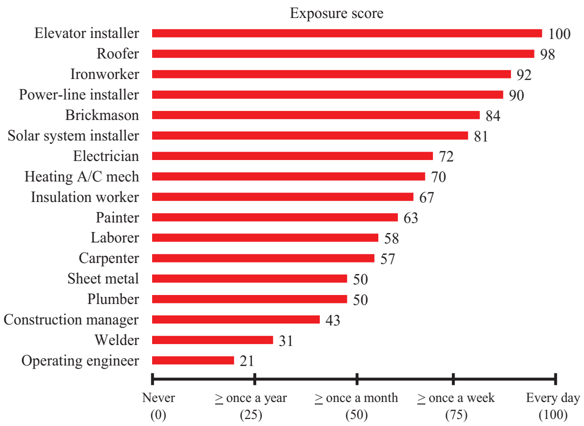
Construction jobs also involve other hazardous exposures (e.g., electricity), equipment (e.g., cranes), and tools (e.g., nail guns). Elevator installers are exposed to hazardous conditions almost daily, followed by power-line installers (chart 32d). Overall, 79% of workers in construction production occupations are likely to be exposed to hazardous equipment at least once a week (chart 32e).[2] These hazards increase the risk of electrocutions, being struck by an object, and other types of fatal and nonfatal injuries (*see* pages 43, 46, and 47). In addition, almost all construction jobs are exposed to distracting or uncomfortable levels of noise at least once a month (chart 32e),[2] which may cause noise-induced hearing loss (NIHL; *see* page 50), cardiovascular disease, and other health disorders.[3-5] Ironworkers, again, exceed all other construction occupations in terms of noise exposure.[2]

Although the O*NET provides an indication of risks for detailed occupations, estimates are based on generalized work contexts rather than specific occupational exposure assessments. For instance, while most welders report rarely or never being exposed to heights at work (chart 32a), a small percentage of welders report working at heights once a week or more.[1] Given the variability and potential interactions among occupational exposures in construction, information in Chart Book pages using O*NET data should be interpreted with caution, in particular for occupations encountered in multiple industries.

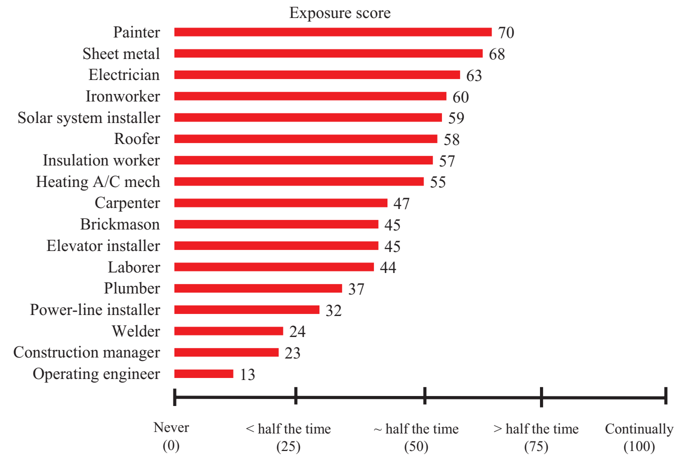
Exposure data from O*NET and other sources are combined and presented by major type of exposures in this Chart Book (*see* pages 32-36).

1. U.S. Department of Labor, Employment and Training Administration. O*NET OnLine, http://www.onetonline.org/ (Accessed April 2017). All data on this page are from O*NET unless otherwise specified. The O*NET data were initially collected from occupation analysts, and are updated annually by ongoing surveys of workers and occupation experts. More information is available at https://www.onetcenter.org/dataUpdates.html.
2. The O*NET respondents are asked about working conditions and exposures. For example, "How often does *your current job* require you to work outdoors, exposed to all weather conditions?" The question includes a five-level scale from (1) Never to (5) Every day. Exposure predictions were estimated by the CPWR Data Center using O*NET exposure scores with the data from the BLS 2014-2024 Employment Projections. https://www.bls.gov/emp/ep_table_109.htm (Accessed April 2017). For occupations grouped in the BLS data, but listed separately in the O*NET, work contexts were averaged.
3. Kerr MJ, Neitzel RL, Hong O, Sataloff RT. 2017. Historical review of efforts to reduce noise-induced hearing loss in the United States. American Journal of Industrial Medicine, 60(6): 569-577.
4. Centers for Disease Control and Prevention (CDC). 2016. Hearing impairment among noise-exposed workers – United States, 2003-2012. Morbidity and Mortality Weekly Report, 65(15): 389-394.
5. Recio A, Linares C, Banegas JR, Diaz J. 2016. Road traffic noise effects on cardiovascular, respiratory, and metabolic health: An integrative model of biological mechanisms. Environmental Research, 146: 359-370.

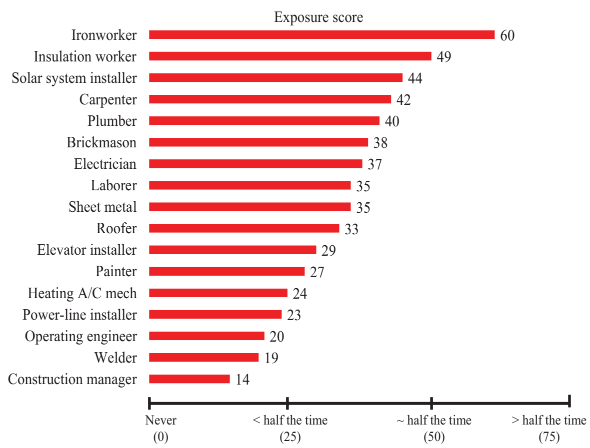
32a. Working at heights on the job, selected occupations



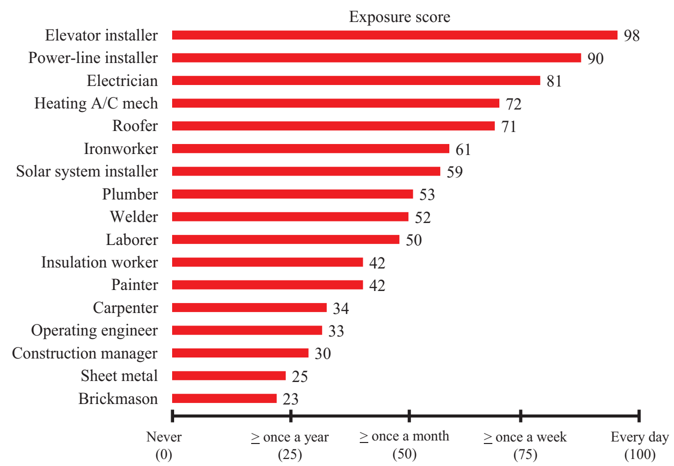
32b. Climbing ladders, scaffolds, or poles at work, selected occupations



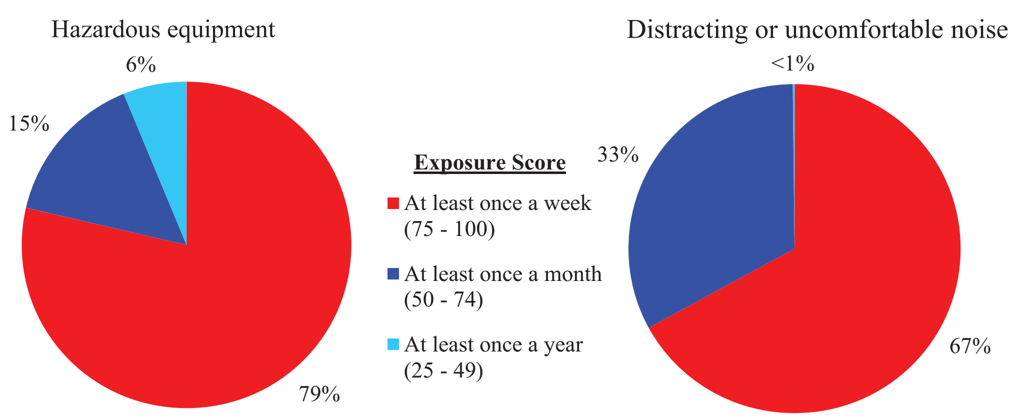
32c. Keeping/regaining balance at work, selected occupations



32d. Exposure to hazardous conditions at work, selected occupations



32e. Percentage of construction workers exposed to hazards, by exposure level (Production workers)



Note: Charts 32a, 32d, and 32e – Exposure scores: 0 = Never; 25 = Once a year or more but not every month; 50 = Once a month or more but not every week; 75 = Once a week or more but not every day; and 100 = Every day.
Charts 32b and 32c – Exposure scores: 0 = Never; 25 = Less than half the time; 50 = About half the time; 75 = More than half the time; and 100 = Continually or almost continually.

Source: Charts 32a-32e – O*NET OnLine. 2015. Work context: Physical work conditions, http://www.onetonline.org/find/descriptor/browse/Work_Context/4.C.2/ (Accessed April 2017). U.S. Bureau of Labor Statistics. 2014-2024 Employment projections. Table 1.9. 2014-2024 Industry-occupation matrix data, by industry, https://www.bls.gov/emp/ep_table_109.htm (Accessed April 2017). Calculations by the CPWR Data Center.

Exposure Risks for Work-Related Musculoskeletal Disorders and Other Illnesses in Construction

Work-related *musculoskeletal disorders* (WMSDs; *see* MSDs in Glossary) are very common in the construction industry (*see* pages 48 and 49). They are injuries of the muscles, tendons, joints, and nerve tissues that are caused or aggravated by work activities. Examples of WMSDs include joint sprains; muscle strains, such as back or neck strain; inflamed tendons (called "tendonitis"), such as tennis elbow or rotator cuff syndrome; and nerve compression, such as carpal tunnel syndrome and spinal cord compression from herniated discs of the neck or lower back. Awkward postures, repetitive motions, and forceful exertions contribute to adverse musculoskeletal outcomes. Work-related back disorders are often caused by repeated exposures to activities such as lifting and carrying materials, sudden jerky movements, whole body vibration (WBV), bending or twisting motions of the back, and working in a cramped space for long periods of time.[1-3]

According to O*NET exposure scores (*see* page 32), many construction occupations require bending or twisting of the body and repetitive motions in work performance. Brickmasons are more likely to use bending, twisting, and repetitive motions during most of their work than other occupations, followed by painters and drywall installers (chart 33a). Many construction jobs also involve kneeling, crouching, stooping, and crawling, which increase the risk of WMSDs as well. Concrete workers, heating and air conditioning mechanics, roofers, and painters have to work in such postures for at least 60% of their working time (chart 33b). Overall, about three-quarters (75%) of workers in construction production occupations need to kneel, crouch, stoop, or crawl for at least half of their work time.[4]

In addition, nearly 77% of workers in construction production occupations are required to work in confined spaces or awkward positions at least once a month.[4] Plumbers and elevator installers have to work in such spaces or positions more than once a week (chart 33c). Some construction jobs entail exposure to WBV; operating engineers are exposed the most often, with exposure occurring multiple times a week (chart 33d).

Most construction workers use their hands to handle, control, and feel objects, tools, and controls at work. About 90% of construction production jobs require manual handling activities for more than half of their work time (chart 33e). Brickmasons, painters, and cement workers typically spend more time physically handling work objects than other production occupations in construction.[4] Such exposure can cause hand injuries as well as increase the risk of skin conditions like dermatitis when hands are exposed to various types of chemicals or construction materials.[5,6]

Construction jobs often require regular outdoor work. Workers exposed to sunlight on the job have an increased risk of skin cancer.[7] In addition, nearly all production occupations in construction require working in very hot or very cold temperatures at least once a month, with about one-third (34%) exposed weekly (chart 33f). Ironworkers, operating engineers, and cement workers are exposed to extreme temperatures more frequently than other construction occupations.[4] High temperatures are a serious hazard for construction workers and can lead to decreased job performance and increased risk of injury, as well as a range of heat-related illnesses, including potentially fatal heat stroke.[8,9]

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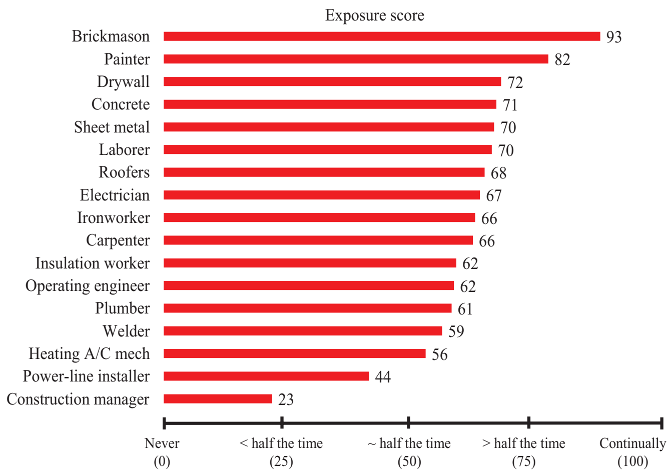
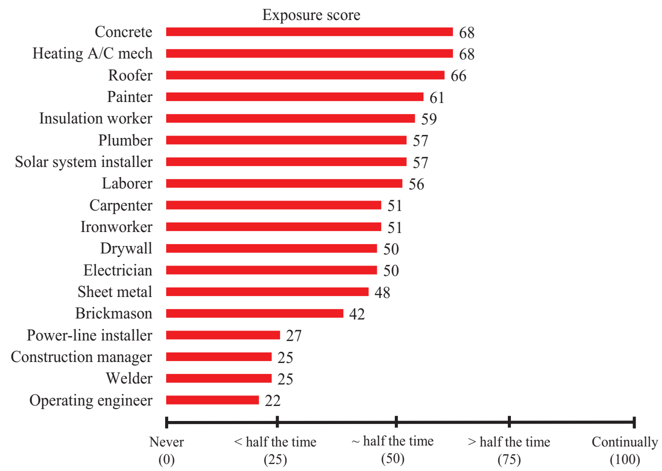
1. Dale AM, Ryan D, Welch L, Olsen MA, Buchholz B, Evanoff B. 2015. Comparison of musculoskeletal disorder health claims between construction floor layers and a general working population. Occupational and Environmental Medicine, 72(1): 15-20.
2. Wang X, Dong XS, Choi SD, Dement J. 2017. Work-related musculoskeletal disorders among construction workers in the United States from 1992 to 2014. Occupational and Environmental Medicine, 74(5): 374-380.
3. West GH, Dawson J, Teitelbaum C, Novello R, Hunting K, Welch LS. 2016. An analysis of permanent work disability among construction sheet metal workers. American Journal of Industrial Medicine, 59(3): 186-195.
4. U.S. Department of Labor, Employment and Training Administration. O*NET OnLine, http://www.onetonline.org/ (Accessed April 2017). All data on this page are from O*NET unless otherwise specified. Exposure percentages were estimated by the CPWR Data Center using O*NET exposure scores for detailed occupations combined with data from the U.S. Bureau of Labor Statistics. 2014-2024 Employment Projections (Table 1.9. 2010-2024 Industry-occupation matrix data, by industry), https://www.bls.gov/emp/ep_table_109.htm (Accessed April 2017). Some occupations were grouped together and average scores for their work contexts were cited.
5. Centers for Disease Control and Prevention. 2013. Workplace safety & health topics: Skin exposures & effects, http://www.cdc.gov/niosh/topics/skin/#contact (Accessed April 2017).
6. Coman G, Zinsmeister C, Norris P. 2015. Occupational contact dermatitis: Workers' compensation patch test results of Portland, Oregon, 2005-2014. Dermatitis, 26(6): 276-283.
7. Schmitt J et al. 2018. Occupational UV-exposure is a major risk factor for basal cell carcinoma: Results of the population-based case-control study FB-181. Journal of Occupational and Environmental Medicine, Jan;60(1):36-43.
8. Zink A, Wurstbauer D, Rotter M, Wildner M, Biedermann T. 2017. Do outdoor workers know their risk of NMSC? Perceptions, beliefs and preventive behaviour among farmers, roofers and gardeners. Journal of the European Academy of Dermatology and Venereology, 31(10): 1649-54.
9. Occupational Safety and Health Administration. Occupational heat exposure, http://www.osha.gov/SLTC/heatstress/index.html (Accessed April 2017).

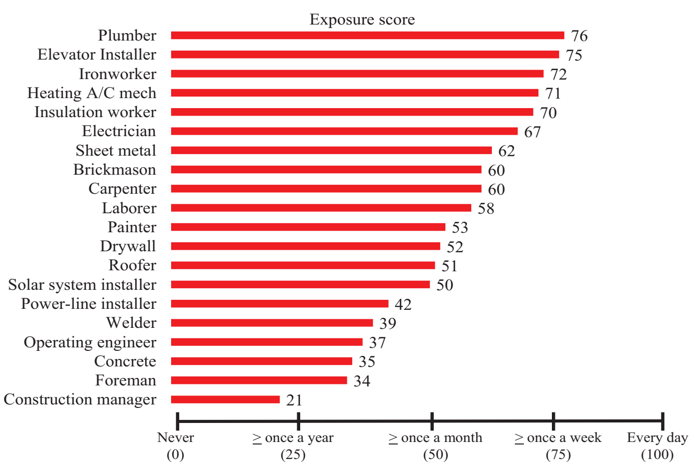
33a. Bending/twisting and repetitive motions at work, selected occupations



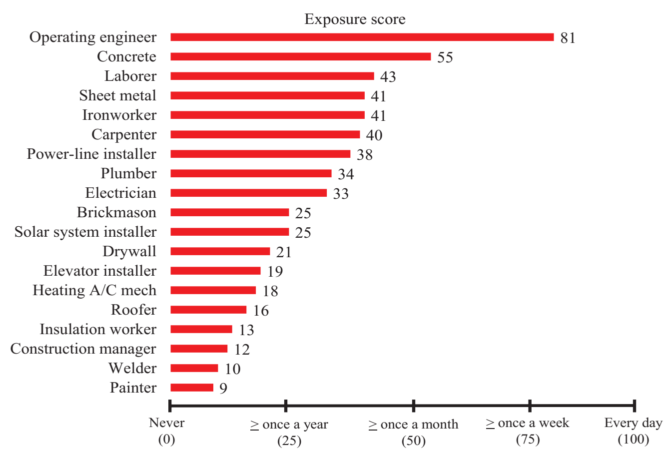
33b. Kneeling, crouching, stooping, or crawling at work, selected occupations



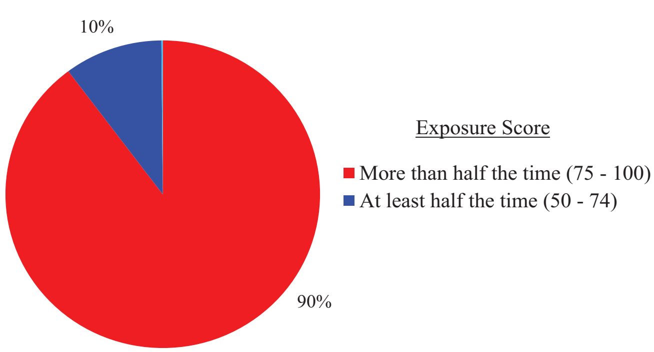
33c. Cramped work space/awkward positions at work, selected occupations



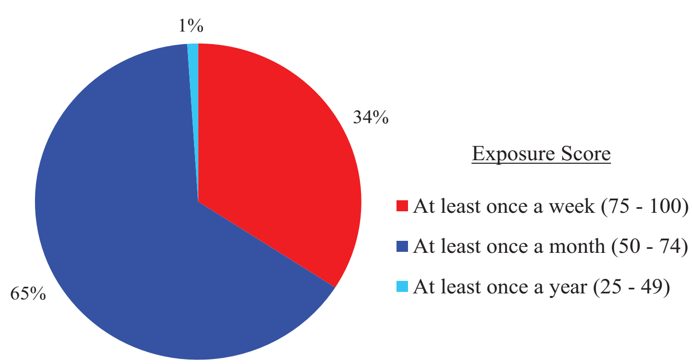
33d. Exposure to whole body vibration at work, selected occupations



33e. Percentage of construction workers using hands to handle, control, or feel objects, tools, or controls, by exposure level (Production workers)



33f. Percentage of construction workers exposed to very hot or or very cold temperatures, by exposure level (Production workers)



Note: Charts 33a and 33b – Exposure scores: 0 = Never; 25 = Less than half the time; 50 = About half the time; 75 = More than half the time; and 100 = Continually or almost continually
Charts 33c and 33d – Exposure scores: 0 = Never; 25 = Once a year or more but not every month; 50 = Once a month or more but not every week; 75 = Once a week or more but not every day; and 100 = Every day.
Charts 33a-33d – "Concrete" here refers to the occupation titled, "Cement masons and concrete finishers."

Source: Charts 33a-33f – O*NET OnLine. 2015. Work context: Physical work conditions, http://www.onetonline.org/find/descriptor/browse/Work_Context/4.C.2/ (Accessed April 2017).
U.S. Bureau of Labor Statistics, 2014-2024 Employment Projections (Table 1.9. 2014-2024 Industry-occupation matrix data, by industry), https://www.bls.gov/emp/ep_table_109.htm (Accessed April 2017). Calculations by the CPWR Data Center.

Exposure to Silica and Other Contaminants in Construction

Silica is a common mineral found in many materials on construction sites, including soil, sand, concrete, masonry, rock, granite, and landscaping materials.[1] Disturbing these materials can create crystalline silica dust.[1] Workers who breathe in this dust are at increased risk of developing silicosis and other nonmalignant respiratory diseases, lung cancer, and kidney disease.[2] To reduce silica exposure, the U.S. Occupational Safety and Health Administration (OSHA) adopted its first Permissible Exposure Limit (PEL) in 1971.[3] However, silica exposure remains a serious threat to U.S. workers, especially for construction workers who frequently perform tasks that can create silica dust. OSHA reported that of 2.3 million workers who are exposed to silica hazards in their workplaces, the majority – an estimated 2 million – work in construction.[4]

To better protect construction workers, OSHA has issued new regulations for silica exposure, which include lowering the PEL for silica to 50 $\mu g/m^3$ (micrograms per meter cubed), averaged over an 8-hour day.[2] According to OSHA's estimates, about 15% of construction workers are exposed to silica at or above 50 $\mu g/m^3$, 9% at or above 100 $\mu g/m^3$, and 4% at 250 $\mu g/m^3$ or more (chart 34a). Furthermore, at every level of silica exposure, the percentage of construction workers exposed is higher than the exposure for workers in all industries.

Silica exposure varies by construction subsector. In the Highway, Street, and Bridge Construction subsector (NAICS 23730), 59% of workers are exposed to silica at certain levels, higher than any other subsector in construction (chart 34b). More than a quarter (26%) of workers in the Foundation, Structure, and Building Exterior Contractors subsector (NAICS 23810) are exposed to silica levels above the PEL (50 $\mu g/m^3$), and as many as 10% are exposed at 250 $\mu g/m^3$ or more.

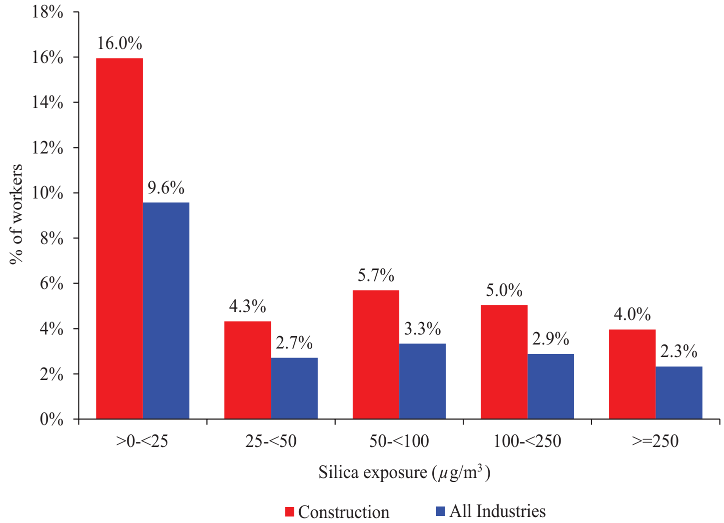
Construction workers are exposed to silica when performing numerous tasks, such as abrasive blasting, tuckpointing, block and brick cutting, and grinding, drilling, cutting and chipping concrete. Some tasks increase the risks of exposure to silica more than others. About 78% of tuckpointers and grinders are exposed to silica levels above the PEL while performing these activities, and nearly half are exposed to more than 250 $\mu g/m^3$ (46%; chart 34c). For workers performing abrasive blasting and demolition work, 69% are exposed at levels above the PEL and more than 30% are exposed above 250 $\mu g/m^3$.

In addition to silica exposure, construction workers also face other contaminants in the workplace. Based on the O*NET occupational exposure ratings (*see* page 32), more than half of construction *production occupations* (*see* Glossary and page 11 for occupation classifications) are exposed to contaminants such as pollutants, gases, dust, or odors at least once a week (score of 75 or greater; chart 34d).

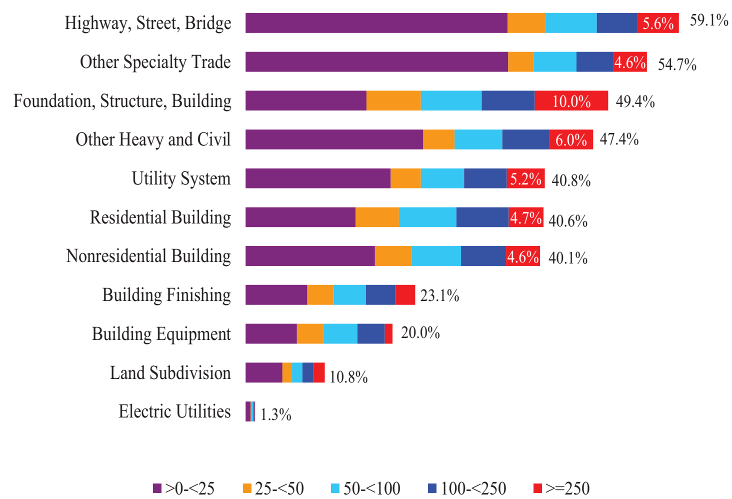
Exposure to silica dust and other contaminants can lead to serious, often fatal illnesses, which may be incurable, yet are preventable.[1] OSHA published specified and alternative silica exposure control methods for the construction industry.[4,5] CPWR's website Work Safely with Silica provides information on how to recognize silica hazards and take actions to reduce silica exposure. In addition, industrial hygiene interventions such as proper tool inspection and replacement,[1] local exhaust ventilation (LEV) systems,[4] and use of wet processes[6] have been demonstrated to be effective in reducing inhalational exposures.

1. CPWR – The Center for Construction Research and Training. Why is silica hazardous? https://www.silica-safe.org/know-the-hazard/why-is-silica-hazardous (Accessed January 2018).
2. Occupational Safety and Health Administration. 2017. OSHA's respirable crystalline silica standard for construction, https://www.osha.gov/Publications/OSHA3681.pdf (Accessed December 2017).
3. Occupational Safety and Health Administration. 2014. Chemical management and permissible exposure limits (PELs), https://www.osha.gov/laws-regs/federalregister/2014-10-10 (Accessed December 2017)
4. Occupational Safety and Health Administration. 2016. Occupational exposure to respirable crystalline silica, Final rule. Federal Register, 81(58), https://www.gpo.gov/fdsys/pkg/FR-2016-03-25/pdf/2016-04800.pdf (Accessed December 2017).
5. Occupational Safety and Health Administration. 2017. Interim enforcement guidance for the respirable crystalline silica in construction standard, 29 CFR 1926.1153, https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=31349 (Accessed January 2018).
6. Carty P, Cooper M, Barr A, Neitzel R, Balmes J, Rempel D. 2017. The effects of bit wear on respirable silica dust, noise, and productivity: A hammer drill bench study. Annals of Work Exposure and Health, 61(6): 700-710.

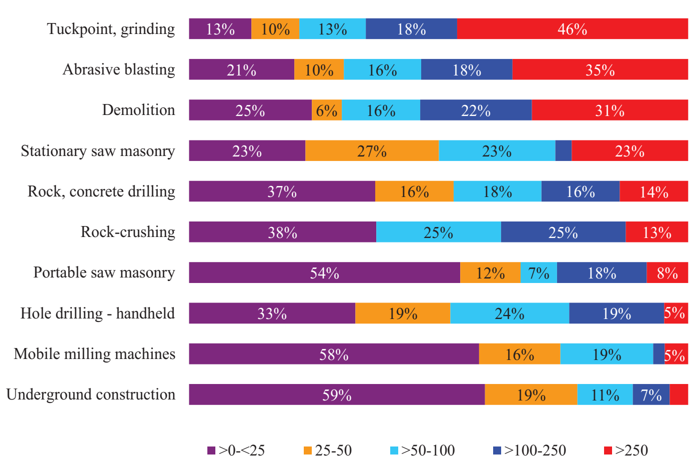
34a. **Percentage of workers exposed to silica, by exposure level, construction versus all industries (Micrograms per meters cubed)**



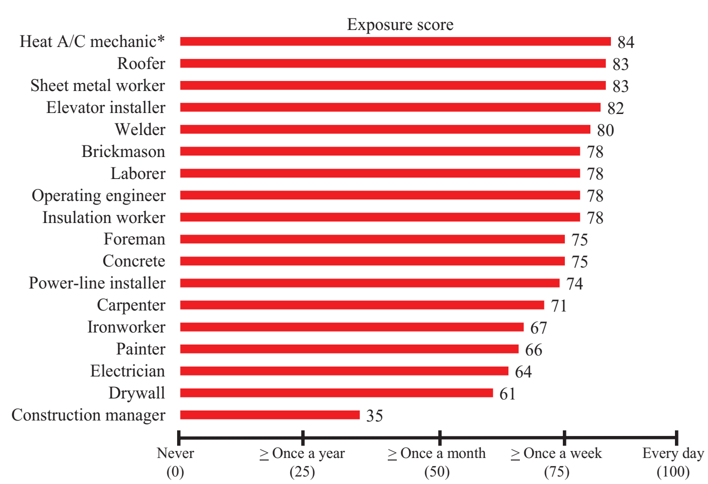
34b. **Percentage of construction workers exposed to silica, by exposure level and construction subsector (Micrograms per meters cubed)**



34c. **Distribution of silica exposures among exposed construction workers, by level and activity (Micrograms per meters cubed)**



34d. **Exposure to contaminants (such as pollutants, gases, dust, or odors) at work, selected occupations**



Note: Charts 34a-34c – The units on these charts are micrograms per meters cubed (μg/m³) of air.
Chart 34d – Exposure scores: 0 = Never; 25 = Once a year or more but not every month; 50 = Once a month or more but not every week; 75 = Once a week or more but not every day; and 100 = Every day.
Asterisk (*) refers to the Heating and Air Conditioning Mechanic occupation.

Source: Charts 34a and 34b – Occupational Safety and Health Administration. 2016. Occupational exposure to respirable crystalline silica, Final rule. Table VII-5: Numbers of worker exposed to silica (by affected industry and exposure level (μg/m³). Federal Register, 81(58): 16427-16432. Calculations by the CPWR Data Center.
Chart 34c – Occupational Safety and Health Administration. 2016. Occupational exposure to respirable crystalline silica, Final rule. Table VII-4: Distribution of silica exposures by application group and job category or activity - Final profile. Federal Register, 81(58): 16420. Calculations by the CPWR Data Center.
Chart 34d – O*NET OnLine. 2015. Work context - Physical work conditions, http://www.onetonline.org/find/descriptor/browse/Work_Context/4.C.2/ (Accessed May 2017).

Engineered nanomaterials in the U.S. construction industry

Nanomaterials are approximately 1 to 100 nanometers, which is incredibly small (1 nanometer is about 100,000 times thinner than a sheet of paper). At this size, materials can exhibit unique properties, which have enabled recent advances in construction materials.[1] Nanomaterials can be naturally occurring, incidental, or engineered. Incidental nanomaterials are unintended by-products of human activities, including work tasks like welding or sandblasting that create ultrafine particles. Engineered nanomaterials (ENM), on the other hand, are created intentionally by humans for some purpose.

Human health effects caused by ENM exposure are currently unknown. Nevertheless, characteristics of ENMs and their similarities to tiny particles found in air pollution suggest that ENMs are likely to pose health risks to humans.[2] There are many different ENMs, and their toxicity varies. Some ENMs have been shown to cause health problems in laboratory animals, including certain types of carbon nanotubes with characteristics similar to those of asbestos fibers. Citing these types of studies, the National Institute for Occupational Safety and Health (NIOSH) established recommended exposure limits for carbon nanotubes/nanofibers and nano-sized titanium dioxide particles, classifying the latter as a potential occupational carcinogen.[3,4]

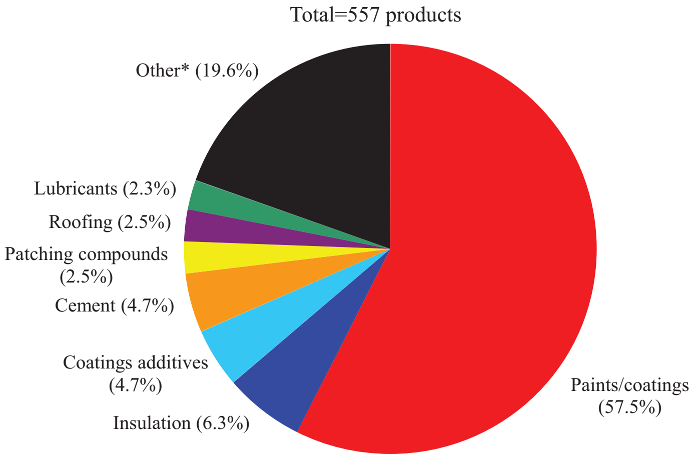
In recent years, nanotechnology has improved traditional building materials, resulting in nano-enhanced or nano-enabled products (NEPs). For example, carbon nanotubes have been added to concrete for increased strength. Out of 557 NEPs identified by CPWR researchers, most (57.5%) were paints and coatings, followed by a variety of construction materials (chart 35a). This information about the use of ENMs in construction has helped researchers to measure exposures to ENMs during routine construction activities (e.g., coatings application, wood sanding, and roofing work).[5,6]

In most cases, however, construction product manufacturers in the United States are not required by law to inform workers and consumers about the presence of ENMs in final products, making it difficult to identify construction materials with added ENMs. Out of 577 nanomaterials reported in CPWR's Electronic Library of Construction Occupational Safety and Health (eLCOSH) nano inventory, 238 (41.3%) were of undetermined chemical composition (chart 35bb). Moreover, construction workers, like the general public, may have limited awareness of nanotechnology. Out of 96 construction health and safety trainers surveyed by CPWR from 2014 to 2017, fewer than half (47.9%) were aware that nanotechnology has been applied to construction materials (chart 35c). A smaller percentage of those surveyed (<13%) knew of NEPs being used on actual jobsites or had addressed nanotechnology while training workers. Insulation and cement were mentioned most frequently with regard to actual use of NEPs on construction sites. Training materials for construction workers handling NEPs are available, including hazard alert cards (www.cpwr.com/publications/hazard-alert-cards) and toolbox talks (http://www.cpwr.com/publications/toolbox-talks). These resources emphasize that ventilation and respirators can reduce exposure to ENMs during routine construction activities.

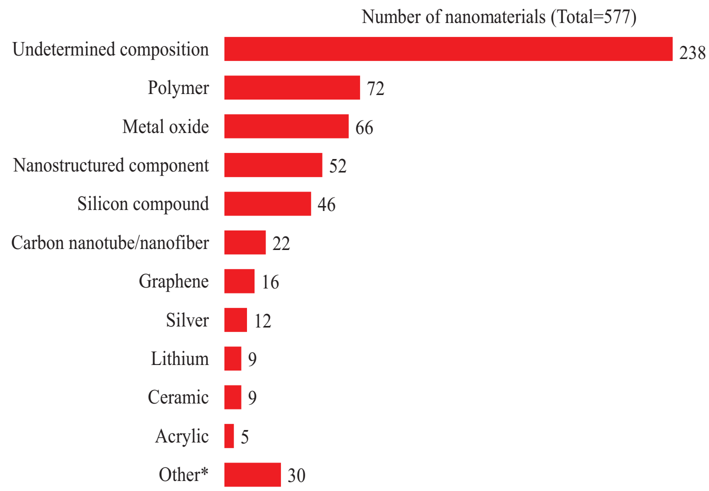
A primary goal of the U.S. federal government's National Nanotechnology Initiative (NNI; http://www.nano.gov) is responsible development of nanotechnology, including protection of workers throughout the life cycle of nanotechnology-derived products. Most NNI research on environment, health, and safety falls within its own investment category, accounting for approximately 5.5% of the $1.2 billion of proposed NNI funding for 2018 (chart 35d). NIOSH participates in the NNI as one of the leading federal agencies for occupational safety and health. The NIOSH Nanotechnology Research Center, established in 2004, has already made significant progress in achieving its strategic goals, including the creation of risk management guidance for the nanomaterial workforce.[7]

1. The National Institute for Occupational Safety and Health. Nanotechnology, https://www.cdc.gov/niosh/topics/nanotech/default.html (Accessed September 2017).
2. Oberdörster G, Oberdörster E, Oberdörster J. 2005. Nanotoxicology: An emerging discipline evolving from studies of ultrafine particles. Environmental Health Perspectives, 113(7):823-839.
3. NIOSH. 2011. Current Intelligence Bulletin 63: Occupational Exposure to Titanium Dioxide. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health; DHHS (NIOSH) Publication No. 2011–160
4. NIOSH. 2013. Current Intelligence Bulletin 65: Occupational Exposure to Carbon Nanotubes and Nanofibers. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health; DHHS (NIOSH) Publication No. 2013-145.
5. West GH, Lippy BE, Cooper MR et al. 2016. Toward responsible development and effective risk management of nano-enabled products in the U.S. construction industry. Journal of Nanoparticle Research, 18(2):49.
6. Cooper MR, West GH, Burrelli LG et al. 2017. Inhalation exposure during spray application and subsequent sanding of a wood sealant containing zinc oxide nanoparticles. Journal of Occupational and Environmental Hygiene, 14(7):510-522.
7. The National Institute for Occupational Safety and Health. Nanotechnology Research Center, https://www.cdc.gov/niosh/topics/nanotech/nanotechnology-research-center.html (Accessed December 2017).

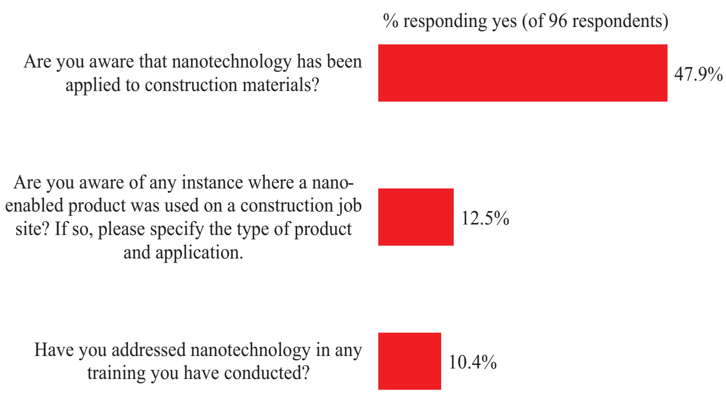
35a. Distribution of products in CPWR's eLCOSH nano inventory



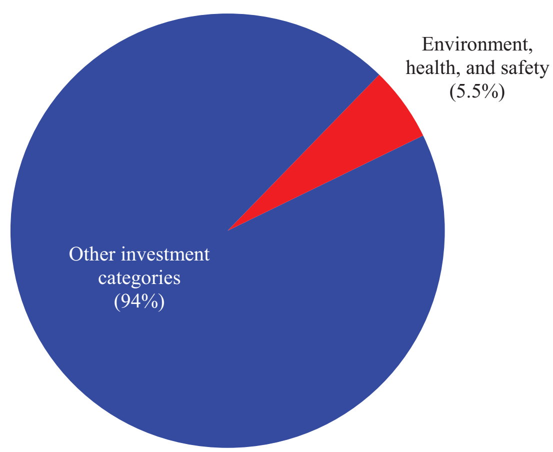
35b. Number and type of nanomaterials reported in CPWR's eLCOSH nano inventory



35c. Awareness of nanotechnology among union construction health and safety trainers (2014 to 2017)



35d. Distribution of proposed National Nanotechnology Initiative (NNI) funding by program component area, 2018



Note: Chart 35a – Data are based on 557 products in the inventory as of July 7, 2017. *Other includes surface preparation, thermal spray coating materials, adhesives, additives for concrete/cement, flooring, glass and solar panels, metal, weld overlays, drywall, miscellaneous, HV/AC, prepregs, weatherproofing membranes, additives for asphalt, caulking, joint sealants, lighting, lumber, boiler additives, fasteners, fuel additives, and interior design..

Chart 35b – Data are based on 577 nanomaterials reported for 557 products in the inventory as of July 7, 2017. *Other includes surface preparation, thermal spray coating materials, adhesives, additives for concrete/cement, flooring, glass and solar panels, metal, weld overlays, drywall, miscellaneous, HV/AC, prepregs, weatherproofing membranes, additives for asphalt, caulking, joint sealants, lighting, lumber, boiler additives, fasteners, fuel additives, and interior design.

Source: Charts 35a and 35b – eLCOSH Nano. 2017. Construction nanomaterial inventory, www.nano.elcosh.org (Accessed July 2017).
Chart 35c – CPWR - The Center for Construction Research and Training. 2017. Unpublished data. Contact: Gavin West.
Chart 35d – NSTC/COT/NSET. 2017. The National Nanotechnology Initiative supplement to the president's 2018 budget. Washington, D.C. https://www.nano.gov/node/1573 (Accessed December 2017).

Lead Exposure in the Construction Industry

Lead is found in many construction materials, including but not limited to paint, welding wire, and electrical conduit.[1,2] Construction workers can be exposed to lead during the handling and demolition of lead-containing products, as well as during tasks that generate fumes and respirable dusts, such as welding, smelting, refining, and soldering.[1,2] In addition, construction workers may expose their children and other family members to lead via take-home exposure (such as lead dust on clothing, skin, hair, and tools).[3] Lead exposure can result in adverse health effects, such as anemia, hypertension, central nervous system effects, peripheral neuropathy, nephropathy, infertility, and miscarriages.[1-5] Lead exposure can be measured by micrograms of lead per deciliter of blood (μg/dL) through a blood test.

Over the past 30 years, the National Institute for Occupational Safety and Health (NIOSH)'s Adult Blood Lead Epidemiology and Surveillance (ABLES) program has worked with states to study lead exposure of adults (≥16 years old) in the U.S. ABLES contributes to the Healthy People 2020 goal of reducing the rate of *blood lead levels* (BLLs; *see* Glossary) ≥10 μg/dL among adults.[4] When the source can be identified, about 95% of those with BLLs ≥25 μg/dL were exposed at work.[4] In 2016, ABLES identified 6,160 cases of BLLs ≥10 μg/dL in 18 states submitting industry data to the program. Of the reported 6,160 cases, the construction industry alone accounted for 20% of the total (chart 36a),[6] which is disproportionately high given that construction employment accounts for just 6.4% of the overall workforce.[7] Even so, the number of construction-related cases is likely underreported due to several factors:

- Workers employed in lead abatement are classified under remediation services (North American Industry Classification System [NAICS] 562910) instead of construction (NAICS 23), resulting in 79 uncounted cases in 2016.[6]
- Employers working in construction may not comply with the Occupational Safety and Health Administration (OSHA)-mandated employee BLL testing and not all construction workers exposed to lead are tested.
- Laboratories may not report all tests to state health departments.
- BLL reports may not have employer or industry information.

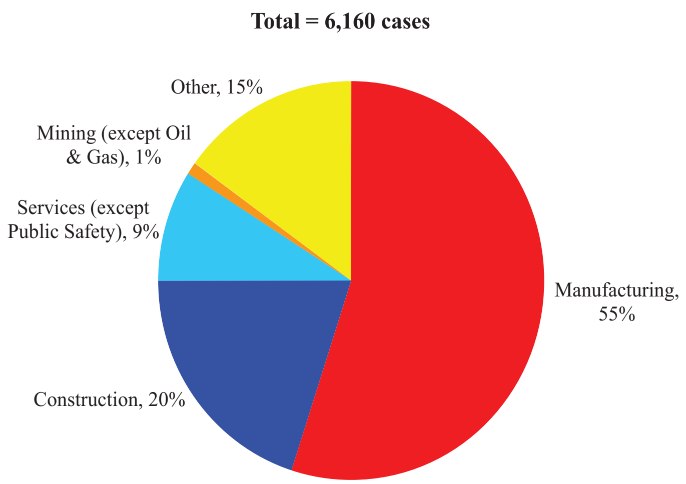
Based on available ABLES data from 2011 to 2016, the prevalence rate of workers with BLLs ≥10 μg/dL in the construction industry has been declining, with a slight increase in 2016 (chart 36b). Highway, Street, and Bridge (NAICS 2373) and Building Finishing (NAICS 2383) were the two construction subsectors with the largest number of reported cases with BLLs ≥10 μg/dL (chart 36c).

Prevalence rates of BLLs ≥10 μg/dL among construction workers vary by state. Among the 12 states that reported five or more occupational cases in the construction industry in 2016, New York, Vermont, Louisiana, Maryland, and Connecticut reported rates above the national prevalence rate (chart 36d).

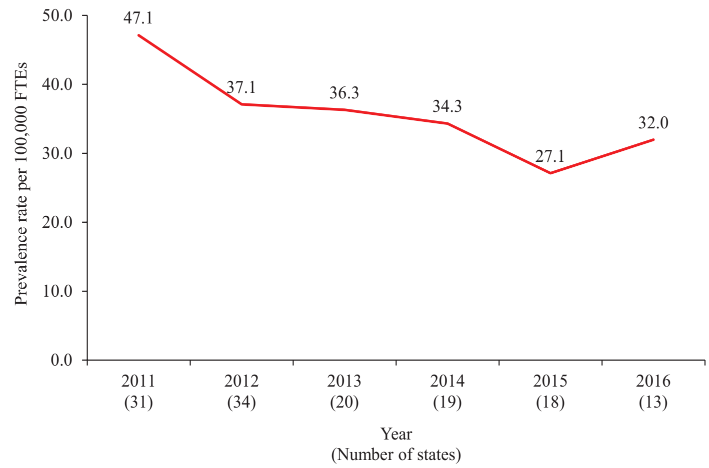
Regulations on lead have gradually been tightened over time. Lead was banned from commercial paint in 1978 and phased out of gasoline in the 1980s.[1] Additionally, workers who disturb lead-based paint in facilities built before 1978 are required to be trained and certified.[8] Responding to increasing evidence of adverse health outcomes at low BLLs, the NIOSH ABLES program, the Centers for Disease Control and Prevention, and the Council of State and Territorial Epidemiologists lowered the case definition for elevated BLLs to BLLs ≥5 μg/dL in 2015.[4,9,10] However, the OSHA requirement to institute protections for workers exposed to lead in the construction industry has not been updated since 1993.[11] Given that a substantial number of construction workers continue to have BLLs ≥10 μg/dL, enhanced efforts are needed to further protect these workers. Currently, three OSHA state plan states (California, Michigan, and Washington), where OSHA is administered by the states and not the federal government, have begun rule-making procedures to reduce the allowable exposure levels of lead for construction and other workers.

1. Polh H, Ingber S, Abadin H. 2017. Historical view on lead: Guidelines and regulations. Metal Ions in Life Sciences, 17: 435-470.
2. Michigan Occupational Safety and Health Administration. 2015. MIOSHA Fact Sheet, Lead exposure in construction, http://www.michigan.gov/documents/lara/lara_miosha_constfact_lead_exposure_in_construction_413873_7.pdf (Accessed December 2017).
3. Bennet K, et al. 2015. Lead poisoning: What's new about an old problem? Contemporary Pediatrics, http://contemporarypediatrics.modernmedicine.com/contemporary-pediatrics/news/lead-poisoning-what-s-new-about-old-problem-1? (Accessed December 2017).
4. National Institute for Occupational Safety and Health. Adult Blood Lead Epidemiology and Surveillance (ABLES), https://www.cdc.gov/niosh/topics/ables/description.html (Accessed December 2017).
5. Agency for Toxic Substances and Disease Registry. 2017. Lead toxicity: What are possible health effects from lead exposure? https://www.atsdr.cdc.gov/csem/csem.asp?csem=34&po=10 (Accessed December 2017).
6. U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. National Institute for Occupational Safety and Health. Adult Blood Lead Epidemiology & Surveillance program [unpublished]. Contact: Rebecca Tsai, NIOSH ABLES program officer (rtsai@cdc.gov)
7. The percentage of construction employment was estimated using data from the 2016 American Community Survey.
8. U.S. Environmental Protection Agency. 2010. Lead; Amendment to the opt-out and recordkeeping provisions in the renovation, repair, and painting program. Federal Register, 75(87): 24,802-24,819 [40 CFR Part 745].
9. Council of State and Territorial Epidemiologists. 2015. Public health reporting and national notification for elevated blood lead levels, http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/2015PS/2015PSFinal/15-EH-01.pdf (Accessed December 2017).
10. Centers for Disease Control and Prevention. 2016. National Notifiable Diseases Surveillance System (NNDSS). Lead, elevated blood levels, 2016 case definition, http://wwwn.cdc.gov/nndss/conditions/lead-elevated-blood-levels/case-definition/2016/ (Accessed December 2017).
11. U.S. Department of Labor. Occupational Safety and Health Administration. 1993. Lead, Safety and health regulations for construction [29 CFR 1926.62], https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10641 (Accessed December 2017).

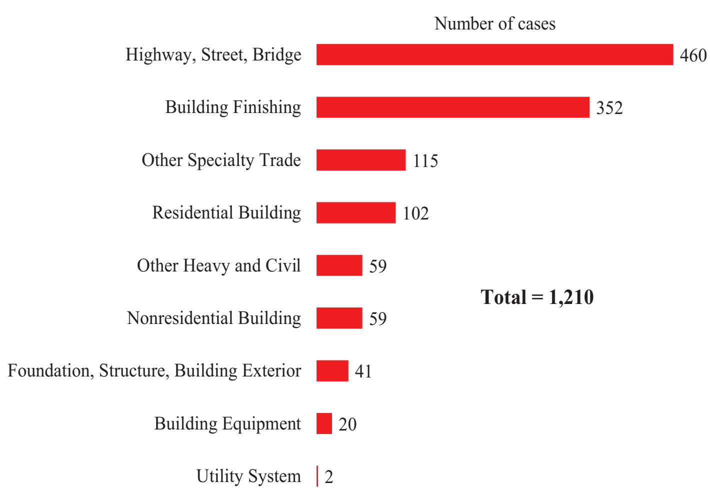
36a. **Distribution of workers with BLLs ≥10 µg/dL, by industry, 2016 (18 states)**



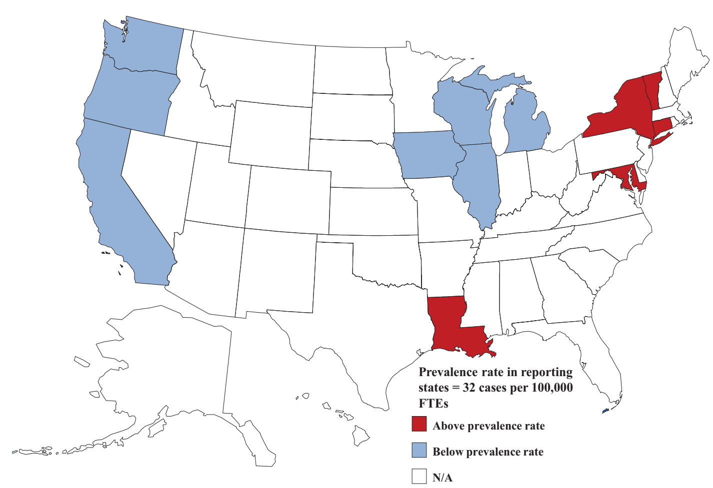
36b. **Prevalence rate of workers with BLLs ≥10 µg/dL in construction, 2011-2016**



36c. **Number of workers with BLLs ≥10 µg/dL, by construction subsector, 2016 (13 states)**



36d. **Prevalence rate of construction workers with BLLs ≥10 µg/dL, by state, 2016 (12 states)**



Note: All charts – For workers with more than one blood lead test in a given year, only the highest BLL for that year was included. Disclaimer: The findings and conclusions on this page are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.

Chart 36a – Other includes cases without industry information. Industries are based on NIOSH's NORA sectors. See information on the NORA sectors at https://www.cdc.gov/niosh/nora/sectorapproach.html (Accessed January 2018).

Chart 36b – When a worker had BLLs ≥10 µg/dL reported in multiple years, this worker was counted as a case each year. Rate = (number of construction workers with BLLs ≥10 µg/dL / number of full-time workers employed in the construction industry) * 100,000.

Chart 36d – Twelve states reporting five or more occupational cases with BLLs ≥10 µg/dL in construction were included in the rate calculations. N/A represents states not participating in the ABLES program, states with fewer than five occupational cases in construction, or states not submitting industry data to NIOSH.

Source: All charts – U.S. NIOSH ABLES program. Denominator data for rates (2011–2016) were from the American Community Survey and consisted of all workers employed in the construction industry (NAICS 23) and not just construction workers exposed to lead. Contact: Rebecca Tsai, NIOSH ABLES program project officer (rtsai@cdc.gov).

Fatal and Nonfatal Construction Injuries in Selected Industrial Countries

In 2013, construction fatal injury rates reported by selected industrial countries ranged from 1.0 to 24.6 deaths per 100,000 workers (chart 37a). The reported construction fatality rate in the United States was relatively high among these countries, at 9.7 deaths per 100,000 *full-time equivalent workers* (FTEs, *see* Glossary). This rate was lower than the rates for Switzerland and Belgium, but more than triple the rate for Finland and Australia, and more than five times the rate for the United Kingdom and Sweden.

In contrast, the nonfatal injury rate in the U.S. construction industry was relatively low compared to most selected countries, at 1.5 injuries per 100 FTEs in 2013 (chart 37b), which suggests nonfatal injuries may be underreported (*see* pages 38, 40, and 41). Compared to the U.S., France, Spain, Finland, and Germany had lower fatality rates but higher nonfatal injury rates.

Most of the data reported here are from the International Labour Organization (ILO),[1] which compiles statistics on fatal and nonfatal occupational injuries provided by represented countries. Due to the wide variability in data collection and reporting, comparisons across countries must be made with caution.

Except for the United States, most countries use insurance and administrative records as data sources (chart 37c). The U.S. collects data through the Census of Fatal Occupational Injuries and the Survey of Occupational Injuries and Illnesses (*see* page 38). Countries that base their data on insurance records include only insured employees in their calculations; some include all reported cases, while others include only events that result in compensation.

Inclusion of self-employed workers differs by country as well. Germany covers both wage-and-salary workers and self-employed workers, whereas in Canada, self-employed workers are included if they opt for coverage, and in the United Kingdom, certain self-employed workers are subject to exemption. Other countries such as Australia exclude self-employed workers.[1,2] In the United States, self-employed workers are included in the fatality data, but excluded in the nonfatal injury data.

Another variable among injury rates is how the selected countries classify injuries from commuting accidents. Some of the selected countries, such as the U.S. and Australia, do not count workers' injuries from road traffic accidents as work-related if they occurred during commuting. However, such injuries can be counted as work-related in Canada if a review board determines it is work-related, while in the United Kingdom, they must meet certain reportable criteria.[2]

Fatalities in some countries, such as Australia, Canada, Germany, Switzerland, and the United Kingdom, include deaths from occupational diseases (chart 37c), while the United States and other countries on the list only include deaths due to occupational injuries.

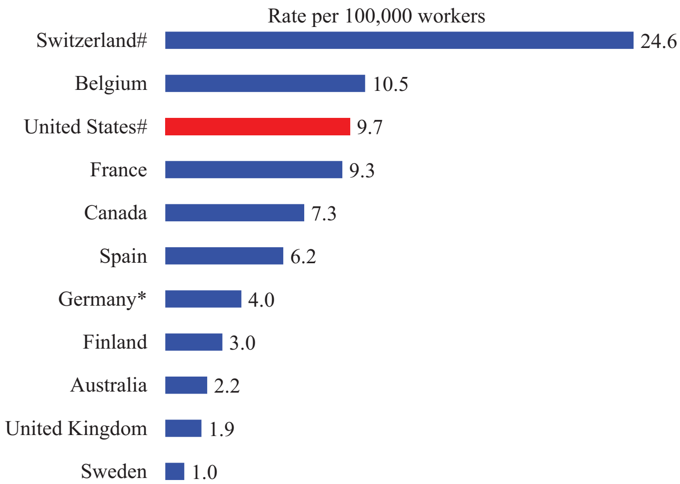
Countries also have different time periods for qualifying deaths and injuries as work-related. Australia, Belgium, Finland, France, and the United Kingdom count fatalities that occurred in the same calendar year as the accident (chart 37c). By contrast, Switzerland counts deaths that occur within the same fiscal year. Germany and Sweden count deaths that occur within one year of the accident, and Spain uses five days as the cutoff point. Similarly, some countries include only injuries with a minimum period of incapacitation. For instance, in Australia, an injury is counted if a worker has been incapacitated for at least five workdays, whereas in Switzerland there is no minimum period of absence.

Some countries are more likely to have full-time employment with one employer (such as in Northern Europe), but in others, construction workers do not work full-time. Therefore, using FTEs allows construction sector data to be more comparable. However, only a few countries adjust injury rates using FTEs. In addition, countries such as Belgium, Finland, Sweden, and Switzerland have a relatively small construction workforce. Thus, injury rates in those countries may be more variable.

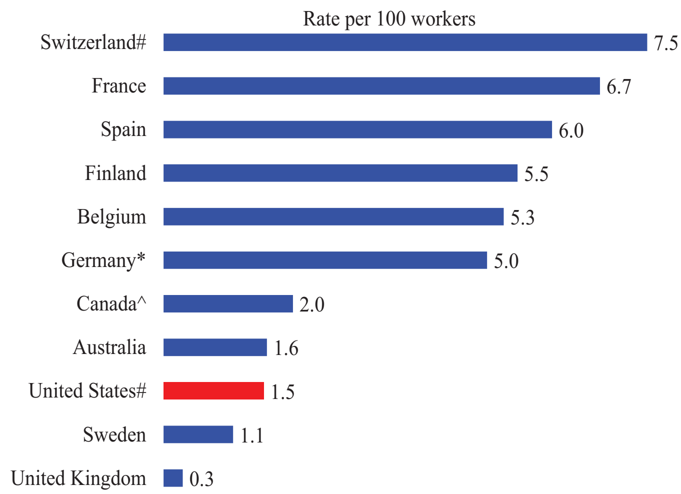
Changes in data classifications are yet another source of variability. The ILO asks the reporting agencies in each country to align their data with the International Standard Industrial Classification (ISIC) of all Economic Activities. Yet, the ISIC system has changed over time and not all countries adopted the latest version in the same year. For example, while most countries presented on this page reported data using the fourth revision of the ISIC, Australia reported data using the third revision of the ISIC. The classification systems may be similar enough to allow general comparisons at a broad level, but the comparisons may be limited within construction subsectors across countries and time periods.

1. International Labour Organization. ILOSTAT - ILO database of labour statistics. http://www.ilo.org/global/statistics-and-databases/lang--en/index.htm (Accessed December 2017).
2. U.S. Bureau of Labor Statistics. 2017. Counting injuries and illnesses in the workplace: An international review. Monthly Labor Review, https://www.bls.gov/opub/mlr/2017/article/counting-injuries-and-illnesses-in-the-workplace.htm (Accessed December 2017).

37a. **Rate of fatalities in construction, selected countries, 2013**



37b. **Rate of nonfatal injuries in construction, selected countries, 2013**



37c. **Factors and criteria of construction fatalities and nonfatal injuries, selected countries, 2013**

Country	Number of Deaths	Period after Incident for Qualifying Death as Work-Related	Includes Deaths from Work-Related Illnesses?	Number of Injuries	Period of Incapacity for Qualifying Injury as Work-Related	Injuries Covered	Source/Record Type	Total Employment (in Thousands)
Australia	21	Within same year	Yes	10,885	5+ workdays	Compensated	Administrative	1,008
Belgium	22	Within same year	No	11,052	1+ workdays	Reported	Insurance	330
Canada ^	221	No specified period	Yes	27,432	1+ workdays	Compensated	Administrative	1,370
Finland	4	Within same year	No	7,327	2+ workdays	Compensated	Insurance	176
France	131	Within same year	No	94,770	1+ workdays	Compensated	Insurance	1,782
Germany	87	Within 1 year	Yes	108,124	2+ workdays	Reported	Insurance	2,685
Spain	43	Within 5 days	No	41,861	1+ workdays	Reported	Insurance	1,029
Sweden	4	Within 1 year	No	3,429	1+ workdays	Reported	Administrative	317
Switzerland#	76	Within same fiscal year	Yes	23,082	No minimum period of absence	Reported	Administrative	297
United Kingdom	39	Within same year	Yes	6,109	3+ workdays	Reported	Insurance	2,157
United States#	828	No specified period	No	82,040	1+ workdays	Reported	Census/Survey	9,271

Note: All charts – An asterisk "*" (Germany) denotes data calculated by the CPWR Data Center. Countries marked with a pound sign "#" (Switzerland and the United States) use FTEs to adjust rates. Data for the U.S. on this page are coded by ISIC for comparison purposes and exclude government employees. Thus, the numbers for the U.S. may not be comparable with the data coded by NAICS reported on other pages of this Chart Book. A caret "^" (Canada) denotes the number of nonfatal injuries in Canada is from Association of Workers' Compensation Boards of Canada (AWCBC), National Work Injury/Disease Statistics Program (NWISP). Employment data are from Canada Statistics. Calculations by the CPWR Data Center.

Charts 37a and 37b – Rates were reported by each individual country separately from the numbers presented in Chart 37c. Due to the wide variability in data collection and reporting, comparisons across countries must be made with caution.

Chart 37a – Rates are defined as follows: 1) Per 100,000 workers insured – Belgium, France, Spain; 2) Per 100,000 workers employed – Australia, Canada, Finland, Germany, Sweden, United Kingdom; 3) Per 100,000 FTEs (200,000,000 hours worked)—Switzerland, United States

Chart 37b – Rates are defined as follows: 1) Per 100 workers insured – Belgium, France, Spain; 2) Per 100 workers employed – Australia, Canada, Finland, Germany, Sweden, United Kingdom; 3) Per 100 FTEs (200,000 hours worked) – Switzerland, United States

Source: All Charts – International Labour Organization. ILOSTAT - ILO database of labour statistics. http://www.ilo.org/global/statistics-and-databases/lang--en/index.htm; Bureau of Labor Statistics. 2017. Counting injuries and illnesses in the workplace: An international review. Monthly Labor Review, https://www.bls.gov/opub/mlr/2017/article/counting-injuries-and-illnesses-in-the-workplace.htm (Accessed December 2017).

Fatal and Nonfatal Injuries in Construction and Other Industries

In 2015, 985 construction workers died from work-related injuries, accounting for 20% of the total (4,836) fatal injuries at workplaces in the United States,[1] more than any other industry (chart 38a). Compared to its lowest level (781 deaths) in 2011, construction fatalities rose 26% in 2015 (chart 38b). Fluctuations were more pronounced among Hispanic construction workers, as fatal injuries dropped about 50% from a high of 360 in 2006 to a low of 182 in 2010, and then reached 285 in 2015, a 57% increase. The fatality trends in construction corresponded with the employment trends in this industry during this time period (*see* pages 2 and 20).

In general, the fatality rate in construction has decreased since 1992. Specifically, it declined 37% from 14.3 per 100,000 *full-time equivalent workers* (FTEs; *see* Glossary) in 1992 to a low point of 9.0 per 100,000 FTEs in 2011. However, the rate has increased since then, to 9.9 per 100,000 FTEs in 2015 (chart 38c). This increase could be partly attributed to expanded employment of high-risk worker groups, such as Hispanic immigrant workers (*see* pages 16 and 17). In 2015, the fatality rate in construction was almost three times higher than the average of all industries, which was 3.4 per 100,000 FTEs.[1] The death rate in construction has also been steadily higher than manufacturing over time.

Following the fatality trends, the number of nonfatal cases resulting in days away from work (DAFW) in construction dropped by 55% from 2002[2] to its lowest point (74,000 cases) in 2011 (chart 38d). It reached nearly 80,000 by 2015, about a 9% increase from 2011. Among Hispanic construction workers, DAFW injuries declined about 67% between 2006 and 2012, and then rose around 35% by 2015.

The DAFW rate in construction was 134.8 per 10,000 FTEs in 2015, remaining 44% higher than the average for all private industries (chart 38e). The rate in construction also consistently exceeded mining and manufacturing and was higher than agriculture until 2008 (chart 38f). Moreover, construction workers generally have longer recovery periods when injured. In 2015, the rate of cases requiring a full month or more away from work was 47 per 10,000 FTEs in construction, compared with 27 per 10,000 FTEs for all private industries combined.[3]

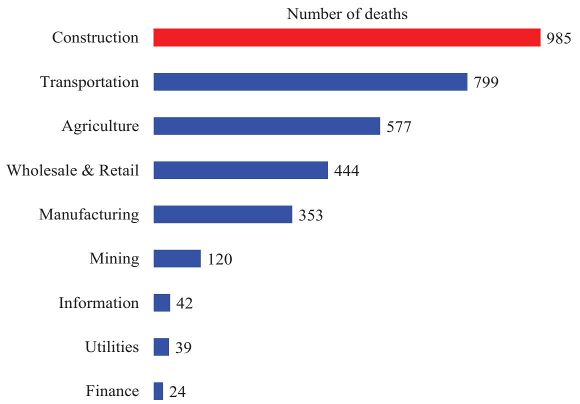
The fatality numbers reported in this section were obtained from the Census of Fatal Occupational Injuries (CFOI) conducted by the U.S. Bureau of Labor Statistics (BLS), including deaths among public and private sectors and self-employed workers. Therefore, the numbers presented may differ from publications that include only fatalities in the private sector. The FTE numbers in death rate calculations were obtained from the Current Population Survey (*see* page 10).

The nonfatal injury and illness data were extracted from the BLS' Survey of Occupational Injuries and Illnesses (SOII). The SOII excludes the self-employed and household workers, small farms with fewer than 11 employees, and federal government employees. Prior to 2008, state and local government employees were also excluded.[4] In addition, illnesses account for less than 3% of nonfatal cases in construction.[5] Since many work-related illnesses may have long latency periods, such as asbestosis or cancers, illnesses are potentially undercounted in the SOII data.[6] As a result, the SOII data presented in this section primarily refer to injuries among construction workers. Studies suggest that injuries among construction workers may be underreported as well.[7]

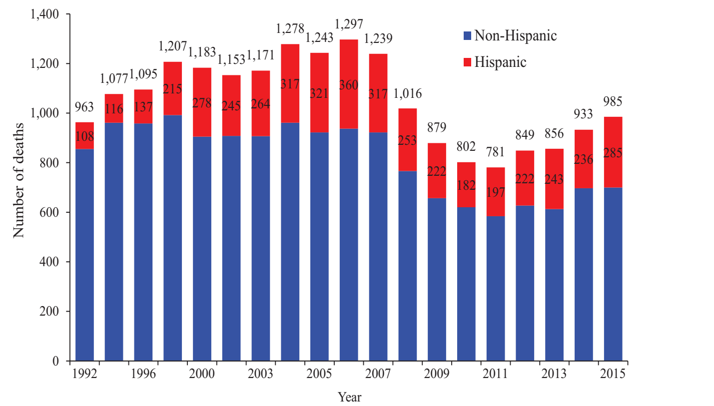
Both the CFOI and SOII have undergone important changes in the last decade, including changes in industrial classification systems and recordkeeping standards for the SOII data collection. Therefore, the injury data reported in this section may not be directly comparable over time.

1. U.S. Bureau of Labor Statistics. Work-related injuries and illnesses database, http://www.bls.gov/iif/ (Accessed April 2017).
2. Effective January 1, 2002, OSHA revised its requirements for recording occupational injuries and illnesses. Due to the revised recordkeeping rules, the estimates since the 2002 survey are not directly comparable with those from previous years.
3. U.S. Bureau of Labor Statistics. Number and rate of nonfatal occupational injuries and illnesses by selected industry, http://www.bls.gov/data/#injuries (Accessed April 2017).
4. U.S. Bureau of Labor Statistics. BLS Handbook of Methods, Chapter 9: Occupational safety and health statistics, http://www.bls.gov/opub/hom/homch9.htm#scope_SOII (Accessed April 2017).
5. U.S. Bureau of Labor Statistics. 2013 Survey of Occupational Injuries and Illnesses, Summary estimates charts package, https://www.bls.gov/iif/oshwc/osh/os/osch0052.pdf (Accessed April 2017).
6. Ruser JW. 2008. Examining evidence on whether BLS undercounts workplace injuries and illnesses. Monthly Labor Review, 131(8): 20-32.
7. Lipscomb HJ, Schoenfisch AL, Cameron W. 2015. Non-reporting of work injuries and aspects of jobsite safety climate and behavioral-based safety elements among carpenters in Washington State. American Journal of Industrial Medicine, 58(4): 411-421.

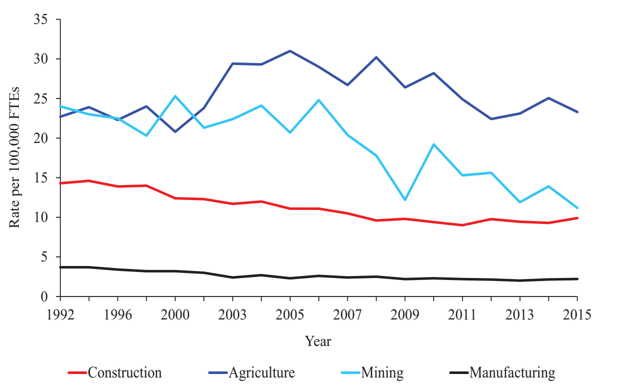
38a. Number of fatalities, by major industry, 2015 (All employment)



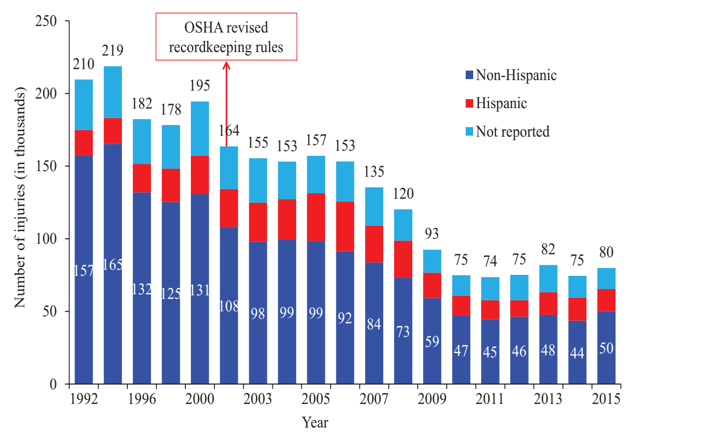
38b. Number of fatalities in construction, selected years between 1992 and 2015 (All employment)



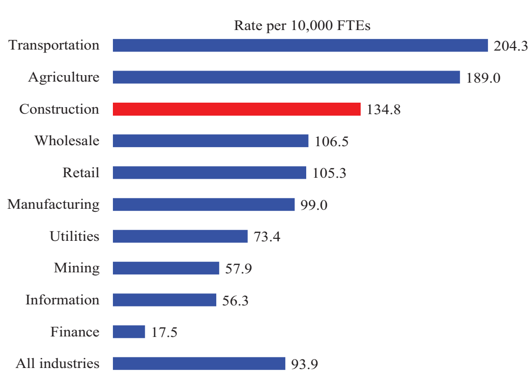
38c. Rate of fatalities, selected industries, selected years between 1992 and 2015 (All employment)



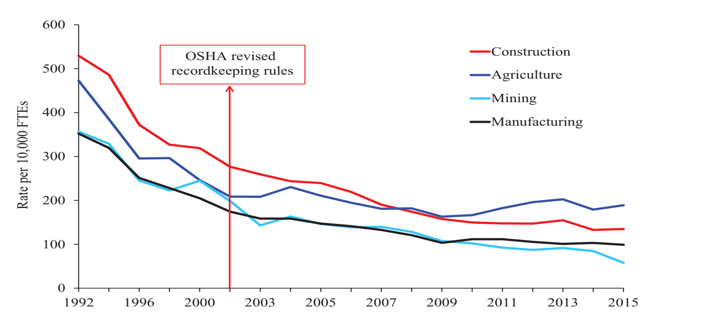
38d. Number of nonfatal injuries resulting in days away from work in construction, selected years between 1992 and 2015



38e. Rate of nonfatal injuries resulting in days away from work, by major industry, 2015



38f. Rate of nonfatal injuries resulting in days away from work, selected industries, selected years between 1992 and 2015



Note: All charts – Since workers may work part-time in construction, safety and health statistics are defined in terms of FTEs to allow comparisons between industries. Full-time employment is defined as 2,000 hours worked per year (*see* Glossary).
Chart 38d – Annually, about 17% of nonfatal cases have no racial/ethnic identifiers.
Charts 38d-38f – Data cover private wage-and-salary workers only.
Charts 38d and 38f – The estimates since the 2002 survey are not directly comparable with those from previous years. Due to space constraints, only even years before 2002 were selected.

Source: Charts 38a and 38b – U.S. Bureau of Labor Statistics. Work-related injuries and illnesses database, Census of Fatal Occupational Injuries, http://www.bls.gov/iif/ (Accessed April 2017).
Chart 38c – U.S. Bureau of Labor Statistics. Work-related injuries and illnesses database, Census of Fatal Occupational Injuries, http://www.bls.gov/iif/ (Accessed April 2017); the Current Population Survey. Calculations by the CPWR Data Center.
Charts 38d-38f – U.S. Bureau of Labor Statistics. Survey of Occupational Injuries and Illnesses, http://www.bls.gov/iif/ (Accessed April 2017).

Fatal and Nonfatal Injuries among Construction Sectors

The number and rate of fatal and nonfatal injuries[1] differ greatly among major construction sectors. In 2015, 472 fatal injuries occurred among Specialty Trade Contractors (NAICS 238; *see* page 1 for industrial classifications and codes), accounting for 64% of all work-related fatal injuries among private *wage-and-salary* (*see* Glossary) workers in construction (chart 39a), similar to its share of construction payroll employment (63.9%; *see* chart 2c). In the same year, there were 124 deaths in Construction of Buildings (NAICS 236), including both Residential (NAICS 2361; 63 deaths) and Nonresidential (NAICS 2362; 57 deaths).[2]

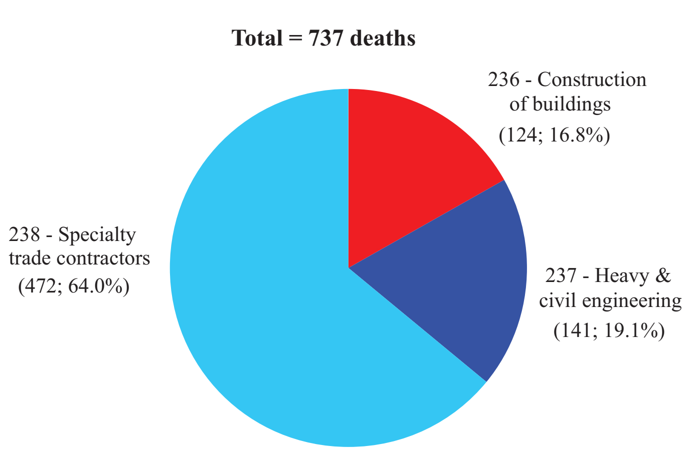
The fatal injury rate for overall private construction declined 23% from 14.0 to 10.7 deaths per 100,000 workers between 2003 and 2011, and then rose to 11.6 in 2015, an 8% increase over the 2011 rate. While the Heavy and Civil Engineering sector (NAICS 237) consistently had the highest fatality rate among the three major construction sectors, it decreased more than 42% from 2003 to 2015, a steeper decline than either Construction of Buildings (NAICS 236) or Specialty Trade Contractors (NAICS 238; chart 39b).

For nonfatal injuries, the Specialty Trade Contractors sector also had the highest number of injuries resulting in days away from work, accounting for 68.0% of such injuries in construction – more than double the sum of the other two construction sectors (chart 39c).

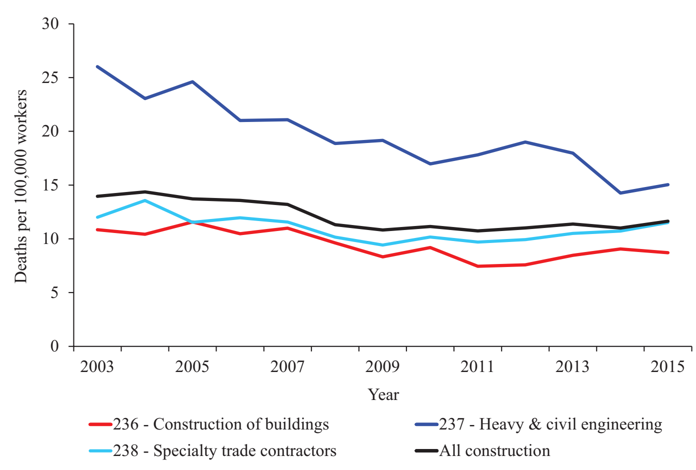
The rates of nonfatal injuries decreased significantly for all sectors from 2003 to 2015. The Specialty Trade Contractors sector, which consistently had the highest injury rate among all three major sectors, fell from 279 injuries per 10,000 *full-time equivalent workers* (FTEs; *see* Glossary) in 2003 to 147 in 2015 (chart 39d). Converse to the fatality trend, both Heavy and Civil Engineering and Construction of Buildings had lower nonfatal injury rates than the overall construction industry on average during this period. However, due to smaller injury numbers, the latter subsector experienced more fluctuation in rate than the former, dipping lower during the recession and rising higher with the economic recovery.

Employment numbers were obtained from the Quarterly Census of Employment and Wages (QCEW, known as the ES-202 program until 2003), an establishment survey conducted by the U.S. Census Bureau. The QCEW collects employment data from payrolls quarterly; self-employed workers are excluded. To match the fatality data and employment data by construction subsector, deaths among construction workers who were self-employed or public employees were excluded, and employment numbers combined the four quarters of a given year in the fatal injury rate tabulations. Fatality rates reported here were not adjusted by FTEs because the QCEW does not collect data on hours worked. Therefore, fatality data reported on this page may not be comparable to data reported on other pages.

39a. Number and percentage of fatalities among major construction sectors,* 2015 (Private wage-and-salary workers)

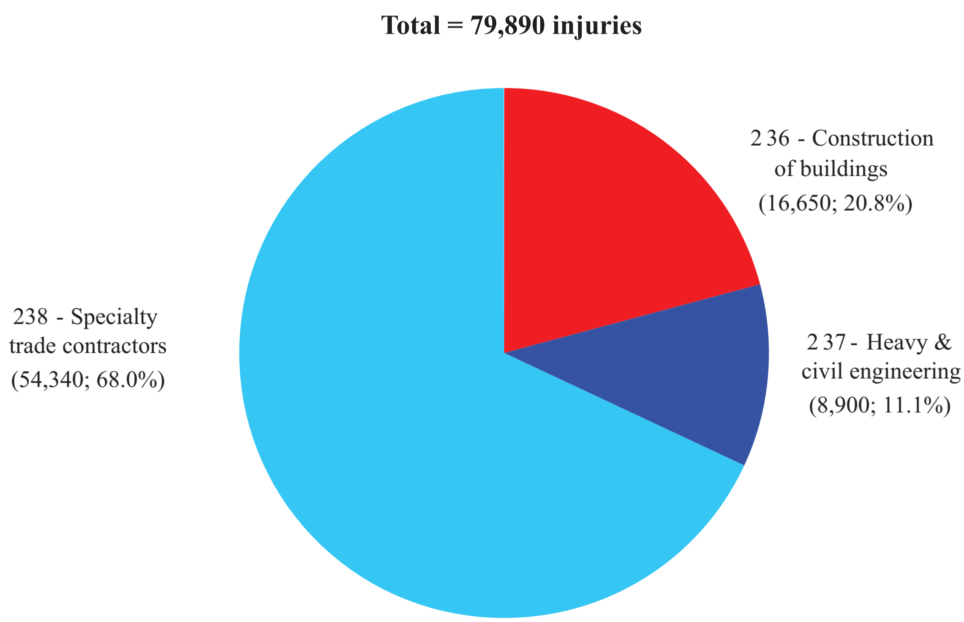


39b. Rate of fatalities, by major construction sector,* 2003-2015 (Private wage-and-salary workers)

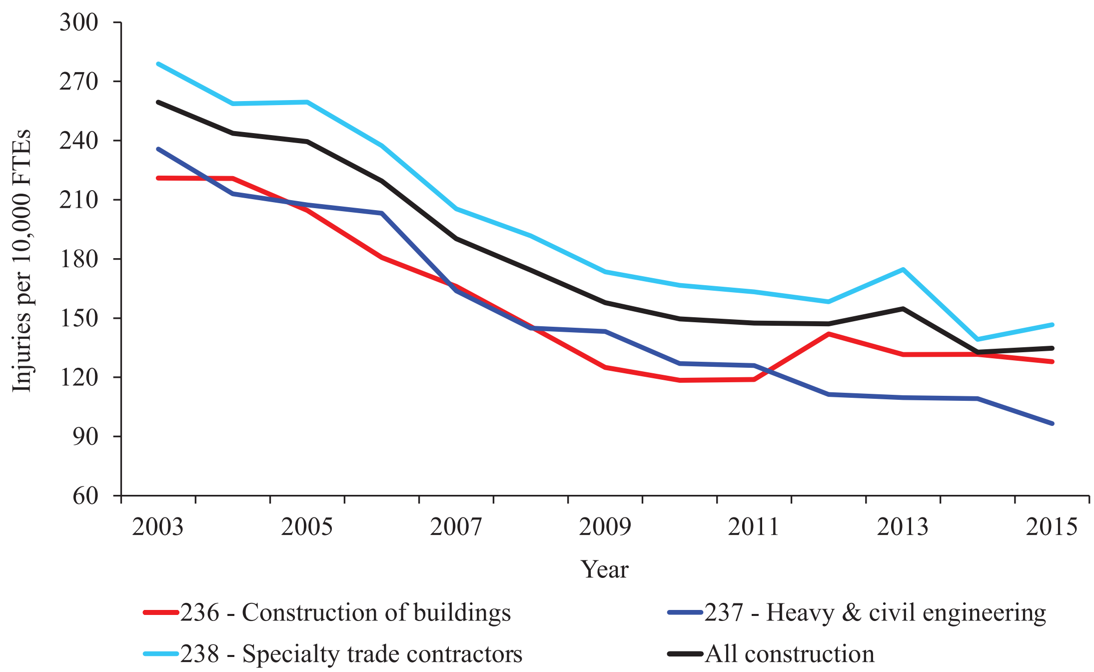


1. Illnesses comprise less than 3% of all nonfatal injuries and illnesses in construction; therefore, numbers for construction largely represent injuries and will be referred to as such in this Chart Book.
2. U.S. Bureau of Labor Statistics. 2015 Census of Fatal Occupational Injuries, http://www.bls.gov/data/#injuries (Accessed April 2017). Deaths without detailed NAICS codes were excluded from the calculation.

39c. Number and percentage of nonfatal injuries resulting in days away from work among major construction sectors,* 2015
(Private wage-and-salary workers)



39d. Rate of nonfatal injuries resulting in days away from work, by major construction sector,* 2003-2015
(Private wage-and-salary workers)



Note: *For text and all charts, major construction sectors refer to the construction industry coded by NAICS at three-digit level, including NAICS 236, 237, and 238.

Source: Chart 39a – U.S. Bureau of Labor Statistics. 2015 Census of Fatal Occupational Injuries, http://www.bls.gov/data/#injuries (Accessed April 2017).
Chart 39b – U.S. Bureau of Labor Statistics. 2003-2015 Census of Fatal Occupational Injuries, http://www.bls.gov/data/#injuries (Accessed April 2017). 2003-2015 Quarterly Census of Employment and Wages. Calculations by the CPWR Data Center.
Chart 39c – U.S. Bureau of Labor Statistics. 2015 Survey of Occupational Injuries and Illnesses (Table R113), https://stats.bls.gov/iif/oshwc/osh/case/ostb4865.pdf (Accessed April 2017).
Chart 39d – U.S. Bureau of Labor Statistics. 2003-2015 Survey of Occupational Injuries and Illnesses (Table R5), https://stats.bls.gov/iif/oshwc/osh/case/ostb4757.pdf (Accessed April 2017).

Fatal and Nonfatal Injuries in Construction by Employment, Establishment, and Geographic Trends

From 1992 to 2015, a total of 25,705 construction workers died from work-related injuries, an annual average of about 1,071 deaths. Among the fatally injured construction workers, 16.5% (4,230 workers) were self-employed[1] (chart 40a). The number of fatal injuries in construction decreased during the economic downturn from 2007 through 2011, and then increased afterward, particularly among *wage-and-salary* (*see* Glossary) workers.

Small establishments, which form the largest segment of the construction industry (*see* page 2), suffer a disproportionate share of fatal work injuries. Between 1992 and 2015, 7,235 construction deaths (42% of deaths among wage-and-salary workers) occurred in establishments with 10 or fewer employees, even though less than 30% of construction workers were employed in such small establishments.[2] In 2015 alone, 57% of construction deaths occurred in establishments with fewer than 20 employees, yet such establishments employed just 37.5% of the wage-and-salary workforce in construction (chart 40b).

Unlike fatal injuries, the rate of injuries[3] resulting in days away from work (DAFW) among the smallest establishments (1-10 employees) was consistently lower than that for establishments with 11-249 employees prior to 2009 (chart 40c). However, this pattern has somewhat reversed since the latest recession. From 2009 to 2015, the injury rate in the smallest establishments exceeded the rate for establishments with 50-249 employees.

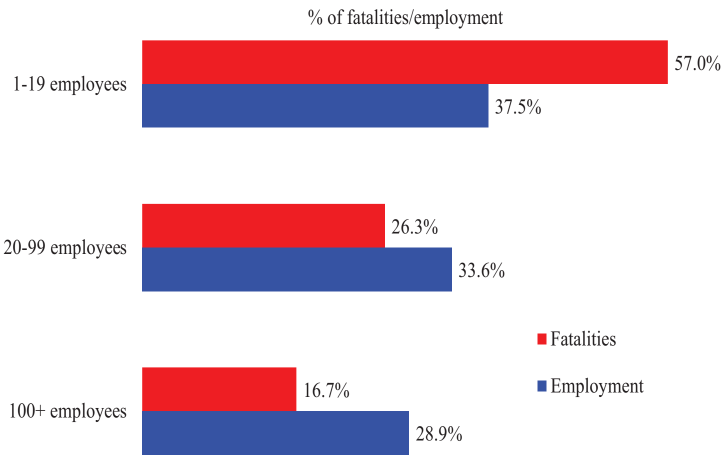
The increasing nonfatal injuries among small construction establishments in recent years may be partially attributed to more accurate injury and illness reporting as well as growing vulnerable worker groups with the economic recovery, such as Hispanic construction workers (*see* page 16) who are more likely to be employed in small construction companies.[4] By comparison, the injury rate for the largest establishments (1,000 or more employees) remained the lowest in construction, reaching 0.3 per 100 *full-time equivalent workers* (FTEs; *see* Glossary) in 2015. Advanced safety and health programs and favorable safety climates may contribute to the low injury rate among large establishments.[4-6]

Both fatal and nonfatal injury rates vary geographically. In the period of 2011-2015, the highest fatal injury rates were found in North Dakota (41.5 deaths per 100,000 FTEs) and Washington, D.C. (32.1; chart 40d). North Dakota has the fastest-growing economy and the least-safe working conditions of any state, which may explain the high fatality rate.[7] For nonfatal injuries, the following three states reported the highest rates over the same period: Washington (257.7 per 10,000 FTEs), Montana (235.9), and Massachusetts (216.0; chart 40e). In general, states with higher fatality rates had lower nonfatal injury rates, whereas states with lower fatality rates had higher nonfatal injury rates. Although fatal and nonfatal injury rates may not necessarily be correlated, the negative association suggests that nonfatal injuries could be underreported in some states.

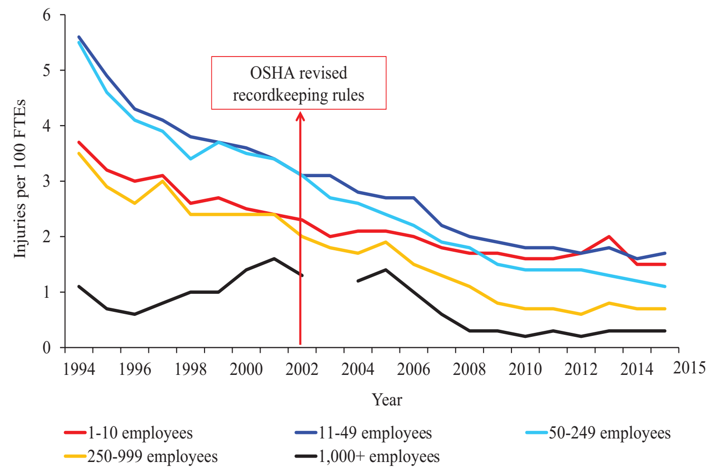
40a. Number of fatalities in construction, by class of worker, 1992-2015, selected years (All employment)

1. Includes owners of unincorporated and incorporated businesses or members of partnerships, and paid or unpaid family workers.
2. The numbers of employees by establishment size were obtained from the County Business Patterns (CBP), an annual survey conducted by the U.S. Census Bureau. The CBP provides information for establishments with payrolls only. Thus, deaths among the self-employed were excluded from this analysis. Deaths not reported by type of employment and establishment size were also excluded.
3. Illnesses comprise about 3% of all nonfatal injuries and illnesses in construction; therefore, numbers for construction largely represent injuries and will be referred to as such in this Chart Book.
4. Dong XS, Fujimoto A, Ringen K, Stafford E, Platner JW, Gittleman JL, Wang X. 2011. Injury underreporting among small establishments in the construction industry. American Journal of Industrial Medicine, 54:339-349.
5. Dong XS, Wang X, Goldenhar LM. 2016. Workplace safety and health perceptions of construction workers. CPWR Quarterly Data Report, Third Quarter, https://www.cpwr.com/publications/third-quarter-workplace-safety-and-health-perceptions-construction-workers (Accessed May 2017).
6. Wang X, Dong, XS, Goldenhar LM. 2016. Safety management and safety culture among small construction firms. CPWR Quarterly Data Report, Second Quarter, https://www.cpwr.com/publications/second-quarter-safety-management-and-safety-culture-among-small-construction-firms (Accessed May 2017).
7. Mother Jones. 2014. North Dakota is the deadliest state to work in, http://www.motherjones.com/environment/2014/05/north-dakota-nations-deadliest-state-work-fracking/ (Accessed October 2017).

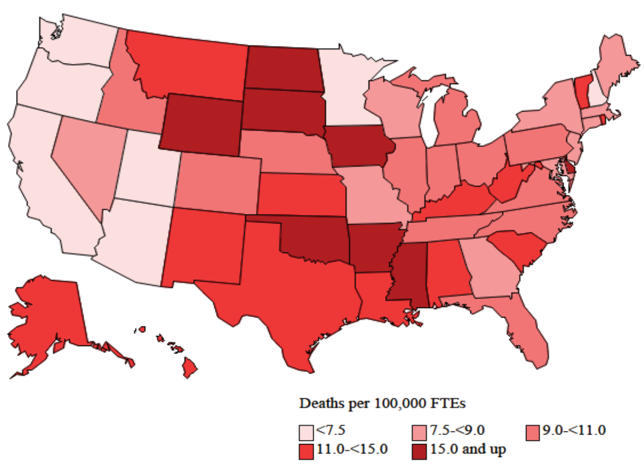
40b. Distribution of construction fatalities and employment, by establishment size, 2015 (Wage-and-salary workers)



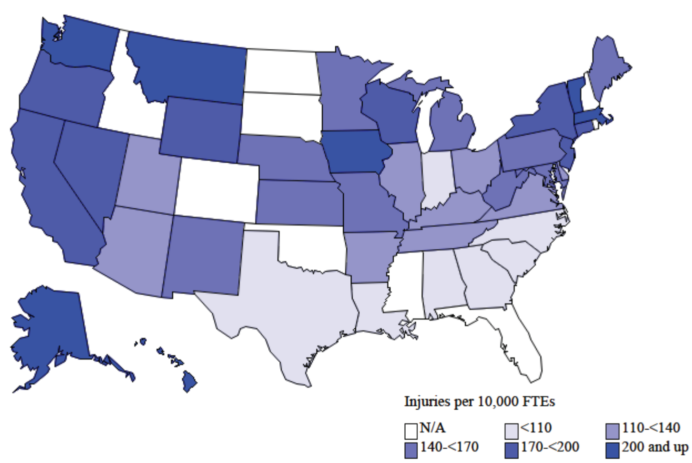
40c. Rate of nonfatal injuries resulting in days away from work in construction, by establishment size, 1994-2015 (Private wage-and-salary workers)



40d. Rate of fatalities in construction, by state, 2011-2015 average (All employment)



40e. Rate of nonfatal injuries resulting in days away from work in construction, by state, 2011-2015 average (Private wage-and-salary workers)



Note: Chart 40b – A total of 985 deaths occurred in construction in 2015, 800 of which were wage-and-salary workers. Deaths not reported by establishment size were excluded. Totals may not add to 100% due to rounding.
Chart 40c – Injury data by establishment size are available since 1994; no data are available for establishments with 1,000+ employees in 2003.

Source: Chart 40a – U.S. Bureau of Labor Statistics. 1992-2015 Census of Fatal Occupational Injuries, http://www.bls.gov/data/#injuries (Accessed April 2017).
Chart 40b – Fatality numbers were estimated from the Census of Fatal Occupational Injuries. This research was conducted with restricted access to U.S. Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS. Establishment data were from the U.S. Census Bureau, 2015 County Business Patterns, https://www.census.gov/data/datasets/2015/econ/cbp/2015-cbp.html (Accessed April 2017). Calculations by the CPWR Data Center.
Chart 40c – U.S. Bureau of Labor Statistics. 1994-2015 Survey of Occupational Injuries and Illnesses, http://www.bls.gov/iif/home.htm (Accessed April 2017).
Chart 40d – U.S. Bureau of Labor Statistics. 2011-2015 Census of Fatal Occupational Injuries, http://www.bls.gov/data/#injuries (Accessed April 2017). FTEs were estimated from the 2011-2015 Current Population Survey. Calculations by the CPWR Data Center.
Chart 40e – U.S. Bureau of Labor Statistics. 2011-2015 Survey of Occupational Injuries and Illnesses, http://www.bls.gov/data/#injuries (Accessed April 2017).

Demographic Trends of Fatal and Nonfatal Injuries in Construction

Injury and illness[1] trends directly reflect demographic changes in construction employment. The proportion of fatalities among construction workers younger than 35 years old has progressively fallen over the past two decades, while the proportion among workers 55 years and older has grown, reflecting the aging workforce (chart 41a; *see* pages 13 and 14). In 2015, workers aged 55 years and older accounted for over a quarter (27%) of all construction fatalities, an increase from 20% in 2005 and 24% in 2010. However, the largest proportion of deaths occurred in the 45-54 age range in 2005, 2010, and 2015.

Nonfatal injuries showed a similar trend as fatalities. From 1992 to 2015, the share of nonfatal cases dropped 38% among workers aged 25-34 years, and tripled among workers 55 years and older (chart 41b). Overall, the proportion of nonfatal cases among workers aged 45 years and older grew from 16% in 1992 to 40% in 2015.

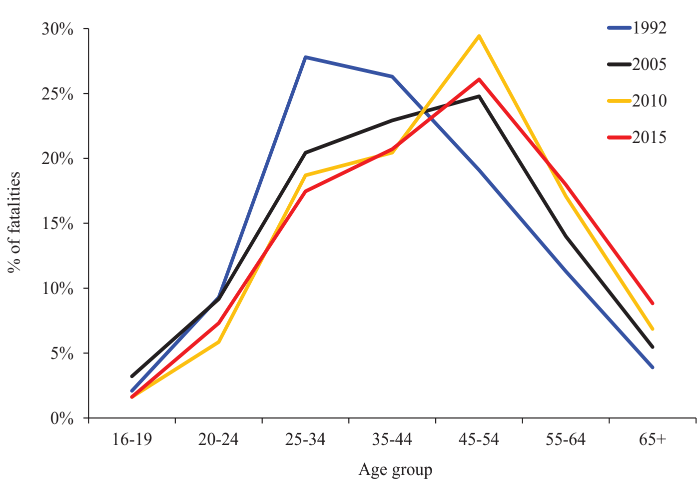
Injury rates varied significantly by age of workers. Between 2013 and 2015, the fatality rate for workers aged 65 years and older was 23.9 deaths per 100,000 *full-time equivalent workers* (FTEs; *see* Glossary), more than three times the rate for workers under 20 years old (chart 41c). Conversely, the youngest construction workers experienced the highest rate of nonfatal injuries, with 139.3 injuries per 10,000 FTEs among those younger than 20 years old, nearly twice the rate (73.8) of the oldest age group (chart 41c). In general, workers aged 45 years and older took more days to recover from occupational injuries than did younger workers. Additionally, injured construction workers took more days to recover after being injured than did workers from all industries on average (13 versus 8 days; chart 41d).

The fatality rate for Hispanic workers was higher than that for white, non-Hispanic workers in general, but the gap has narrowed over time (chart 41e). On average, the annual death rate for Hispanic workers was about 48% higher than for white, non-Hispanic workers between 1992 and 2002, but was just 9% higher between 2012 and 2015. Targeted intervention programs for Hispanic construction workers may have contributed to the injury reduction among this vulnerable worker group.[2]

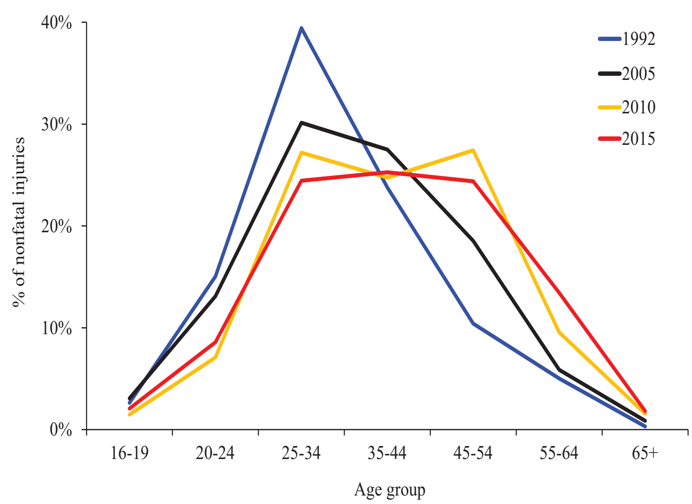
In contrast to fatal injury rates, the nonfatal injury rate for Hispanic workers was consistently lower than for white, non-Hispanic workers during these time periods (chart 41f). This suggests that injury underreporting may exist among Hispanic construction workers.

Women workers only accounted for a small proportion of the construction workforce, in particular among construction production occupations (*see* page 19). Even so, in total, 341 female construction workers died from work-related injuries from 1992 to 2015, about 14 per year on average. Additionally, there were more than 84,000 injuries resulting in lost workdays among female construction workers, or about 3,500 per year, during the same time period.[3]

41a. Distribution of fatalities in construction, by age group, selected years (All employment)

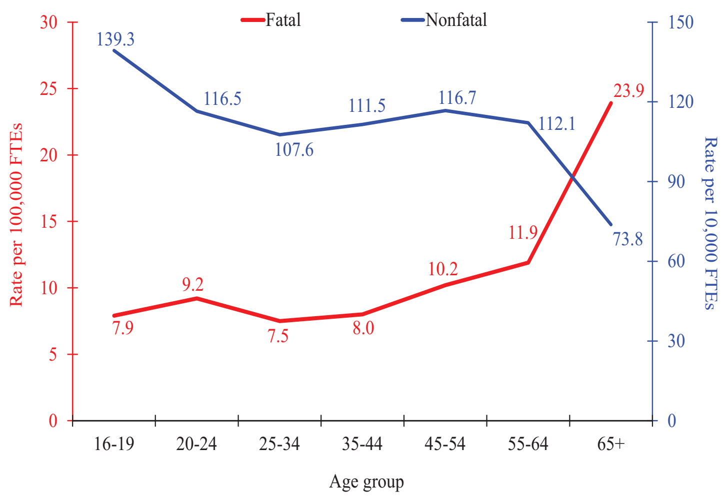


41b. Distribution of nonfatal injuries resulting in days away from work in construction, by age group, selected years (Private industry)

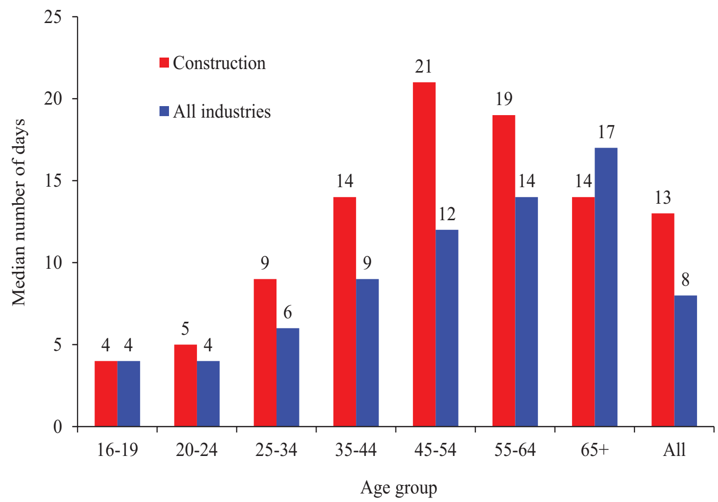


1. Illnesses comprise less than 3% of all nonfatal injuries and illnesses in construction; therefore, numbers for construction largely represent injuries and will be referred to as such in this Chart Book.
2. The National Institute for Occupational Safety and Health. NIOSH Program Portfolio: Occupational Health Disparities, http://www.cdc.gov/niosh/programs/ohd/risks.html (Accessed April 2017).
3. U.S. Bureau of Labor Statistics. Work-related Injuries and Illnesses Database, Census of Fatal Occupational Injuries, and Survey of Occupational Injuries and Illnesses, http://www.bls.gov/iif/home.htm#data (Accessed April 2017).

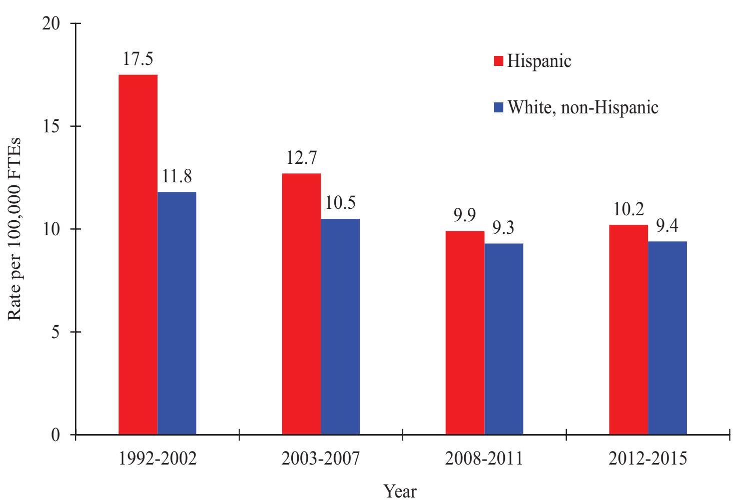
41c. Rate of fatal and nonfatal injuries in construction, by age group, 2013-2015 average



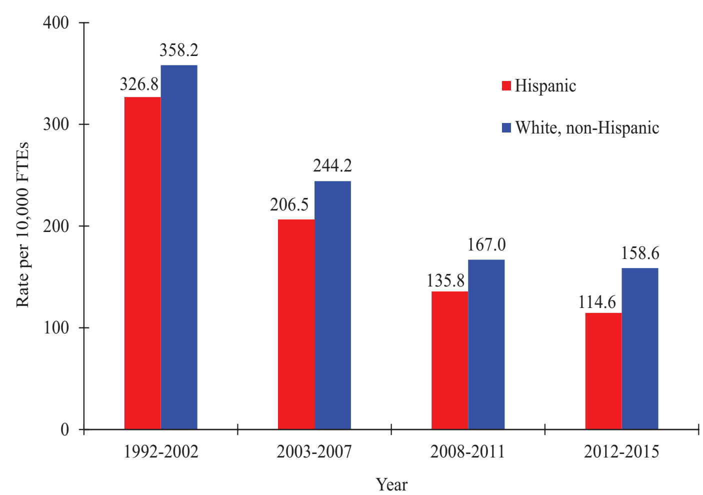
41d. Median days away from work by age group, construction versus all industries, 2015



41e. Rate of fatalities in construction, by Hispanic ethnicity, four time periods from 1992-2015 (All employment)



41f. Rate of nonfatal injuries in construction, by Hispanic ethnicity, four time periods from 1992-2015



Note: Charts 41b, 41d, and 41f – Data cover private wage-and-salary workers only.
Chart 41c – Rates are adjusted for full-time workers. Fatality data cover all employment. Nonfatal injury data cover private wage-and-salary workers.
Chart 41d – The median is the middle value that divides the group into two parts, with 50% of values below the median, and 50% above it.
Charts 41e and 41f – Rates are adjusted for full-time workers. The four time periods used in these charts account for the OSHA reporting requirement changes in 2002, the switch of the industrial and occupational classifications beginning in 2003, the economic downturn from 2008-2011, and the economic recovery from 2012-2015.

Source: Charts 41a and 41b – U.S. Bureau of Labor Statistics. Work-related injuries and illnesses database, Census of Fatal Occupational Injuries, and Survey of Occupational Injuries and Illnesses, http://www.bls.gov/iif/home.htm#data (Accessed April 2017). Proportions were calculated by the CPWR Data Center.
Charts 41c, 41e, and 41f – U.S. Bureau of Labor Statistics. Work-related Injuries and Illnesses Database, Census of Fatal Occupational Injuries, and Survey of Occupational Injuries and Illnesses, http://www.bls.gov/iif/home.htm#data (Accessed April 2017); and the Current Population Survey. Rates were calculated by the CPWR Data Center.
Chart 41d – U.S. Bureau of Labor Statistics. Work-related Injuries and Illnesses Database, Nonfatal cases involving days away from work, selected characteristics, http://www.bls.gov/iif/ (Accessed April 2017).

Fatal and Nonfatal Injuries within Construction Occupations

Death and injury counts vary widely among construction occupations. Between 2011 and 2015, the number of work-related deaths among construction laborers – the largest construction trade – totaled 988,[1] far exceeding that in any other construction occupation, and accounting for 22% of all construction fatalities during that time period (chart 42a). Foremen experienced 502 deaths during the same period, second only to construction laborers in the number of fatalities. Construction laborers also had the highest number of nonfatal injuries and illnesses[2] resulting in days away from work (DAFW) in 2015, at 16,960 cases. This was double the number of injuries among carpenters, the occupation with the second highest number of nonfatal injuries (7,790; chart 42b).

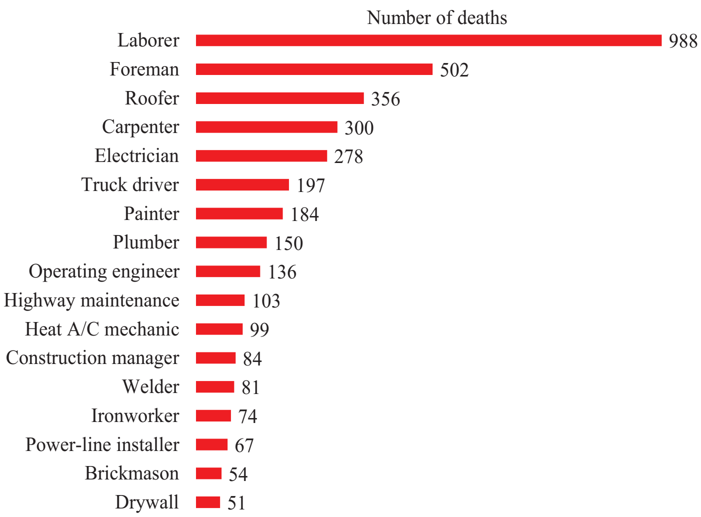
In terms of fatal injury rates, electrical power-line installers had the highest rate of fatal injuries at 67.1 deaths per 100,000 *full-time equivalent workers* (FTEs; *see* Glossary), more than seven times the rate for all construction workers on average (chart 42c). Nevertheless, fatal injury rates have significantly declined for this high-risk occupation since 1992 (the year when BLS started to report such data), when electrical power-line installers experienced 149.3 deaths per 100,000 FTEs.[3] Roofers ranked as the second most dangerous occupation for fatal injuries at 41.8 deaths per 100,000 FTEs. These two occupations also had a high risk of fall fatalities (*see* page 44).

For nonfatal injuries, construction helpers had the highest injury rates between 2011 and 2015, followed by sheet metal workers and power-line installers (chart 42d). The category "construction helpers" includes helpers in multiple occupations. Helpers assist construction craft workers, such as electricians, carpenters, and cement masons, with a variety of tasks.[4] For example, many helpers work with cement masons to move and set the forms that determine the shape of poured concrete. Other helpers assist with taking apart equipment, cleaning up sites, and disposing of waste, as well as helping with any other needs of craft workers. In general, construction helpers are younger (about nine years younger than the average age of the construction workforce in 2015)[5] and have less job-related training and experience than other construction occupations.[4]

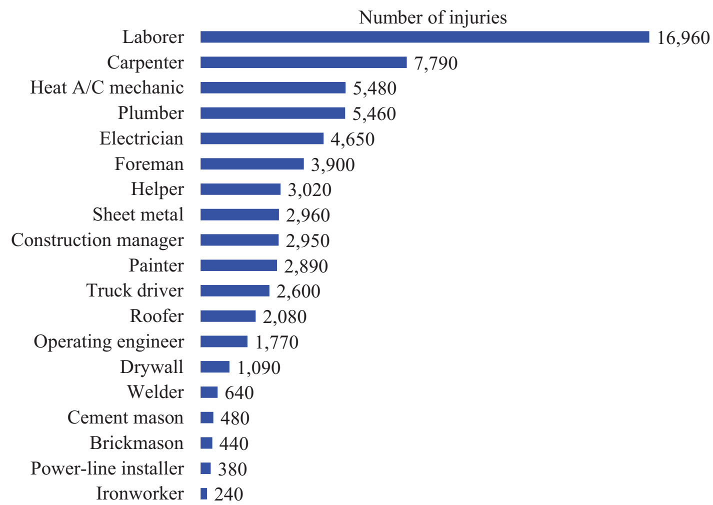
The fatality data were from the Census of Fatal Occupational Injuries, and the nonfatal injury data were from the Survey of Occupational Injuries and Illnesses (*see* page 38). The number of construction workers, expressed as FTEs, was obtained from the Current Population Survey (*see* page 10). Due to coding system modifications and other changes in these data sources, numbers reported on this page may not be directly comparable to those in previous publications.

1. The tabulations are a sum of five years of data for more reliable estimates.
2. Illnesses comprise less than 3% of all nonfatal injuries and illnesses in construction; therefore, numbers for construction largely represent injuries and will be referred to as such in this chart book.
3. CPWR – The Center for Construction Research and Training. 2013. The Construction Chart Book: The U.S. Construction Industry and Its Workers. Fifth edition, page 42, http://www.cpwr.com/publications/construction-chart-book (Accessed May 2017).
4. United States Department of Labor. Occupational Outlook Handbook: What construction laborers and helpers do, https://www.bls.gov/OOH/construction-and-extraction/construction-laborers-and-helpers.htm#tab-2 (Accessed May 2017).
5. This number was estimated from the Current Population Survey. Calculations by the CPWR Data Center.

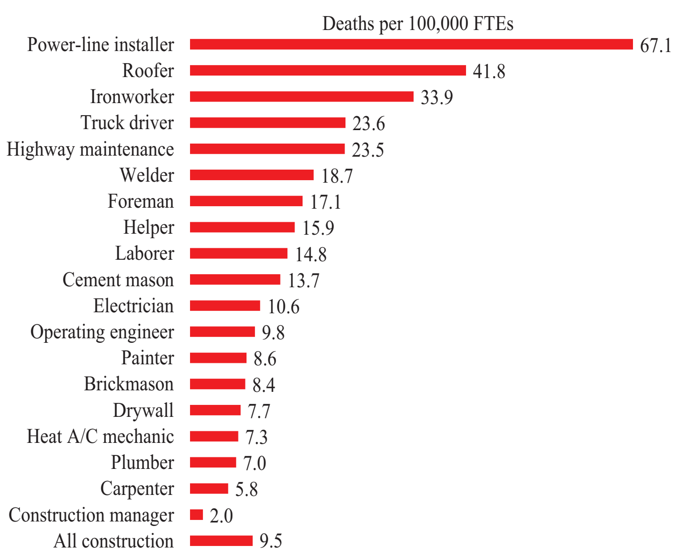
42a. Number of fatalities, selected construction occupations, 2011-2015 total (All employment)



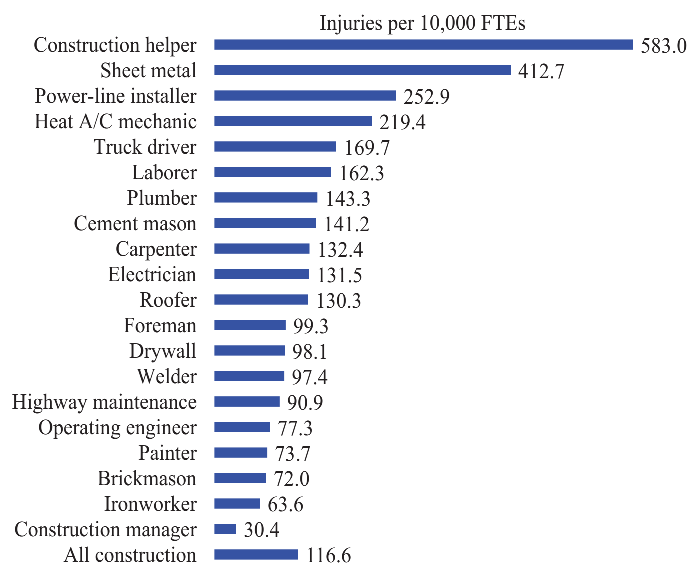
42b. Number of nonfatal injuries resulting in days away from work, selected construction occupations, 2015 (Private wage-and-salary workers)



42c. Rate of fatalities, selected construction occupations, 2011-2015 average (All employment)



42d. Rate of nonfatal injuries resulting in days away from work, selected construction occupations, 2011-2015 average (Private wage-and-salary workers)



Source: Charts 42a and 42c – Fatality numbers were estimated from the Census of Fatal Occupational Injuries. This research was conducted with restricted access to U.S. Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS. Numbers of FTEs were estimated from the Current Population Survey. Calculations by the CPWR Data Center.
Charts 42b and 42d – Numbers of nonfatal injuries were from the U.S. Bureau of Labor Statistics, Survey of Occupational Injuries and Illnesses. Numbers of FTEs were estimated from the Current Population Survey. Calculations by the CPWR Data Center.

Leading Causes of Fatal and Nonfatal Injuries in Construction

In 2015, injuries caused by falls, slips, and trips were responsible for over one-third (367 of 985) of all fatal work injuries in construction (chart 43a). Transportation incidents (263 deaths) and contact with objects (166 deaths) were the second and third leading causes of construction fatalities, respectively.[1]

Leading causes of nonfatal injuries differ from fatal injuries. For example, contact with objects caused one-third (26,550 of 79,890) of all nonfatal injuries resulting in days away from work (DAFW; chart 43b) in 2015, making it the number one cause of nonfatal injuries, even though this category ranked third among fatal injuries with 17% of fatalities. Similarly, falls to a lower level were a major contributor to fatalities in construction, accounting for 96% (353 of 367) of all fatal falls, while slips, trips, and falls on the same level caused more than half (12,710 of 23,860; 53%) of all nonfatal fall injuries in construction. Overexertion / bodily reactions do not normally lead to death, but are often known as a major cause of musculoskeletal disorders (*see* page 48), responsible for more than one-quarter of DAFW cases in construction in 2015.

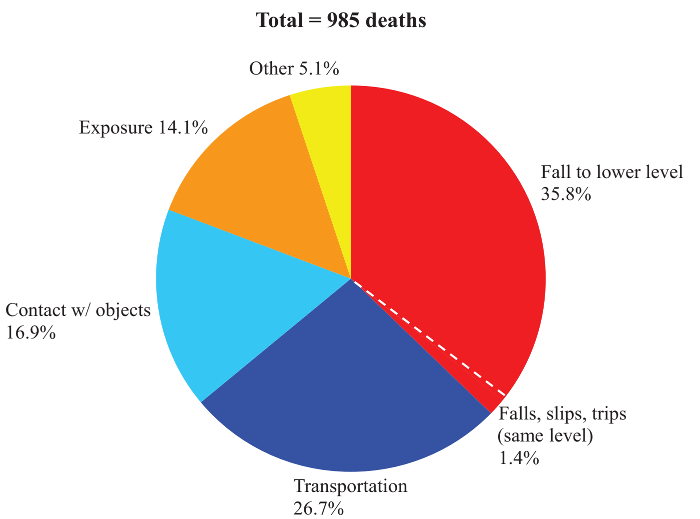
Using more detailed injury categories, from 1992 through 2015, the highest-ranking causes of fatalities in construction were falls to a lower level (8,211 deaths), being struck by an object or a vehicle (4,648 deaths), contact with electric current (2,807 deaths), and caught-in/between (2,207 deaths; chart 43c). These four causes are recognized as the "Construction Focus Four" by OSHA, claiming 745 lives on average per year in construction, and accounting for 70% of all construction fatalities during this time period.

Each of these causes of death hit their lowest point between 2010 and 2012 during the latest recession and increased since then, though at different rates. Fatalities due to falls increased by more than a third (36%) from 2011 to 2015 with the recovery of the U.S. housing market, more rapidly than the other three leading causes.[2]

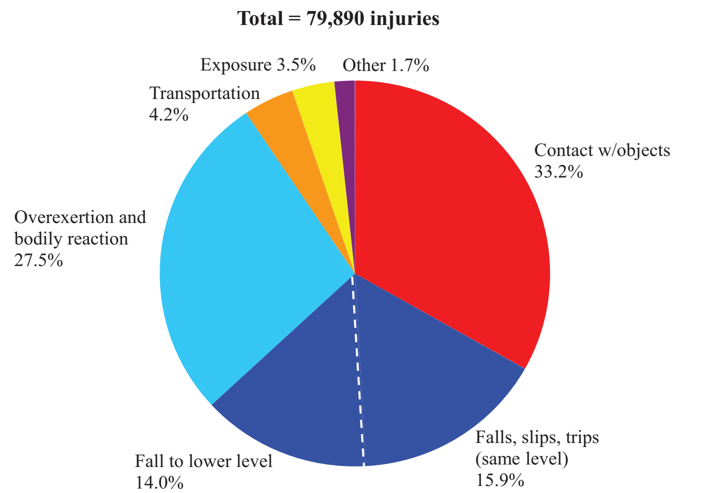
Being struck by an object has remained the leading cause of nonfatal injuries in construction since 1992 (chart 43d). Yet, the rate of such injuries has generally fallen along with the overall injury trend in construction, dropping from 94.2 injuries per 10,000 *full-time equivalent workers* (FTEs; *see* Glossary) in 1992, to an all-time low rate of 23.8 injuries per 10,000 FTEs in 2010. The rate then rose slightly, with 27.4 injuries per 10,000 FTEs in 2015. Despite an overall decline, falls to a lower level shifted from the third to the second leading cause of nonfatal injuries in 1996, and has remained higher than overexertion since then. Fall prevention continues to be a challenge for the construction industry.

1. Information on the data sources used for the tabulations is reported on page 38.
2. In 2011, the U.S. Bureau of Labor Statistics switched to Occupational Injury and Illness Classification System (OIICS) version 2.01. Therefore, the numbers of fatal and nonfatal falls are not directly comparable before and after 2011.

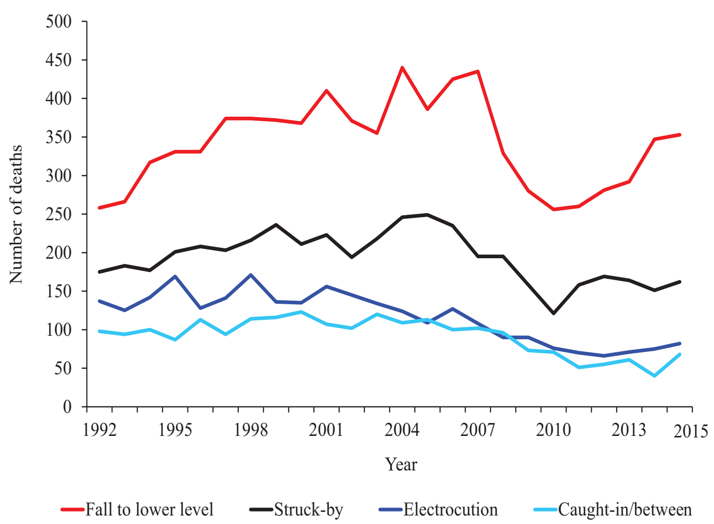
43a. Distribution of leading causes of fatalities in construction, 2015 (All employment)



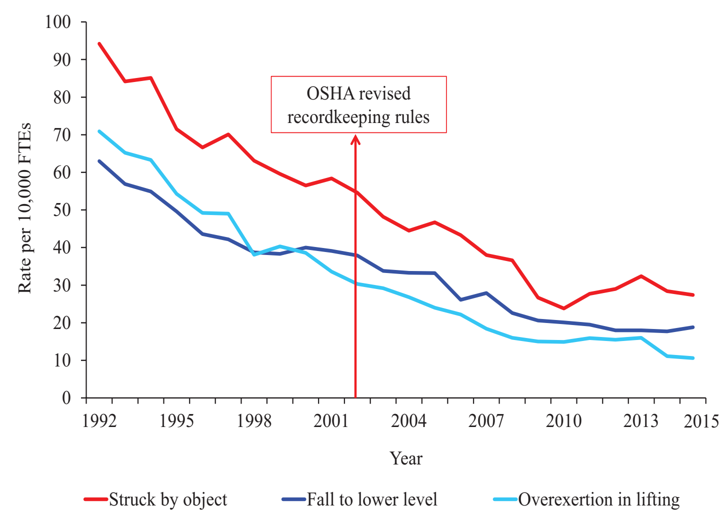
43b. Distribution of leading causes of nonfatal injuries resulting in days away from work in construction, 2015 (Private wage-and-salary workers)



43c. Leading causes of fatalities in construction, 1992-2015 (All employment)



43d. Rate of leading causes of nonfatal injuries resulting in days away from work in construction, 1992-2015 (Private wage-and-salary workers)



Note: Chart 43a – "Falls, slips, and trips (same level)" also includes jump to a lower level and fall, slip, trip, unspecified. "Transportation" refers to injuries involving vehicles that are due to collision or other type of traffic accident, loss of control, or a sudden stop, start, or jolting of a vehicle regardless of the location where the event occurred. "Contact with objects" includes being struck by an object, struck against an object, caught in or compressed by equipment or objects, and caught in or crushed by collapsing materials. "Exposure" includes exposure to electric current; temperature extremes; air pressure changes; caustic, noxious, or allergenic substances; and harmful substances and environments. "Other" includes fires and explosions; assaults and violent acts, including self-inflicted injuries, assaults, and assaults by animals; bodily reactions/exertion, such as when startled; and other non-classifiable events or exposures.

Chart 43b – "Falls, slips, trips (same level)" also includes 610 (<1%) nonfatal injuries that are classified as "jump to lower level" and "fall, slip, trip, unspecified". "Other" includes fires and explosions; assaults and violent acts; and other non-classifiable events or exposures. Lost-workday cases include only cases involving days away from work and excludes those with restricted work activity. Illnesses account for less than 3% of the total.

Chart 43c – Struck-by fatalities include deaths due to being struck by a vehicle, object, or equipment. Caught-in/between fatalities include deaths due to being caught in or compressed by equipment or objects, as well as those due to being caught in or crushed by collapsing materials.

Source: Chart 43a – U.S. Bureau of Labor Statistics. 2015 Census of Fatal Occupational Injuries, http://www.bls.gov/iif/oshcfoi1.htm (Accessed April 2017).
Chart 43b – U.S. Bureau of Labor Statistics. 2015 Survey of Occupational Injuries and Illnesses, http://www.bls.gov/data/#injuries (Accessed April 2017).
Chart 43c – U.S. Bureau of Labor Statistics. 1992-2015 Census of Fatal Occupational Injuries, http://www.bls.gov/iif/oshcfoi1.htm (Accessed April 2017).
Chart 43d – U.S. Bureau of Labor Statistics. 1992-2015 Survey of Occupational Injuries and Illnesses, Table R75, https://www.bls.gov/iif/oshwc/osh/case/ostb4827.pdf (Accessed April 2017).

Fatal Injuries from Falls to a Lower Level in Construction

Falls are the number one cause of fatal injuries in construction (*see* page 43). In 2015, 96% of deaths related to falls (including slips and trips) were attributed to falls to a lower level.[1] Deaths of this type increased 36% from 260 deaths in 2011 to 353 deaths in 2015 (chart 44a). The rate of such deaths also increased from 3.0 to 3.6 deaths per 100,000 *full-time equivalent workers* (FTEs; *see* Glossary) during the same period. Overall, falls to a lower level killed 4,439 construction workers between 2003 and 2015, about 341 deaths annually.

While working at a height of 30 feet or above is very dangerous, 38% of fatal falls to a lower level in construction that occurred between 2011 and 2015 were from a height of 15 feet or less (chart 44b). The primary cause of fall fatalities in construction was falling from roofs, accounting for one-third of all fatal falls to a lower level (chart 44c), followed by falls from ladders.

Between 2011 and 2015, over 60% of fatal falls to a lower level in construction occurred in establishments with ten or fewer employees (chart 44d). This was disproportionately high given that less than 30% of construction workers were employed in establishments of this size (*see* page 2).

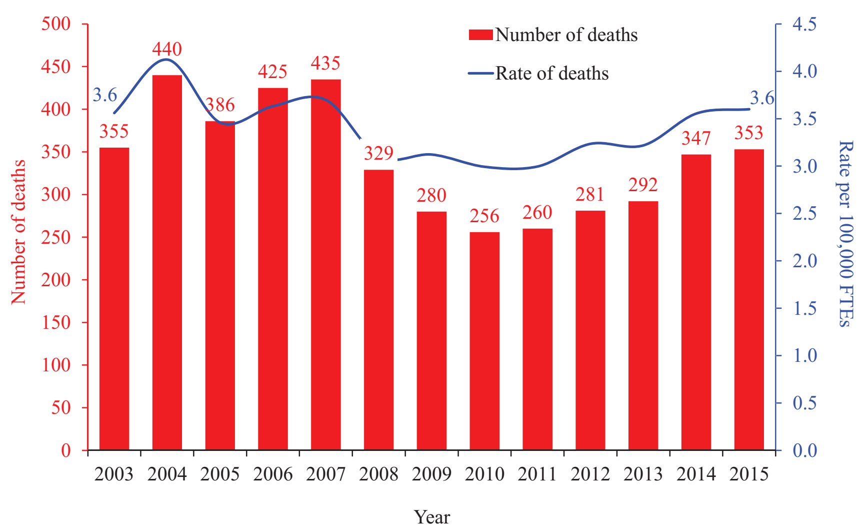
The risk of fatal falls to a lower level varies among construction occupations. Between 2011 and 2015, the rate of such deaths among roofers was 34.2 per 100,000 FTEs, more than ten times that of all construction workers on average (3.3 per 100,000 FTEs; chart 44e). Ironworkers had the second highest rate at 19.9 per 100,000 FTEs.

By major construction subsector, 1,058 fatal falls to a lower level occurred among Specialty Trade Contractors (NAICS 238; *see* page 1 for industry classifications and codes) from 2011 to 2015, accounting for 69% of such fatalities in construction during that time.[1] In the residential roofing industry (NAICS 238161), 80% of fatalities were from falls.[2] Workers who were older than 55 years and foreign-born Hispanics also had higher proportions of fatal falls.[2]

Effective fall protection is crucial to reduce fall injuries. OSHA requires employers to provide fall protection before any work that necessitates the use of fall protection begins.[3] However, a study based on NIOSH Fatality Assessment and Control Evaluation (FACE) reports indicates that a large number of construction workers killed by falls did not have access to personal fall arrest systems (PFAS) when the incident occurred.[4]

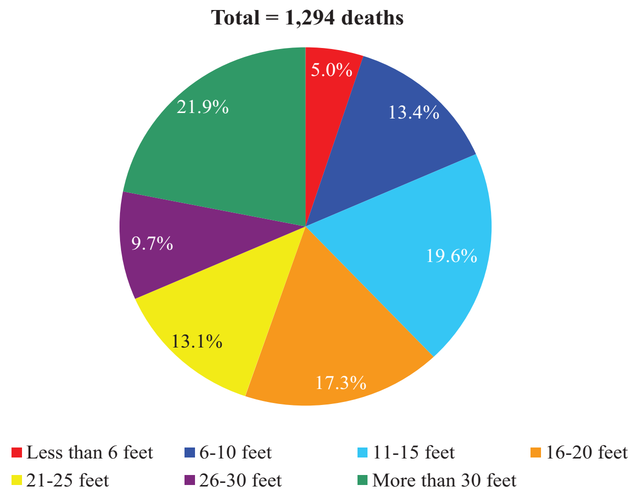
In response to the staggering number of fall-related injuries and fatalities, the National Occupational Research Agenda (NORA) Construction Sector Council, NIOSH, and OSHA launched the National Fall Prevention Campaign in 2012. The National Safety Stand-Down, a major annual event of the campaign, reached more than five million workers across the United States between 2014 and 2016.[5,6]

44a. Number and rate of fatal falls to a lower level in construction, 2003-2015 (All employment)

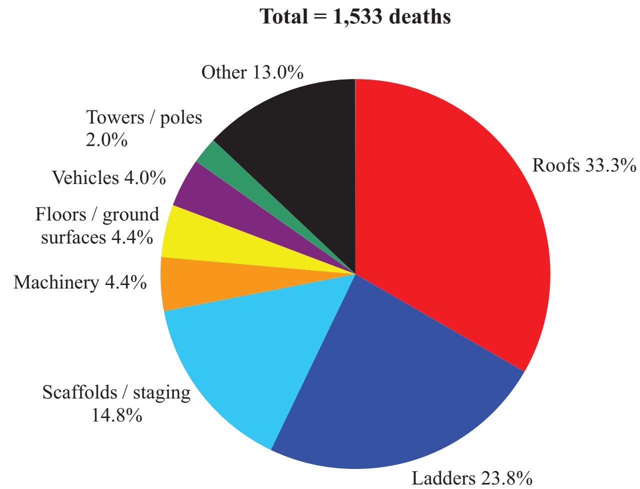


1. U.S. Bureau of Labor Statistics. 2011-2015 Census of Fatal Occupational Injuries, http://www.bls.gov/data/#injuries (Accessed November 2017).
2. Dong XS, Wang X, Largay JA, Platner JW, Stafford E, Cain CT, Choi SD. 2014. Fatal falls in the U.S. residential construction industry. American Journal of Industrial Medicine, 57(9): 992-1000.
3. Occupational Safety and Health Administration. 1995. Subpart M - Fall Protection: Duty to have fall protection, https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10757&p_table=STANDARDS (Accessed June 2017).
4. 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. Accident Analysis & Prevention, 102: 136-143.
5. Bunting J. 2017. The national campaign to prevent falls in construction final report on the 2016 Safety Stand-Down: A follow-up report to the final report on the 2014 & 2015 Safety Stand-Downs: A quantitative and qualitative analysis on data collected from OSHA's Stand-Down Certificate of Participation database, https://www.osha.gov/StopFallsStandDown/2016report.pdf (Accessed June 2017).
6. Dong XS, Wang X, Katz R, West G, Bunting J. 2017. Fall injuries and prevention in the construction industry, https://www.cpwr.com/publications/first-quarter-fall-injuries-and-prevention-construction-industry (Accessed August 2017).

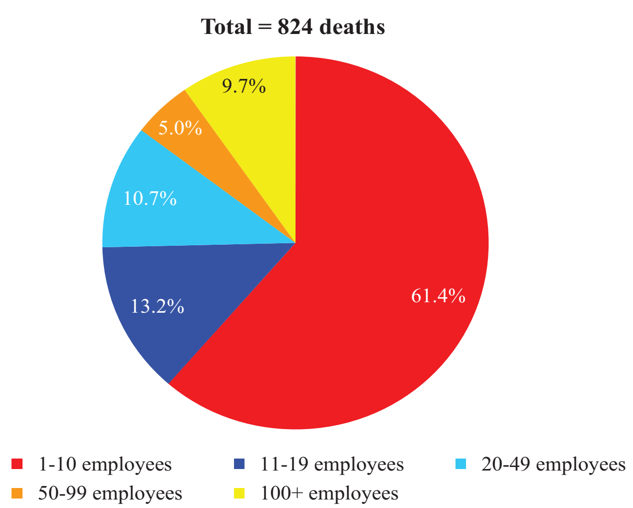
44b. **Fatal falls to a lower level in construction, by height of fall, 2011-2015 total**



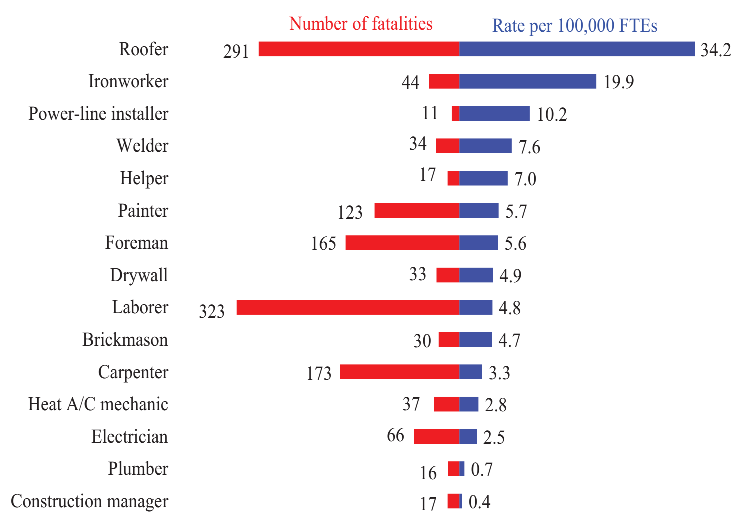
44c. **Fatal falls to a lower level in construction, by primary source, 2011-2015 total**



44d. **Distribution of fatalities from falls to a lower level in construction, by establishment size, 2011-2015 total (Wage-and-salary workers)**



44e. **Number and rate of work-related fatalities from falls to a lower level in construction, selected occupations, 2011-2015 total**



Note: Chart 44b – There were 239 deaths excluded due to lack of height information.
Charts 44b, 44c, and 44d – Totals may not add to 100% due to rounding.
Chart 44c – Other includes parts and materials, building, confined spaces, and other sources with numbers that do not meet BLS publication criteria.
Chart 44d – Deaths of self-employed workers and those without information on establishment size were excluded.

Source: Charts 44a, 44b, 44c, and 44e – Fatality numbers were obtained from the BLS through special requests. The views expressed here do not necessarily reflect the views of the BLS. Numbers of full-time equivalents (FTEs) were estimated from the Current Population Survey. Calculations by the CPWR Data Center.
Chart 44d – Fatality numbers were estimated from the Census of Fatal Occupational Injuries. This research was conducted with restricted access to the BLS data. The views expressed here do not necessarily reflect the views of the BLS.

Nonfatal Injuries from Falls in Construction

Nonfatal fall injuries resulting in days away from work (DAFW) among construction workers followed the overall trend of employment and fall fatalities in this industry (*see* pages 20 and 44). The number of DAFW fall injuries increased 21% in recent years, from 19,710 in 2011 to 23,860 in 2015 (chart 45a), accounting for 30% of the nonfatal injuries in construction in 2015 (*see* page 43). Falls on the same level increased faster than any other type of nonfatal fall injury, reaching 8,120 in 2015, a 49% increase over the 2011 level (5,460).

While the majority (96%) of fatal falls in construction were falls to a lower level (*see* page 44), slips, trips, and falls on the same level caused more than half (51%) of all nonfatal fall injuries in 2015. For nonfatal falls on the same level, slipping was the most common cause, leading to 3,980 injuries in 2015, accounting for one third (32.9%) of all nonfatal injuries in this category (chart 45b). For nonfatal injuries due to falls to a lower level, more than one-third (35.2%) were from a height of less than six feet (chart 45c).

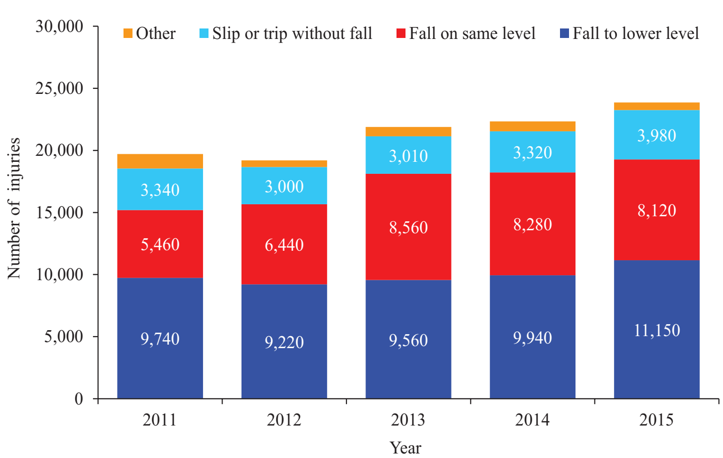
The risk of nonfatal falls varied among construction occupations. Helpers had the highest rate of nonfatal falls resulting in DAFW at 351.6 per 10,000 *full-time equivalent workers* (FTEs; *see* Glossary). The next highest occupations were power-line installers and sheet metal workers, respectively (chart 45d).

By age group, more nonfatal fall injuries occurred to workers between the ages of 35 and 44 than any other age group (29%; chart 45e). However, the rate of nonfatal fall injuries was highest among workers 55 years and older. More than 45 fall injuries per 10,000 FTEs occurred among workers ages 55 to 64 years, and more than 38 fall injuries per 10,000 FTEs occurred among workers ages 65 years and older.

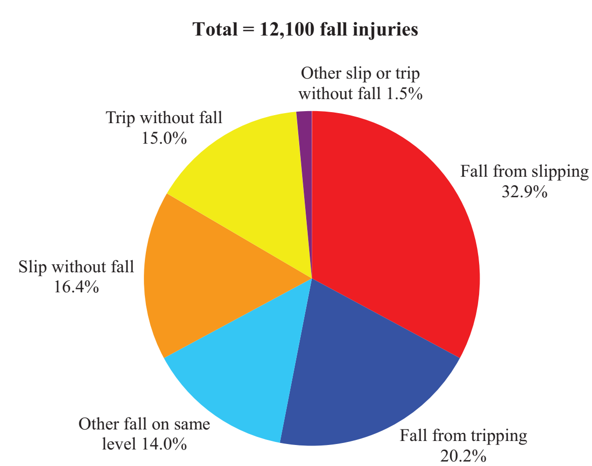
Effective fall protection is crucial to reduce fall injuries. OSHA requires employers to provide training to employees who may be at risk of falling. These training programs must teach employees how to recognize fall hazards and how to minimize risks by properly using the appropriate fall arrest systems and techniques.[1] Fall injuries can also be prevented through design features, such as slip-resistant flooring, planned pedestrian routes that are separated from moving machinery, and adequate lighting. Risk reduction activities may also include marking trip hazards, planning for inclement weather, providing education, and encouraging exercise and suitable footwear.[2]

Increasing public awareness of the risk of falls in construction is also important. In response to the staggering number of fall-related injuries and fatalities, the National Occupational Research Agenda (NORA) Construction Sector Council, NIOSH, OSHA, and CPWR have co-sponsored the National Fall Prevention Campaign since 2012. New findings from the National Safety Stand-Down, the major annual event associated with the fall prevention campaign, indicate that the campaign is reaching all construction subsectors, including small residential construction companies nationwide.[3]

45a. Number of nonfatal injuries due to falls, slips, and trips involving days away from work in construction, by cause, 2011-2015

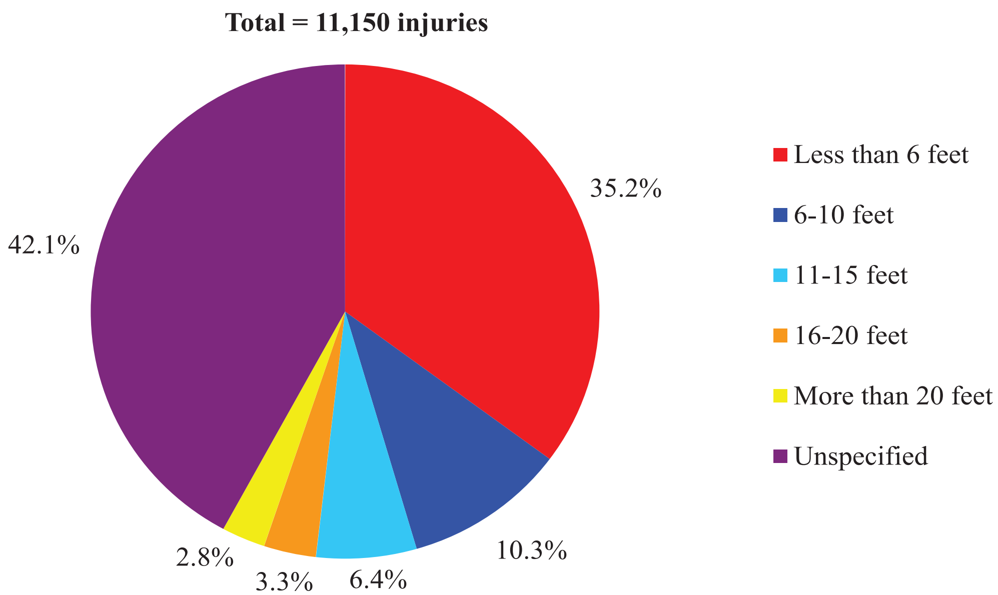


45b. Distribution of nonfatal injuries due to falls, slips, and trips on the same level resulting in days away from work in in construction, 2015

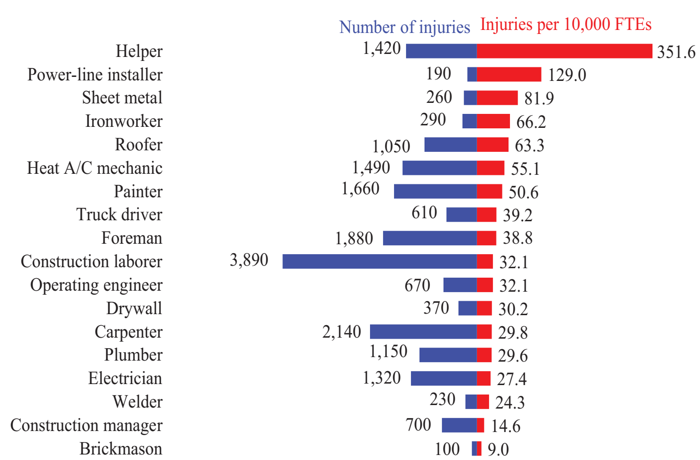


1. Occupational Safety and Health Administration. OSHA Fall Protection Training Requirements, https://legalbeagle.com/6689196-osha-fall-protection-training-requirements.html?ref=Track2&utm_source=IACB2B (Accessed November 2017).
2. Occupational Safety and Health Administration. 1995. Subpart M - Fall Protection: Duty to have fall protection, https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10757&p_table=STANDARDS (Accessed March 2017).
3. Dong XS, Wang X, Katz R, West G, Bunting J. 2017. Fall injuries and prevention in the construction industry. CPWR First Quarterly Data Report, https://www.cpwr.com/publications/first-quarter-fall-injuries-and-prevention-construction-industry (Accessed October 2017).

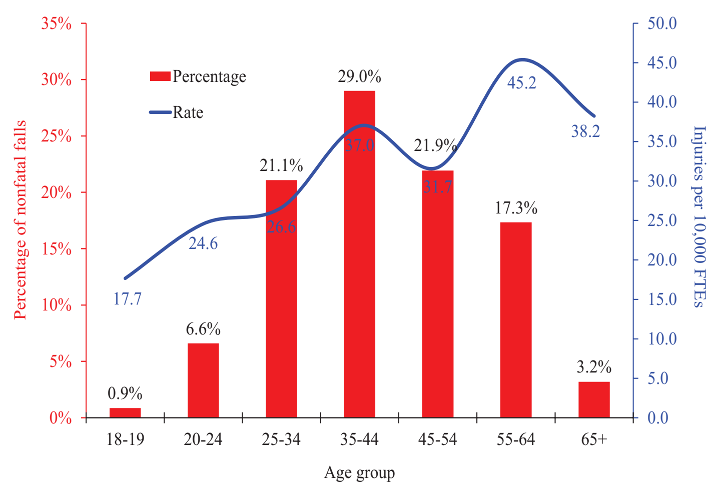
45c. Nonfatal injuries due to falls to a lower level resulting in days away from work in construction, by height of fall, 2015



45d. Number and rate of nonfatal injuries from falls resulting in days away from work, selected construction occupations, 2015



45e. Percentage and rate of nonfatal injuries from falls in construction, by age group, 2015



Note: Chart 45a – "Other" includes jump to a lower level; fall or jump curtailed by personal fall arrest system; fall, slip, trip, unspecified; and fall, slip, trip, not elsewhere classified.
Charts 45b and 45c – Total may not add to 100% due to rounding.
Charts 45d and 45e – Falls include injuries from slips and trips.
All Charts - Data cover private wage-and-salary workers only.

Source: Charts 45a-45c – U.S. Bureau of Labor Statistics. Survey of Occupational Injuries and Illnesses, http://www.bls.gov/iif/ (Accessed November 2017).
Charts 45d-45e – U.S. Bureau of Labor Statistics. 2015 Survey of Occupational Injuries and Illnesses. Numbers were obtained from the BLS through special requests (e-mail: IIFSTAFF@BLS.GOV). Numbers of FTEs were estimated using the Current Population Survey. Calculations by the CPWR Data Center.

Fatalities from Contact with Electricity in Construction

Electrocution is one of the leading causes of death in construction (*see* page 43). From 1992 to 2015, a total of 2,807 construction workers died from electrocution at job sites, accounting for nearly half (47%) of the overall work-related electrocution deaths (5,876) in the United States.[1] While both the number and rate have declined since 1992, the number of electrocution deaths in construction rose 24% from 66 in 2012 to 82 in 2015 (chart 46a). The death rate in 2015 was similar to 2012, with 0.8 deaths per 100,000 *full-time equivalent workers* (FTEs; *see* Glossary), less than half of the 1992 level.

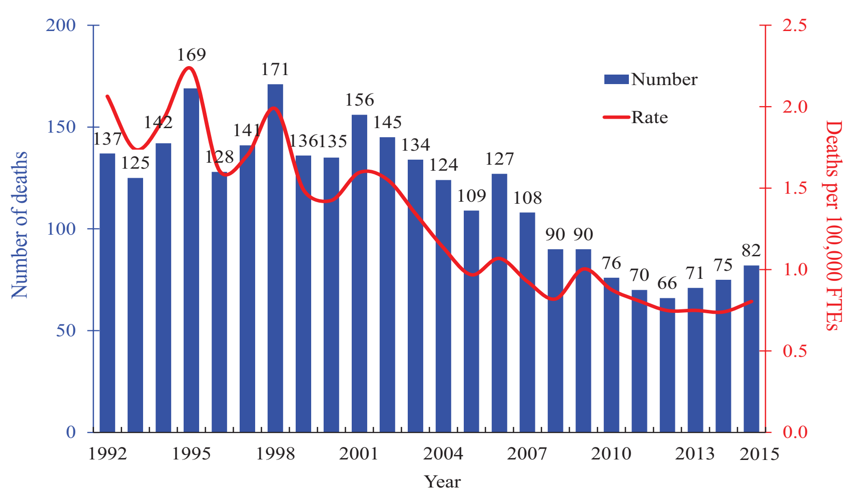
Between 2011 and 2015, electrocution deaths accounted for 8.3% (364 deaths) of all fatal injuries in construction.[1] Of these deaths, more than a third (36%; 131 deaths) were due to direct exposure to electricity greater than 220 volts (chart 46b). Including both direct and indirect exposure, exposure to electricity greater than 220 volts caused more than two-thirds of all electrocution deaths in construction during these five years (70%; 254 deaths).

The sources of electrocution deaths were quite different for electrical and non-electrical workers.[2] While electric parts (e.g., power lines, transformers) were responsible for 80% of electrocution deaths among electrical workers, energized equipment, machines, tools, or other sources caused the majority of electrocution deaths among non-electrical workers (chart 46c). Of the 189 deaths caused by electric parts in construction from 2011 to 2015, power-lines, transformers, and converters, as well as electrical wiring were the two major sources, responsible for 39% and 37% of such deaths, respectively (chart 46d).

Electricians experienced more fatalities due to electrocution than any other construction occupation, with 105 deaths from 2011 to 2015 (chart 46e). However, power-line installers had a much higher death rate from electrocution in construction, with 29.7 deaths per 100,000 FTEs. Although electrocution was more common among electrical workers, many electrocution deaths occurred among non-electricians, such as construction laborers, foremen, roofers, and other construction trades.

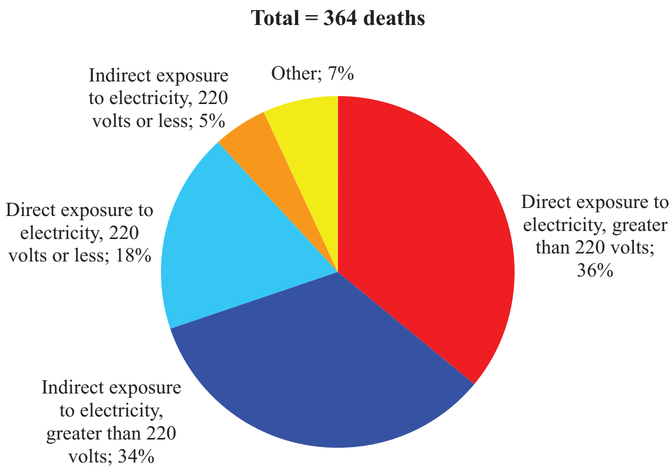
Electrocution is one of the leading four causes of death in the construction industry as identified by OSHA.[3] To reduce electrocutions, OSHA has developed training materials to help workers recognize major electrocution hazards at construction worksites, and understand their employer's responsibilities for protecting workers from workplace hazards.[4] Enhancement of electrical hazard awareness is critical to reduce construction worker electrocutions. CPWR's Hazard Alert on the topic is an excellent tool for reviewing electrical hazards for workers in every trade.[5] Providing appropriate equipment, including personal protective equipment (PPE), and conducting worksite hazard surveys are also important.[6] Strategic improvements to the design of structures, tools, facilities, equipment, machinery, products, substances, work processes, and the organization of work are essential to prevent occupational injuries, illnesses, and fatalities.[7]

46a. Number and rate of electrocution deaths in construction, 1992-2015

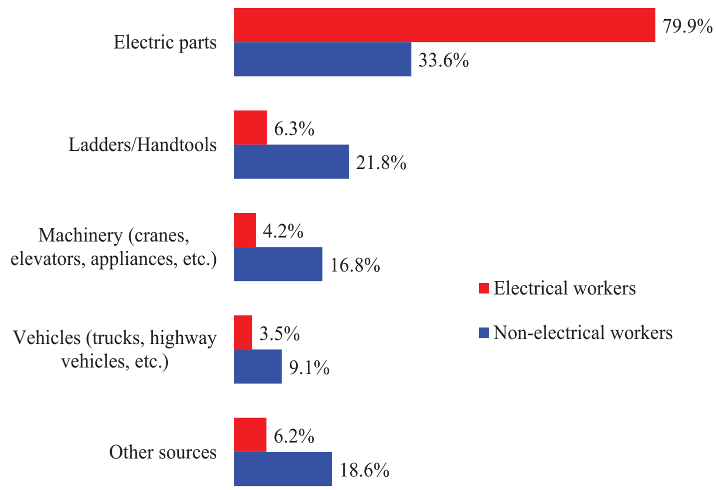


1. Electrocution deaths include "exposure to electricity" (event codes 51xxxx in OIICS 2.01) and "contact with electrical current" (event codes 31xxxx in OIICS 1.01). All numbers on this page were estimated from the Census of Fatal Occupational Injuries. This research was conducted with restricted access to U.S. Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS.
2. Electrical workers include electricians, power-line installers, and telecom-line installers, while non-electrical workers include all other occupations.
3. OSHA Training Institute. 2011. Construction focus four: Outreach training packet, https://www.osha.gov/dte/outreach/construction/focus_four/constrfocusfour_introduction.pdf (Accessed June 2017).
4. OSHA Training Institute. 2011. Construction focus four: Electrocution hazards, https://www.osha.gov/dte/outreach/construction/focus_four/electrocution/electr_ig.pdf (Accessed August 2017).
5. CPWR – The Center for Construction Research and Training. 2016. Hazard alert cards, http://www.cpwr.com/publications/hazard-alert-cards (Accessed June 2017).
6. Construction Safety Council. 2012. Health hazards in construction, https://www.osha.gov/dte/grant_materials/fy09/sh-19495-09/health_hazards_workbook.pdf (Accessed June 2017).
7. National Institute for Occupational Safety and Health. 2012. Prevention through Design, https://www.cdc.gov/niosh/topics/ptd/default.html (Accessed June 2017).

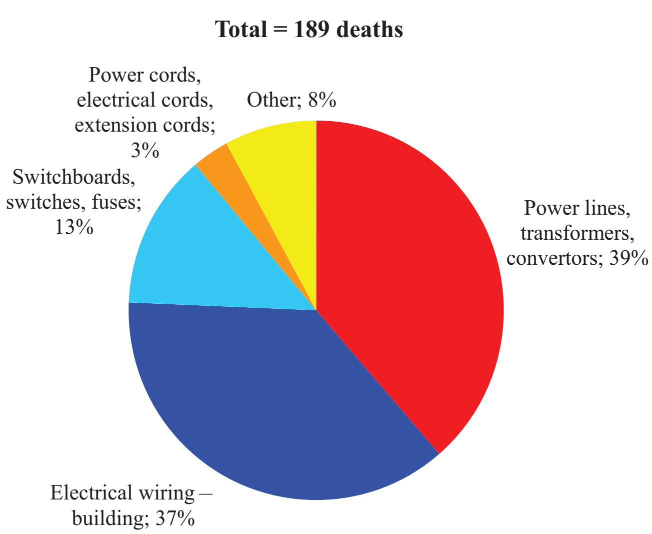
46b. Electrocution deaths in construction, by major event or exposure, 2011-2015 total



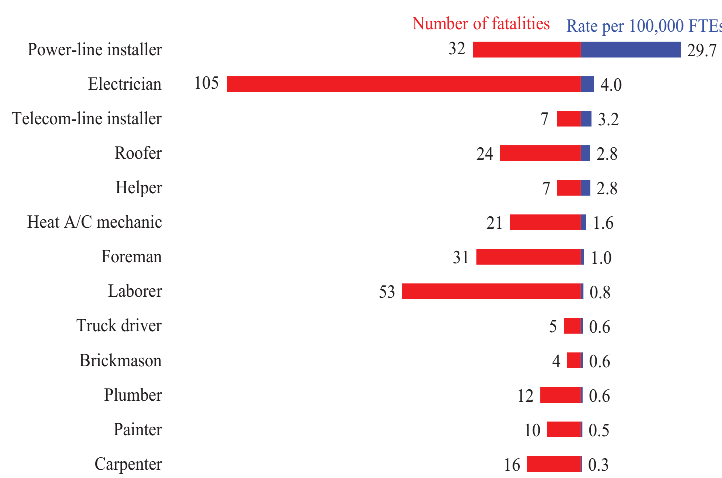
46c. Primary source of electrocution deaths in construction, electrical workers versus non-electrical workers, 2011-2015 total



46d. Electrocution deaths caused by electric parts in construction, by primary source, 2011-2015 total



46e. Number and rate of electrocution deaths in construction, selected construction occupations, 2011-2015 total



Note: All charts – Data cover all employment.
Chart 46b – Other includes unspecified cause or voltage.
Chart 46c – Other sources include containers, furniture, and fixtures; parts and materials; and other sources with numbers that do not meet BLS publication criteria.
Chart 46d – Other includes electric parts unspecified and not elsewhere classified.

Source: All charts – Fatality numbers were estimated from the Census of Fatal Occupational Injuries. This research was conducted with restricted access to U.S. Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS. Numbers of FTEs were obtained from the Current Population Survey. Calculations by the CPWR Data Center.

Fatalities at Road Construction Sites

Working at *road construction sites* (*see* Glossary) is dangerous. From 2003 to 2015, 1,166 construction workers died at road construction sites, about 90 deaths annually, accounting for approximately 9% of all construction fatalities each year (chart 47a).[1] Compared to other major industries, the construction industry experiences a larger burden of deaths at road construction sites. From 2011 to 2015, 429 fatal injuries at road construction sites occurred among construction workers, comprising 70% of all such deaths. This was six times higher than that in transportation, the industry with the second highest number of deaths at these sites (chart 47b).

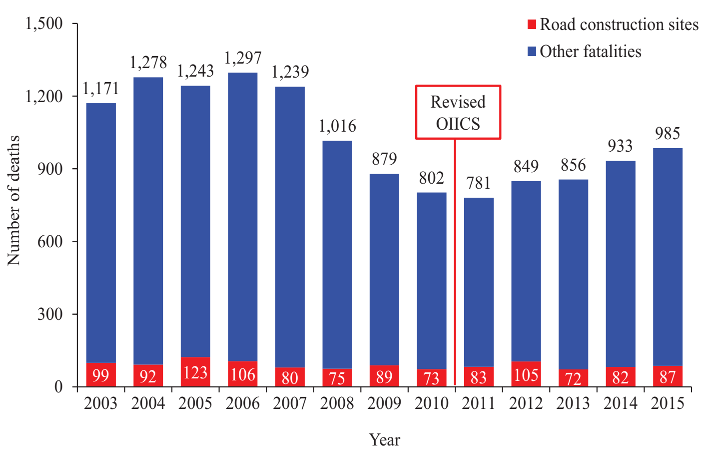
Workers at road construction sites can be involved in a variety of injury *events* (*see* Glossary). Between 2011 and 2015, more than half (52.2%) of road construction deaths were pedestrian vehicular incidents where a worker was struck by a vehicle or mobile equipment (chart 47c). Another 12.6% of road construction fatalities were roadway incidents involving a worker who was operating a vehicle at the time of incident.

Trucks were the top *source* (*see* Glossary) of deaths at road construction sites. Between 2011 and 2015, trucks were involved in nearly one-quarter of fatal injuries at road construction sites (23.5%; chart 47d). Passenger vehicles (including automobiles, buses, and passenger vans) were the next most common source, causing 17.5% of construction fatalities at those sites, followed by multipurpose highway vehicles (such as pick-up trucks and SUVs; 16.6%).

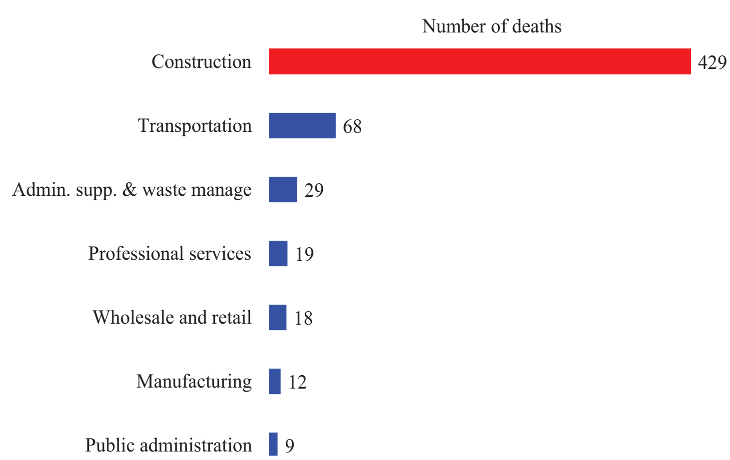
Construction workers exposed to hazards at road construction sites include not only those engaged in road construction work, but also those working in road maintenance and utilities management (e.g., electricity, communications, water, and gas). From 2011 to 2015, 309 workers in the Highway, Street, and Bridge subsector (NAICS 2373) were killed at road construction sites, accounting for 72% of all road construction fatalities during these years. The Utility System Construction subsector (NAICS 2371) ranked second in road construction deaths among construction subsectors (chart 47e). By occupation, 136 construction laborers were fatally injured at road construction sites between 2011 and 2015, more than any other occupation in construction (chart 47f). Highway maintenance workers and foremen also experienced an elevated number of deaths during this time.

According to OSHA, during the peak construction season, approximately 20% of the nation's highway system is under construction with more than 3,000 work zones.[2] As the highway infrastructure in this country ages, rebuilding and improving existing roadways will be more frequent than before.[3] To prevent injuries and fatalities at road construction sites, OSHA and NIOSH offer safety training materials and intervention information for workers and employers.[4,5] Select safety solutions are also available at the CPWR Construction Solution Database, NIOSH Motor Vehicle Safety at Work, and the National Work Zone Safety Information Clearinghouse. Moreover, worker safety and road user accessibility should be an integral and high priority aspect of every road project from design to construction.[6]

47a. Number of fatalities in construction, road construction sites and other fatalities, 2003-2015

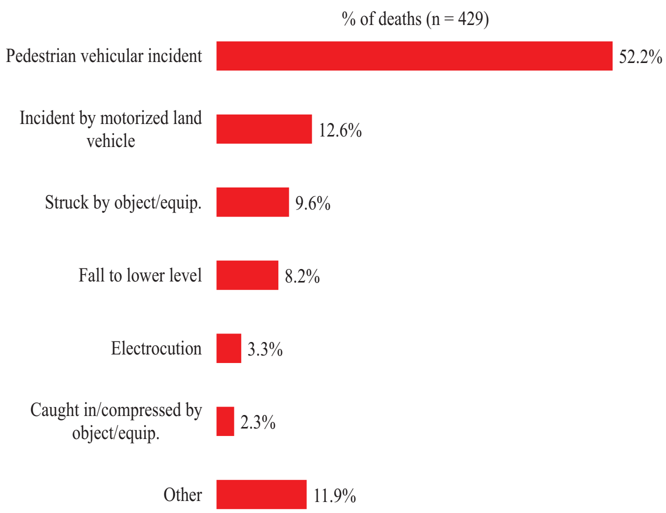


47b. Fatal injuries at road construction sites, by major industry, 2011-2015 total

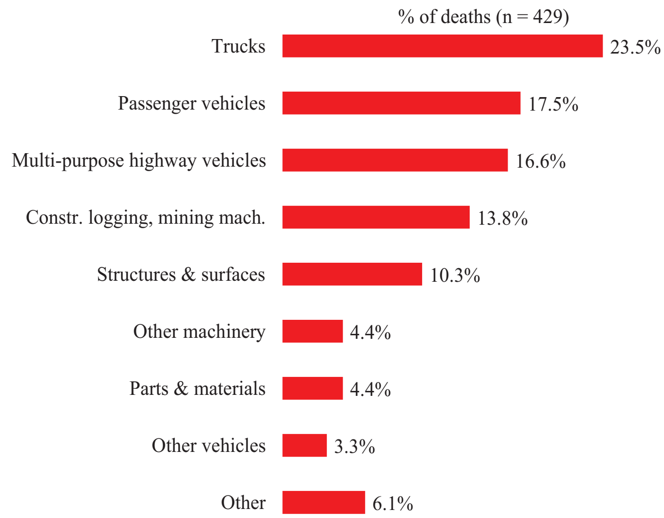


1. Fatality numbers were estimated from the Census of Fatal Occupational Injuries. This research was conducted with restricted access to the U.S. Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS. Calculations by the CPWR Data Center.
2. Construction Safety Council. 2008. Work zone hazards workbook, https://www.osha.gov/dte/grant_materials/fy08/sh-17795-08/workzone_hazards_awareness_english.pdf (Accessed November 2017).
3. American Society of Civil Engineers, https://www.asce.org/ (Accessed November 2017).
4. Occupational Safety and Health Administration. Highway work zones and signs, signals, and barricades, https://www.osha.gov/doc/highway_workzones (Accessed November 2017).
5. National Institute for Occupational Safety and Health. 2017. Highway work zone safety, https://www.cdc.gov/niosh/topics/highwayworkzones/ (Accessed July 2017).
6. U.S. Department of Transportation, Federal Highway Administration. 2009 Edition Chapter 6B, Fundamental principles. Section 6B.01 Fundamental principles of temporary traffic control, https://mutcd.fhwa.dot.gov/pdfs/millennium/pr2/6br2.pdf. (Accessed November 2017).

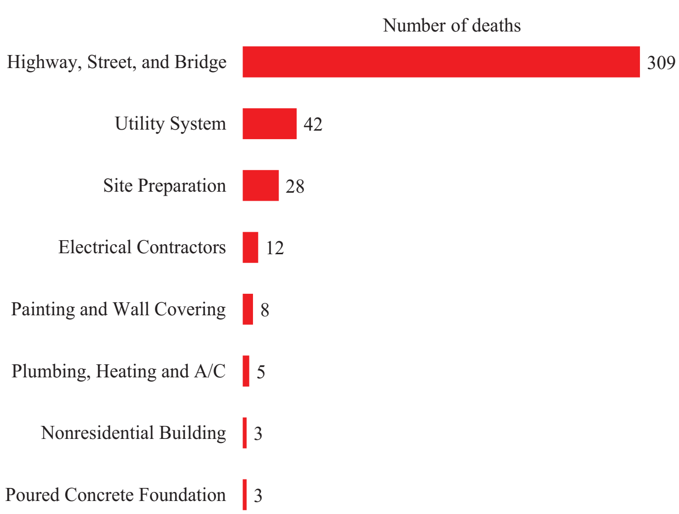
47c. Fatal injuries at road construction sites, by event or exposure, 2011-2015 total



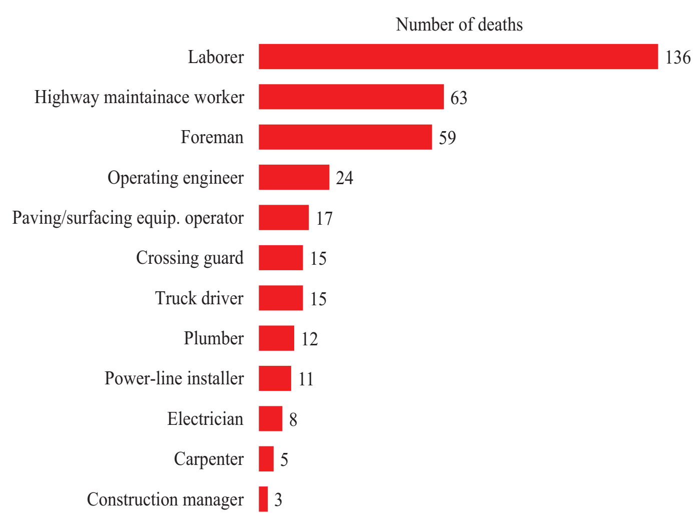
47d. Fatal injuries at road construction sites, by primary source, 2011-2015 total



47e. Fatal injuries at road construction sites, selected construction subsectors, 2011-2015 total



47f. Fatal injuries at road construction sites, selected occupations, 2011-2015 total



Note: All charts – Data cover all employment.
Chart 47a – Other fatalities are fatalities from all causes except at road construction sites.
Chart 47b – Admin. supp. & waste manage: Administrative and Support and Waste Management and Remediation Services (NAICS 56).
Chart 47c – Other includes intentional injuries by person; exposure to temperature extremes; and other event or exposure with numbers that do not meet BLS publication criteria.
Chart 47d – Multi-purpose highway vehicles includes vehicles that can be used either for transport of passengers or of goods and materials as their primary function. Other includes sources with numbers that do not meet BLS publication criteria.

Source: All charts – Fatality numbers were estimated from the Census of Fatal Occupational Injuries. This research was conducted with restricted access to the U.S. Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS. Calculations by the CPWR Data Center.

Musculoskeletal Disorders in Construction and Other Industries

Work-related *musculoskeletal disorders* (WMSDs, *see* MSDs in Glossary) in construction decreased dramatically in the past decades, similar to the overall injury trend (*see* page 38). Both the number and rate of WMSDs resulting in days away from work (DAFW) dropped to a record low in 2014, even lower than the recession-related dip in 2010 (chart 48a). Although WMSDs in construction slightly increased in 2015, the number of cases (20,510) was less than 40% of the level in 1992, and the rate (34.6 per 10,000 full-time equivalent workers; *see* FTEs in Glossary) was 25% of the 1992 level. Despite the reduction, the rate of WMSDs in construction was still 16% higher than the rate of 29.8 per 10,000 FTEs for all industries combined in 2015.[1] These numbers may be underestimated due to a variety of factors (*see* pages 40 and 41).[2]

The back remains the primary body part affected by WMSDs in construction, although its proportion of the WMSD cases decreased modestly from 48% in 2011 to 43% in 2015 (chart 48b). WMSDs from shoulder injuries increased marginally from 12% to 16% over the same period.

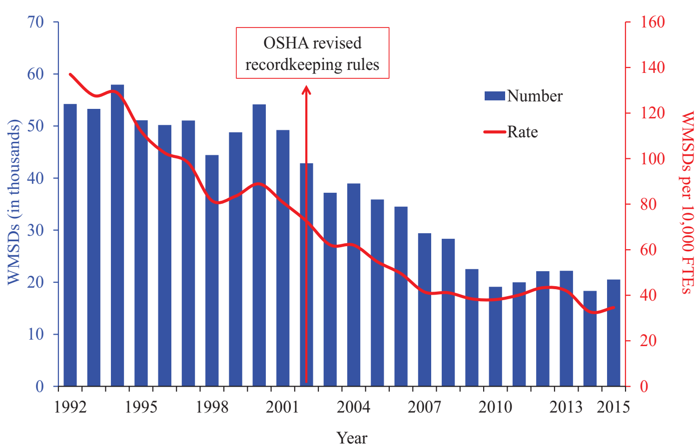
Overexertion (*see* Glossary) is not only a major cause of WMSDs, but also a leading cause of overall nonfatal injuries in construction (*see* page 43). In 2015, overexertion from lifting and lowering caused 30% of the WMSDs among construction workers (chart 48c). Other types of overexertion involving pushing, pulling, holding, carrying, and catching caused an additional 37% of WMSDs.

The rate of injuries from overexertion in lifting was 10.6 per 10,000 FTEs in construction, higher than all industries on average (chart 48d). By construction subsector, the rate of overexertion injuries among Finish Carpentry Contractors (NAICS 23835) and Tile and Terrazzo Contractors (NAICS 23834) was 52% higher than that for all construction (56.1 versus 37.0 per 10,000 FTEs; chart 48e). Residential Building Construction (NAICS 2361) also had a high rate of overexertion injuries at 47.1 per 10,000 FTEs.

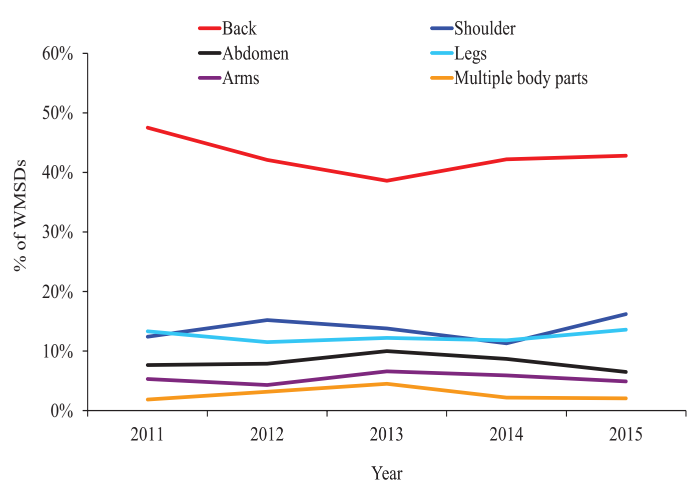
About 65% of WMSDs in construction were related to sprains, strains, and tears (chart 48f). Such injuries may develop into chronic conditions and permanent disabilities.[3,4] Task-specific ergonomic innovations to reduce physical workload are important to mitigate the risk of WMSDs and to facilitate sustained employment,[3-6] such as the revised NIOSH Lifting Equation (RNLE).[6] Information on ergonomic solutions and ideas are also available at the Construction Solutions database, CPWR Ergonomics Handouts, and CPWR Ergonomics Toolbox Talks.

Many available tools and technologies can reduce the risk of WMSDs, but barriers to adoption exist such as costs, uncertain return on investment, solutions not suitable for small jobs, lack of related knowledge, etc.[7] Factors that would improve the adoption of ergonomic interventions include the involvement and appropriate training of all affected stakeholders, changes in work systems and design, and safety culture.[7]

48a. Number and rate of work-related musculoskeletal disorders in construction, 1992-2015

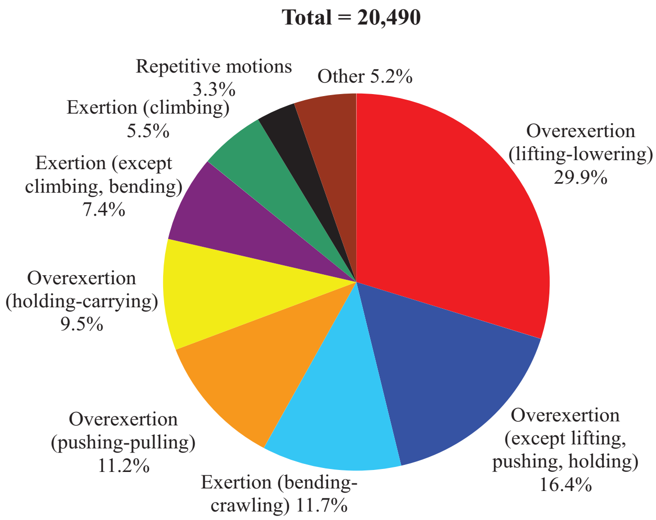


48b. Work-related musculoskeletal disorders in construction, by body part, 2011-2015

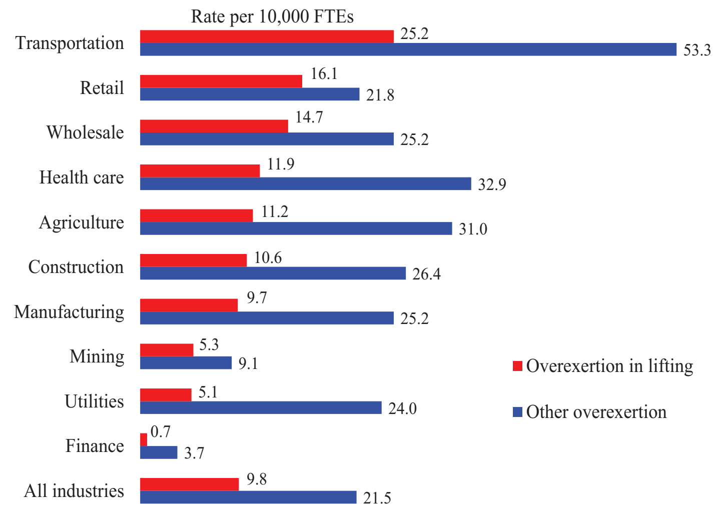


1. U.S. Bureau of Labor Statistics. 2015 Survey of Occupational Injuries and Illnesses, http://www.bls.gov/data/#injuries (Accessed July 2017).
2. Wang X, Dong XS, Choi S, Dement J. 2017. Work-related musculoskeletal disorders among construction workers in the United States from 1992 to 2014. Occupational and Environmental Medicine, 74(5): 374-380.
3. West GH, Dawson J, Teitelbaum C, Novello R, Hunting K, Welch LS. 2016. An analysis of permanent work disability among construction sheet metal workers. American Journal of Industrial Medicine, 59(3): 186-195.
4. Marcum J, Adams D. 2017. Work-related musculoskeletal disorder surveillance using the Washington state workers' compensation system: Recent declines and patters by industry, 1999-2013. American Journal of Industrial Medicine, 60(5): 457-471.
5. Kumar P, Agrawal S, Kumari P. 2016. Ergonomics methods to improve safety in construction industry. International Research Journal of Engineering and Technology, 3(8): 680-683.
6. National Institute for Occupational Safety and Health (NIOSH). Musculoskeletal Health Program. Success story: Revised NIOSH lifting equation, https://www.cdc.gov/niosh/programs/msd/impact.html (Accessed July 2017).
7. Dale AM, Jaegers L, Welch L, Barnidge E, Weaver N, Evanoff BA. 2017. Facilitators and barriers to the adoption of ergonomic solutions in construction. American Journal of Industrial Medicine, 60(3): 295-305.

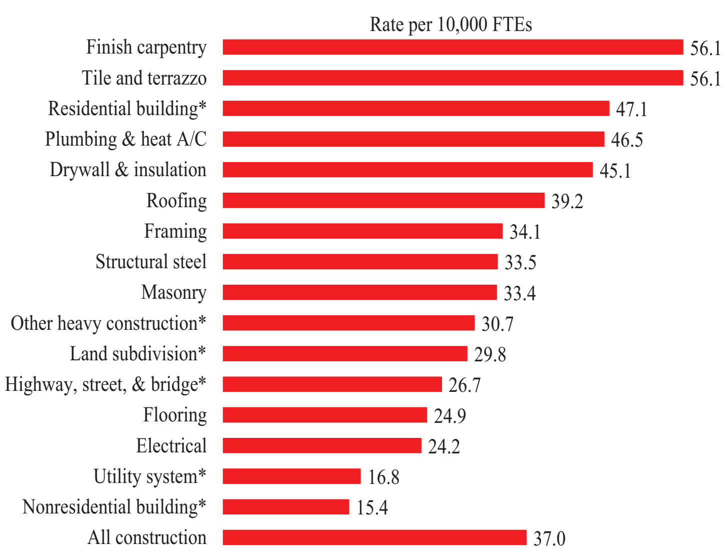
48c. **Distribution of risk factors for work-related musculoskeletal disorders resulting in days away from work in construction, 2015**



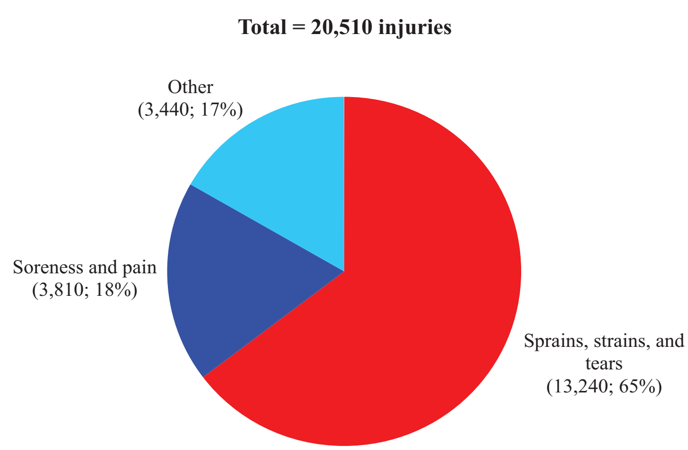
48d. **Rate of overexertion injuries resulting in days away from work, selected industries, 2015**



48e. **Rate of overexertion injuries resulting in days away from work, selected construction subsectors, 2015**



48f. **Work-related musculoskeletal disorders resulting in days away from work in construction, by nature of injury, 2015**



Note: All charts – Data cover private wage-and-salary workers only.
Chart 48c – Totals may not add to 100% due to rounding. Other includes multiple types of overexertions and bodily reactions, and not elsewhere classified overexertion, bodily reaction, and exertion.
Chart 48e – An asterisk (*) represents four-digit NAICS codes; the remaining are five-digit NAICS codes.
Chart 48f – Other includes carpal tunnel syndrome, tendonitis, and other nature with numbers that do not meet BLS publication criteria.

Source: Charts 48a and 48b – U.S. Bureau of Labor Statistics. 1992-2015 Survey of Occupational Injuries and Illnesses. Data were obtained from the BLS by special requests (e-mail: IIFSTAFF@BLS.GOV). Calculations by the CPWR Data Center.
Charts 48c and 48f – U.S. Bureau of Labor Statistics. 2015 Survey of Occupational Injuries and Illnesses. Data were obtained from the BLS by special requests (e-mail: IIFSTAFF@BLS.GOV). Calculations by the CPWR Data Center.
Charts 48d and 48e – U.S. Bureau of Labor Statistics. 2015 Survey of Occupational Injuries and Illnesses, http://www.bls.gov/iif/ (Accessed July 2017).

Back Injuries in Construction and Other Industries

Workers in many construction occupations frequently perform activities that can lead to back problems (*see* page 33) and work-related musculoskeletal disorders (*see* page 48). In 2015, back injuries alone accounted for almost 17% of nonfatal injuries resulting in days away from work (DAFW) in construction according to data collected by the U.S. Bureau of Labor Statistics (BLS; chart 49a).[1]

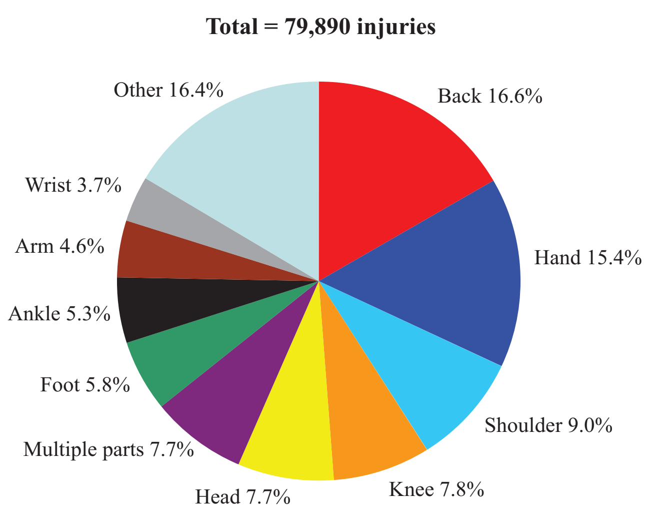
The number of reported back injuries has declined considerably over the past two decades. In 2003, there were about 31,560 back injuries among construction workers reported to the BLS, but slightly more than 13,000 such cases in 2015 – a 58% decrease (chart 49b). The rate of back injuries has also declined over time, dropping 58% between 2003 and 2015, from 52.7 injuries per 10,000 *full-time equivalent workers* (FTEs, *see* Glossary) to a rate of 22.3 injuries per 10,000 FTEs. Even so, construction workers still had a higher rate of back injuries in 2015 than in all industries combined (22.3 versus 16.2 per 10,000 FTEs), and the fourth highest rate among major industry groups (chart 49c).

The risk of back injuries varies among construction subsectors. Tile and terrazzo contractors reported the highest rate of back injuries (54.9 per 10,000 FTEs; chart 49d) in 2015, followed by roofing contractors (42.8 per 10,000 FTEs). This may be a result of their exposure to lifting and carrying materials, bending and twisting of the body, and making repetitive motions in performing work tasks (*see* page 33).

Estimates based on self-reported data suggest that the true prevalence of back disorders may be significantly higher than the numbers reported by BLS. In a 2015 household survey, more than one-third of construction workers reported experiencing "back pain during the previous three months," with the highest rate among those 55 years and older (chart 49e). While it is unclear whether such back problems were related to a worker's job according to this survey, a longitudinal study found that construction workers who were once injured at work were twice as likely to report back pain and joint pain compared to those who had never been injured in a ten-year follow-up.[2] Research also shows that older construction workers who have severe low back pain are more likely than other workers to leave the industry due to disability.[3]

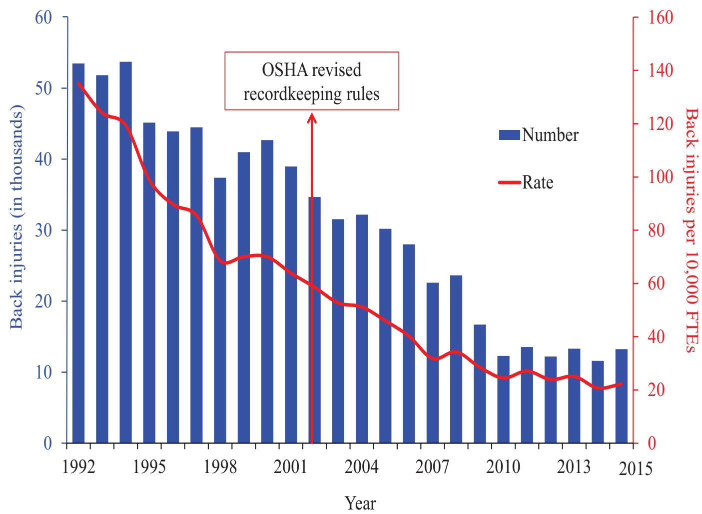
Back problems are costly. Low back and neck pain accounted for the third-highest amount of the personal health care spending total in the United States, with an estimate of $87.6 billion in 2013.[4] Identified ergonomic solutions, such as increased use of mechanical handling devices and optimizing lifting height wherever possible, are the primary methods of reducing exposure to risk factors associated with back injuries and musculoskeletal disorders (*see* page 48).[5,6]

49a. Distribution of nonfatal injuries resulting in days away from work in construction, by body part, 2015 (Private wage-and-salary workers)

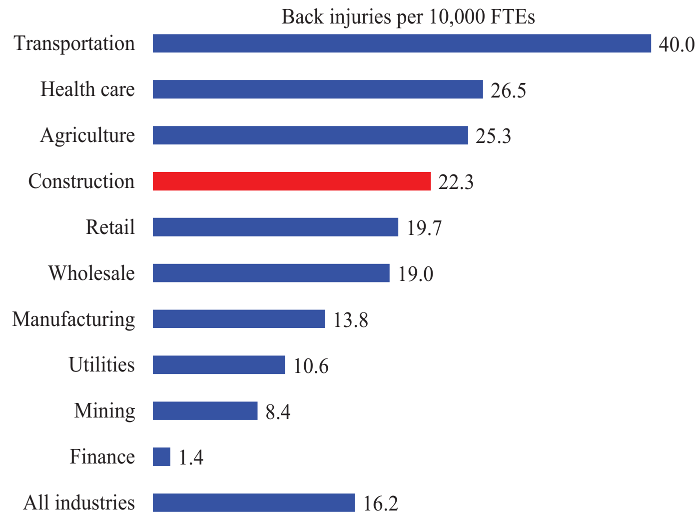


1. U.S. Bureau of Labor Statistics. Occupational Injury and Illness Classification Manual, Section 2: Definitions, rules of selection, and titles and descriptions, https://www.bls.gov/iif/osh_oiics_2010_2.pdf. The BLS defines back injuries as related to the posterior part of the trunk that is bounded by the neck and pelvis. Includes: cartilage, muscles, nerves, and neuroglia of the spine and spinal cord (except cervical); tendons, veins, and arteries of the back; and vertebra (backbone) and discs (except cervical). Excludes: neck or cervical vertebrae (C1 - C7); and cervical spine and/or cervical discs.
2. Dong XS, Wang X, Largay JA, Sokas R. 2015. Long-term health outcomes of work-related injuries among construction workers—Findings from the National Longitudinal Survey of Youth. American Journal of Industrial Medicine, 58: 308–318.
3. West G, Dawson J, Teitelbaum C, Novello R, Hunting K, Welch L. 2016. An analysis of permanent work disability among construction sheet metal workers. American Journal of Industrial Medicine, 59(3): 186-195.
4. Dieleman JL, Baral R, Birger M, et al. 2016. U.S. spending on personal health care and public health, 1996-2013. JAMA, 316(24): 2627-2646.
5. Ngo B, Yazdani A, Carlan N, Wells R. 2017. Lifting height as the dominant risk factor for low-back pain and loading during manual materials handling: A scoping review. IISE Transactions on Occupational ergonomics and Human Factors, 5(3-4):158-71.
6. Kincl LD, Anton D, Hess JA, Weeks DL. 2016. Safety voice for ergonomics (SAVE) project: Protocol for a workplace cluster-randomized controlled trial to reduce musculoskeletal disorders in masonry apprentices. BMC Public Health, 16: 362.

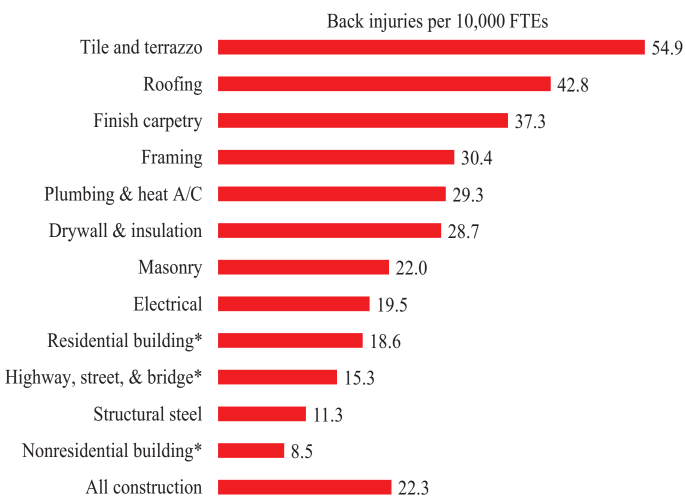
49b. Number and rate of back injuries resulting in days away from work in construction, 1992-2015 (Private wage-and-salary workers)



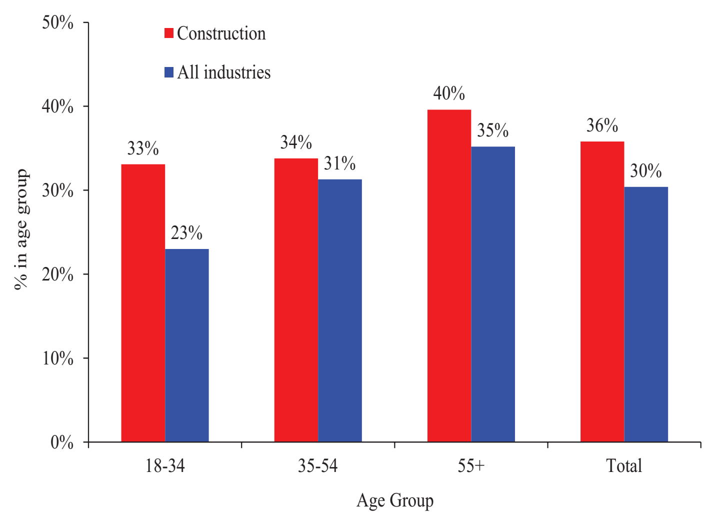
49c. Rate of back injuries resulting in days away from work, selected industries, 2015 (Private wage-and-salary workers)



49d. Rate of back injuries resulting in days away from work, by construction subsector, 2015 (Private wage-and-salary workers)



49e. Rate of self-reported back pain among construction workers, by age group, 2015 (All employment)



Note: Chart 49a – Total may not add to 100% due to rounding. Other includes neck, body system, and other parts with numbers that do not meet BLS publication criteria.
Chart 49b – OSHA revised the requirements for recording injuries and illnesses in 2002. Therefore, data prior to 2002 may not be directly comparable to data from 2002 forward.
Chart 49d – An asterisk (*) represents four-digit NAICS codes; the remaining are five-digit NAICS codes.

Source: Chart 49a – U.S. Bureau of Labor Statistics. 2015 Survey of Occupational Injuries and Illnesses, Table R2, https://www.bls.gov/iif/oshwc/osh/case/ostb4754.pdf (Accessed July 2017).
Chart 49b – U.S. Bureau of Labor Statistics. 1992-2015 Survey of Occupational Injuries and Illnesses, http://www.bls.gov/data/#injuries (Accessed July 2017).
Charts 49c and 49d – U.S. Bureau of Labor Statistics. 2015 Survey of Occupational Injuries and Illnesses, Table R6, https://www.bls.gov/iif/oshwc/osh/case/ostb4758.pdf (Accessed July 2017).
Chart 49e – National Center for Health Statistics. 2015 National Health Interview Survey. Calculations by the CPWR Data Center.

Noise-Induced Hearing Loss in Construction and Other Industries

Every year, thousands of construction workers suffer hearing loss from excessive noise exposure on the job. *Noise-induced hearing loss* (NIHL; *see* Glossary) affects workers' quality of life and increases the risk of injury – for instance, when a worker cannot hear approaching vehicles or warning signals.[1] The U.S. Occupational Safety and Health Administration (OSHA) set the *permissible exposure limit* (PEL; *see* Glossary) for construction noise to 90 *A-weighted decibels* (dBA; *see* Glossary) over an eight-hour period.[2] However, NIHL often results from extended exposure to sound levels at or above 85 dBA, and can even occur at lower exposure levels.[3] The National Institute for Occupational Safety and Health (NIOSH) *recommended exposure level* (REL; *see* Glossary) is 85 dBA for an eight-hour period,[4] but noise exposure in construction may exceed this standard (*see* page 32).

Even if employees experience noise levels at or above OSHA's PEL, employers have no obligation to test workers' hearing (audiometric testing) on job sites.[5] As a result, hearing loss among construction workers is rarely recognized as work-related. From 2011 to 2015, the U.S. Bureau of Labor Statistics (BLS) reported only 900 cases of NIHL in construction through the Survey of Occupational Injuries and Illnesses,[6] and the rate was just 0.1 per 10,000 *full-time equivalent workers* in 2015 (FTEs; *see* Glossary; chart 50a). These numbers are too small for a valid conclusion.

In spite of this, according to the 2015 National Health Interview Survey (NHIS), a large household survey in the U.S., at least one in five (20.4%) construction workers reported some *hearing trouble* (*see* Glossary), 30% higher than that for all industries combined (15.7%; chart 50b). Yet, information about whether hearing loss was induced by the respondent's job is unavailable in the current NHIS data.

To develop a national surveillance system for occupational hearing loss, NIOSH has collected millions of de-identified audiograms from thousands of workplaces across the nation.[7] The results from the NIOSH database indicate that construction workers have the highest prevalence of hearing loss of any industry except for mining. Among construction workers tested between 2003 and 2012, 16.3% had *hearing impairment* (*see* Glossary) compared to 12.9% among all industries (chart 50c). It is estimated that hearing loss leads to more than three *disability-adjusted life years* (DALYs; *see* Glossary) per 1,000 construction workers, the second highest among all industries (chart 50d).

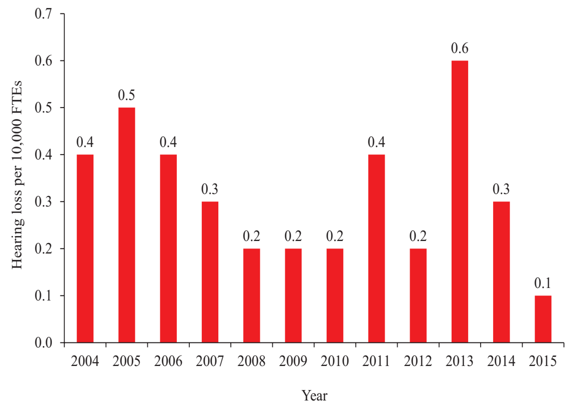
Hearing loss increases with age. Among construction workers ages 18-25 years surveyed by NIOSH, over 98% had no hearing impairment. However, among those ages 56-65 years, nearly half had some hearing impairment (chart 50e).

Hearing loss varies by occupation. Findings from the Building Trades National Medical Screening Program (BTMed), which examined construction workers with an average of more than 20 years of occupational exposure, show that over 58% of construction workers examined between 1996 and 2015 had *material hearing impairment* (1998 NIOSH definition, *see* Glossary); among welders, it was 77% (chart 50f).

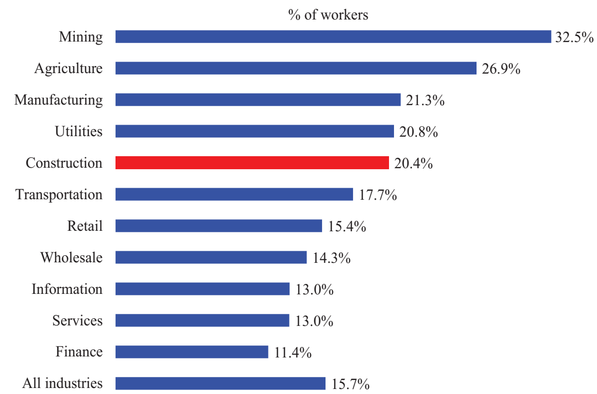
Under most circumstances, NIHL is preventable. Research suggests that hearing protection in construction can and should be improved through education, training, quieter tools, and predictive analytics.[8] For example, encouraging construction workers to use the NIOSH Sound Level Meter App can raise their awareness about noise hazards in the work environment.[9] Moreover, integrating hearing protection devices (HPD) training into multi-component construction interventions has proven effective, resulting in substantial improvement in the use of HPD among participants.[10]

1. Masterson E, Themann C, Luckhaupt S, Li J, Calvert G. 2016. Hearing difficulty and tinnitus among U.S. workers and non-workers in 2007. American Journal of Industrial Medicine, 59(4): 290-300.
2. Occupational Safety and Health Administration. Safety and Health Regulations for Construction, Part 1926, http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10625 (Accessed September 2017).
3. Better Hearing Institute, http://www.betterhearing.org/ (Accessed September 2017).
4. National Institute for Occupational Safety and Health. Noise and hearing loss prevention, https://www.cdc.gov/niosh/topics/noise/default.html (Accessed September 2017).
5. Masterson E, Bushnell P, Themann C, Morata T. 2016. Hearing impairment among noise-exposed workers-United States, 2003-2012. Morbidity and Mortality Weekly Report (MMWR), 65(15): 389-394.
6. U.S. Bureau of Labor Statistics. 2011-2015 Survey of Occupational Injuries and Illnesses, https://www.bls.gov/iif/oshsum.htm (Accessed September 2017).
7. National Institute for Occupational Safety and Health. Occupational hearing loss surveillance, https://www.cdc.gov/niosh/topics/ohl/status.html (Accessed September 2017).
8. Schneider S. 2016. Preventing hearing loss in construction in the USA: Challenges and opportunities. Acoustics Australia, 44(1): 83-85.
9. National Institute for Occupational Safety and Health. Noise and hearing loss prevention: NIOSH sound level meter app, https://www.cdc.gov/niosh/topics/noise/app.html (Accessed September 2017).
10. Royster J. 2017. Preventing noise-induced hearing loss. North Carolina Medical Journal, 78(2): 113-117.

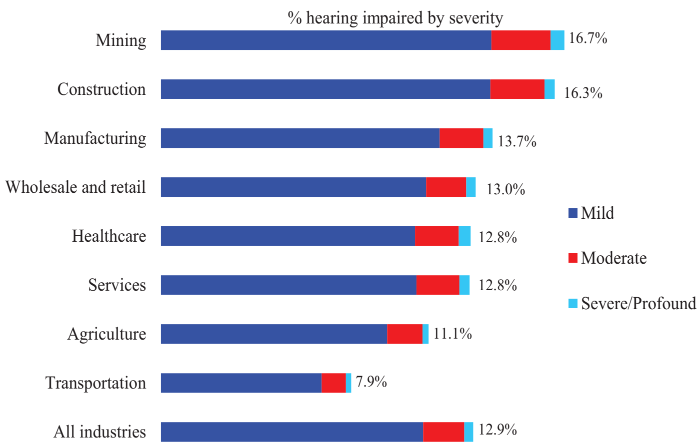
50a. Rate of hearing loss in construction, 2004-2015 (Private wage-and-salary workers)



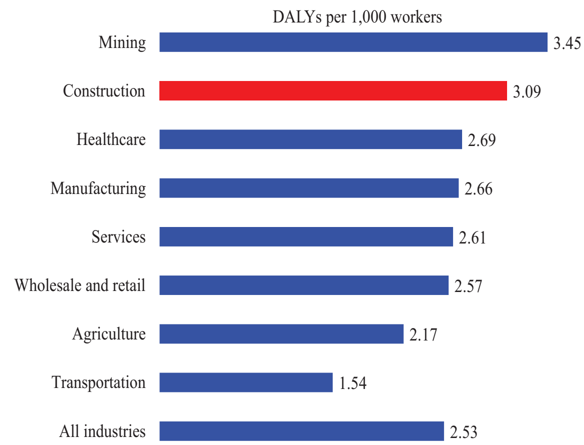
50b. Percentage of workers with self-reported hearing trouble, by industry, 2015 (All employment)



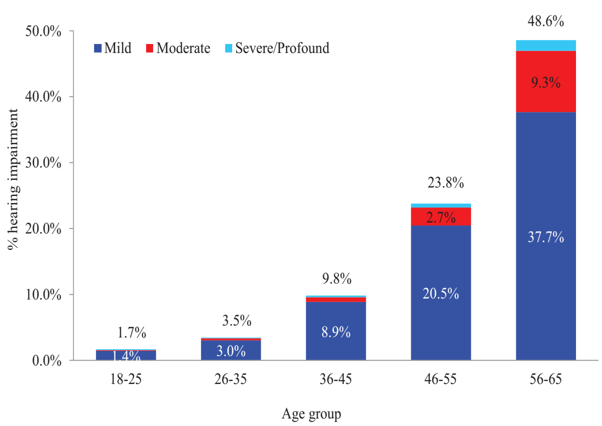
50c. Percentage of workers with hearing impairment, by major industry and severity, 2003-2012



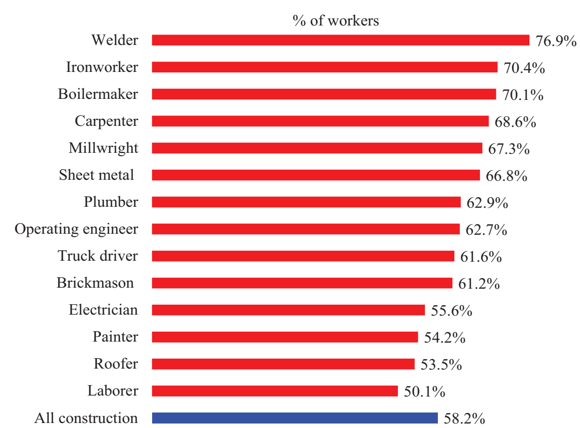
50d. Rate of disability-adjusted life years (DALYs) due to hearing impairment, by major industry, 2003-2012



50e. Proportion of construction workers with hearing impairment, by age and severity, 2003-2012



50f. Prevalence of noise-induced material hearing impairment, selected occupations in construction, 1996-2015



Note: Charts 50c and e – Normal hearing is defined as a threshold of less than 20 decibels; mild impairment: 20-34 decibels; moderate: 35-49; severe: 50-64; profound: 65+.

Source: Chart 50a – U.S. Bureau of Labor Statistics. 2004-2015 Survey of Occupational Injuries and Illnesses, https://www.bls.gov/iif/oshsum.htm (Accessed August 2017).
Chart 50b – National Center for Health Statistics. 2015 National Health Interview Survey. Calculations by the CPWR Data Center.
Charts 50c and 50d – Masterson E, Bushnell P, Themann C, Morata T. 2016. Hearing impairment among noise-exposed workers - United States, 2003-2012. Table 3. Morbidity and Mortality Weekly Report (MMWR), 65(15): 389-394.
Chart 50e – National Institute for Occupational Safety and Health. Occupational Hearing Loss (OHL) Worker Surveillance Data. Calculations by the CPWR Data Center.
Chart 50f – BTMed disease prevalence: Exams completed through 2015. Contact: John Dement, Duke University Medical Center.

Respiratory Diseases in the Construction Industry

Occupational exposures encountered by construction workers (*see* page 35) can cause many kinds of lung diseases. For example, exposure to respirable crystalline silica and asbestos can lead to an interstitial lung disease that causes damage and fibrosis in lung tissue (called silicosis or asbestosis); chronic obstructive pulmonary disease (COPD), such as chronic bronchitis and emphysema; and lung cancer. Exposures in construction can also cause or exacerbate asthma. In 2015, the U.S. Bureau of Labor Statistics (BLS) reported about 500 nonfatal work-related "respiratory conditions" among the nation's 6.5 million wage-and-salary construction workers in the private sector.[1] This figure is believed to be a vast underestimation since work-relatedness of such illnesses is often difficult to establish due to long latency periods after exposure. Also, the connection between work exposures and the development of diseases like asthma is often overlooked.

Using chest x-rays to screen construction workers for interstitial lung disease, the Building Trades National Medical Screening Program (BTMed, *see* page 50) found that among former construction workers at U.S. Department of Energy (DOE) nuclear sites, 16.5% had an abnormal chest x-ray (chart 51a). For asbestos workers, the rate was more than double the overall average (33.7%).[2]

The BTMed pulmonary function test also found that nearly 40% of construction workers in the program had abnormal lung function (obstruction, restriction, or mixed conditions); the percentage was closer to 50% among truck drivers as well as brickmasons and concrete workers (chart 51b). For both chest x-rays and pulmonary function tests, workers in *production* (blue-collar; *see* Glossary) occupations had a higher prevalence of abnormalities than those employed in administrative or support positions, consistent with their exposure levels to workplace hazards (*see* page 35).

Construction workers who worked in former DOE nuclear facilities are also at risk of developing chronic beryllium disease (CBD), a disease that causes difficulty breathing and scarring of lung tissue. About 1.1% of construction workers included in the BTMed program had beryllium sensitivity (BeS),[3] an indicator of CBD, and the percentage was nearly double for roofers (2.1%), boilermakers (1.9%), and sheet metal workers (1.9%; chart 51c). Construction workers may be exposed to beryllium from working in facilities where beryllium is manufactured or from using coal slag based abrasives as an alternative to sand in sandblasting.[4]

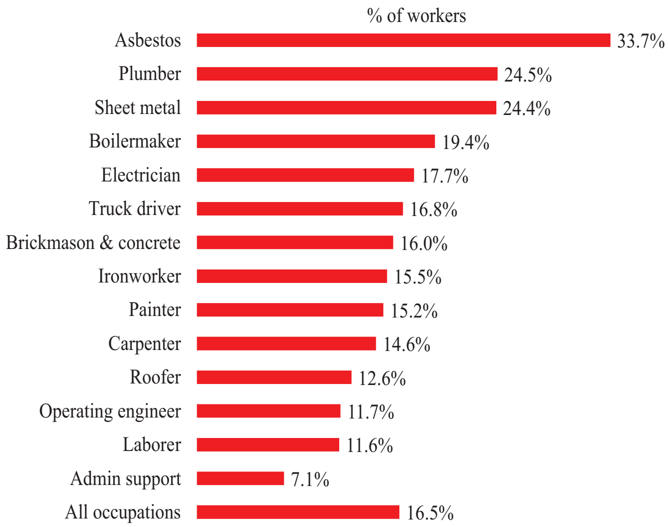
In addition to nuclear sites, respiratory hazards are common at construction worksites. Findings from the Health and Retirement Study, a large longitudinal survey on the U.S. population aged 50 years and older, showed that the proportion of respiratory cancer-related deaths for workers whose longest job was in construction trades was nearly double that for white-collar workers (14.6% versus 8.3%; chart 51d). Construction trade workers also had a higher percentage of deaths from diseases of the respiratory system than their white-collar counterparts (13.4% versus 8.9%). After adjusting for smoking and other major confounders, construction trade workers were about twice as likely to die of respiratory cancer or non-malignant respiratory diseases compared to their white-collar counterparts.[5] The results suggest that the higher mortality rates among construction trade workers may be attributed to their long-term occupational exposure.[5]

Other studies on construction workers also confirm that exposure to vapors, gases, dusts, and fumes decreases workers' lung function and increases prevalence of COPD and respiratory cancer.[6-8] In a study of sheet metal workers, higher exposure to respiratory hazards such as dusts and fumes was associated with a higher prevalence of COPD.[8] Prevalence of COPD was also higher among workers frequently exposed to asbestos, concrete dusts, mold, man-made fibers, and paints.[8] Moreover, such work exposures can be exacerbated by smoking (*see* page 55). Therefore, workers' respiratory health can be improved by both work exposure controls and smoking cessation interventions.

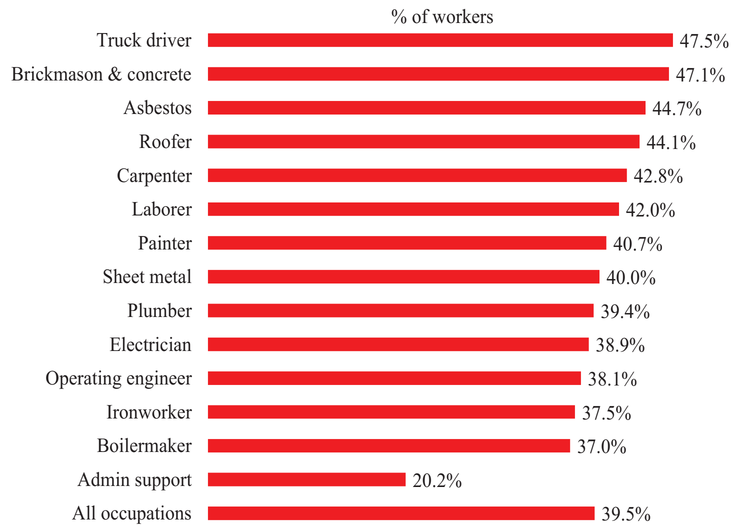
In addition to physical suffering, the annual costs of COPD to the nation from medical bills and absenteeism alone were $36 billion in 2010, and are expected to reach $49 billion by 2020.[9] Reducing occupational exposures and respiratory diseases among construction workers would not only benefit the workers themselves, but also employers, society, and the nation (*see* page 35).

1. U.S. Bureau of Labor Statistics. Survey of Occupational Injuries and Illnesses. Table SNR10. Number of nonfatal occupational illnesses by industry and category of illness, 2015, https://www.bls.gov/iif/oshwc/osh/os/ostb4745.pdf (Accessed December 2017).
2. An abnormal chest x-ray was defined as parenchymal or pleural changes consistent with pneumoconiosis by criteria established by the International Labor Organization.
3. BeS is diagnosed by either two positive tests or a single positive test and a borderline test.
4. Occupational Safety and Health Administration. Final rule to protect workers from beryllium exposure, https://www.osha.gov/berylliumrule/index.html (Accessed November 2017).
5. Wang X, Dong X, Welch L, Largay J. 2016. Respiratory cancer and non-malignant respiratory disease-related mortality among older construction workers. Occupational Medicine and Health Affairs, 4: 235.
6. Borup H, Kirkeskov L, Hanskov D, Brauer C. 2017. Systematic review: Chronic obstructive pulmonary disease and construction workers. Occupational Medicine, 67(3): 199-204.
7. Dement J, Welch L, Ringen K, Cranford K, Quinn P. 2017. Longitudinal decline in lung function among older construction workers. Occupational and Environmental Medicine, 74(10):701-708.
8. Dement J, Welch L, West G. 2014. Airways obstruction among sheet metal workers participating in a respiratory screening program. CPWR Small Study Final Report, https://www.cpwr.com/publications/airways-obstruction-among-sheet-metal-workers-participating-respiratory-screening (Accessed August 2017).
9. Ford E, Murphy L, Khavjou O, Giles W, Holt J, Croft J. 2015. Total and state-specific medical and absenteeism costs of COPD among adults aged ≥ 18 years in the United States for 2010 and projections through 2020. Chest, 147(1): 31-45.

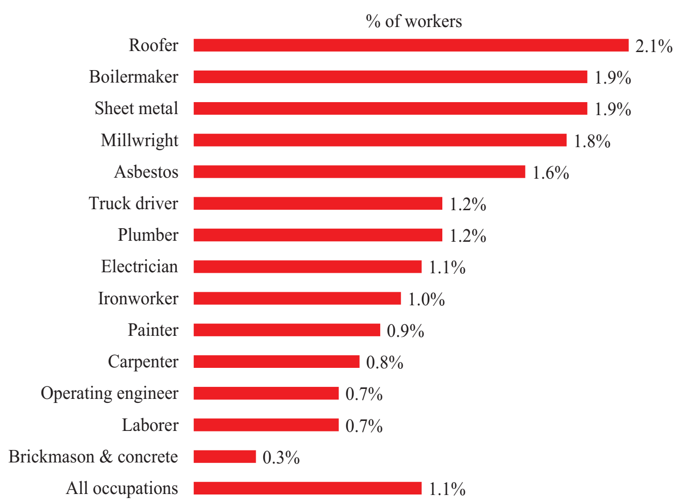
51a. Prevalence of chest x-ray abnormalities, selected construction occupations, 1996-2016



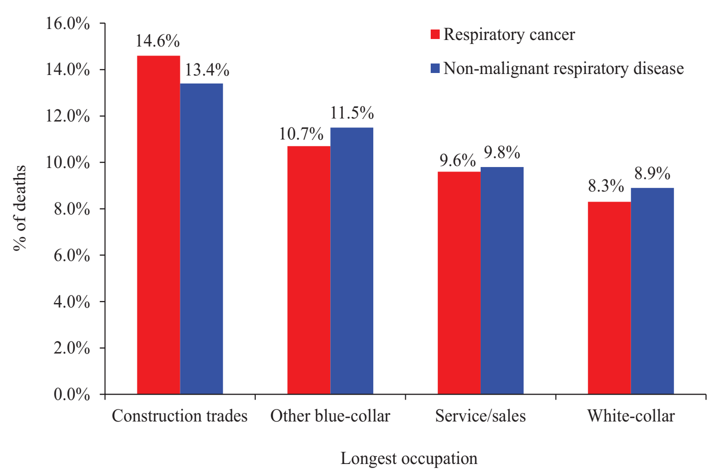
51b. Prevalence of abnormal pulmonary function tests, selected construction occupations, 1996-2016



51c. Prevalence of beryllium sensitivity, selected construction occupations, 1996-2016



51d. Cause of death among older workers, by longest occupation, respiratory cancer versus non-malignant respiratory disease, 1992-2011



Note: Chart 51d – Longest occupation refers to the respondent's longest-held job reported to the Health and Retirement Study. Other blue-collar refers to production workers in non-construction trade occupations.

Source: Charts 51a-51c – BTMed disease prevalence: Exams completed through March 2017. Contact: John Dement, Duke University Medical Center.
Chart 51d – Wang X, Dong X, Welch L, Largay J. 2016. Respiratory cancer and non-malignant respiratory disease-related mortality among older construction workers. Occupational Medicine and Health Affairs, 4:235.

OSHA Enforcement of Construction Safety and Health Regulations: Inspections

The U.S. Occupational Safety and Health Administration (OSHA) has been responsible for the enforcement of workplace safety and health standards in the United States since its establishment in 1970. OSHA also allows states to develop and operate their own programs, and requires that they promulgate standards "at least as effective" as federal OSHA standards. Currently, there are 28 states or territories with OSHA-approved state-plans.[1]

Between 2001 and 2015, OSHA conducted nearly 360,000 federal inspections of any scope in construction. The number and proportion of construction establishments inspected by federal OSHA peaked in 2010, then declined. In 2015, there were about 18,100 federal inspections in construction, accounting for only 2.7% of all construction establishments that year (chart 52a). Moreover, the number of construction worksites visited can be much lower than the number of inspections since multiple employers are usually working at one construction worksite. Despite this, in 2015, nearly half (46%) of all federal OSHA inspections were in construction,[2] reflecting OSHA's inspection priority and corresponding to the high risk at construction workplaces. Currently, OSHA (including state-plans) has approximately 2,100 inspectors for 8 million worksites and 130 million workers in all industries nationwide;[3] this is equivalent to one OSHA inspector for every 3,800 worksites or 61,900 workers.

From 2010 to 2015, complete inspections (or comprehensive inspections)[4] decreased from 38% to 24% of the overall construction inspections, while the share of partial inspections[5] increased from 53% to 68% (chart 52b). This trend indicates that OSHA targeted projects where greater hazards may exist, or focused on particular hazards (i.e., falls) rather than complete full inspections at all worksites visited.

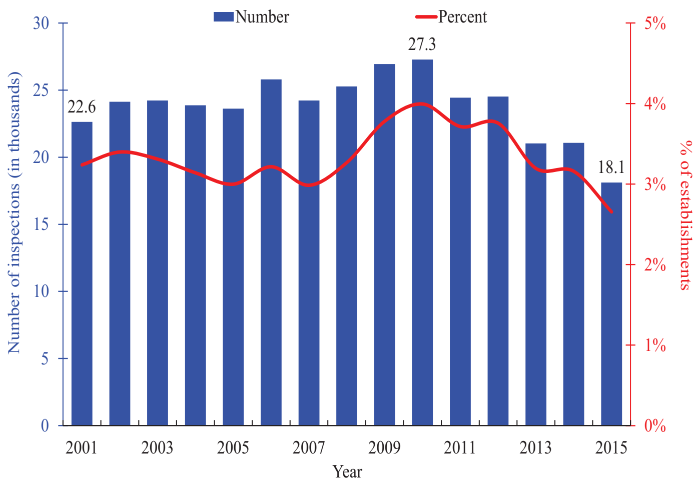
OSHA construction inspections differed among states. In 2015, 54% of construction establishments in the District of Columbia were inspected, more than three times the proportion in Nevada (16%) – the state with the next highest inspection rate. Other states with inspection rates of 10% or higher included Michigan, Hawaii, and Oregon (listed in descending order; chart 52c). By contrast, Iowa, Montana, and South Dakota had a lower inspection level, at 2.5% or less in each. Overall, more than 36,000 federal and state inspections were conducted in construction across the nation that year.

OSHA health inspections in construction were just one-third of that for all industries (20.8%), accounting for less than 7% of all inspections in this industry. In 2015, 728 programmed silica hazard inspections in construction were conducted by federal and state OSHA, more than inspections for asbestos and lead combined (chart 52d). Altogether, these three programs account for nearly half (45%) of health-related inspections conducted by OSHA between 2003 and 2015. The presence of silica dust in the workplace increases the risk of silicosis, lung cancer, and other respiratory diseases (*see* page 34).[6] To reduce silica exposure, OSHA's new silica standard for the construction industry has been implemented since September 2017.[7] Inhalational exposure to lead (*see* page 36) and to asbestos fibers can also lead to serious diseases; hence OSHA has regulated and enforced standards to reduce exposure to these two agents for decades.[6,8] Standards provide additional mechanisms to protect workers from chemical exposures through safe work practices, hazard communication, training, medical surveillance, and other procedures.[6-8]

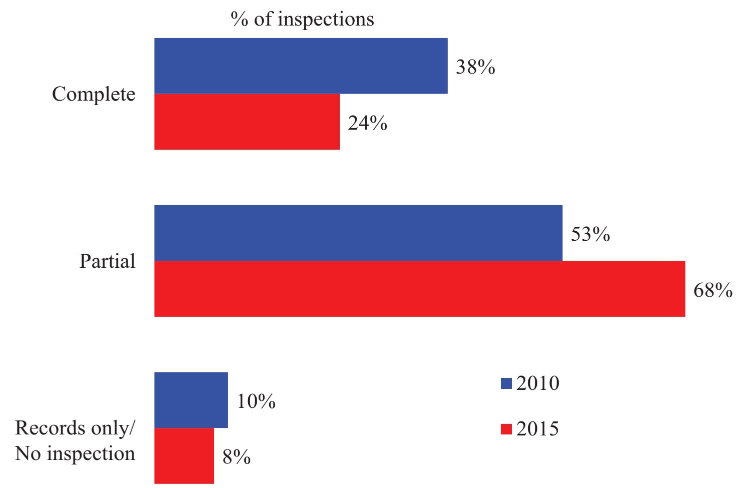
Along with enforcement, OSHA encourages employer voluntary compliance. The OSHA Training Institute (OTI) and OTI Education Centers offer training courses on safety and health. In 2016, more than 670,000 construction workers completed the 10- or 30-hour training.[9] OSHA also awards grants to train hard-to-reach construction workers and those at high risk of incurring work-related injuries and illnesses, as well as to expand trainings in Spanish.[10]

1. Occupational Safety and Health Administration, http://www.osha.gov/dcsp/osp/index.html (Accessed July 2017).
2. Except those with special notes, all numbers in the text were tabulated by the CPWR Data Center using the OSHA IMIS (or inspection) database, https://www.osha.gov/pls/imis/industry.html (Accessed July 2017). The OSHA Integrated Management Information System (IMIS) – an OSHA Automated Information System – includes information about every inspection conducted by federal OSHA.
3. Occupational Safety and Health Administration. Commonly used statistics, http://www.osha.gov/oshstats/commonstats.html (Accessed July 2017).
4. A substantially complete inspection of the potentially high hazard areas of the establishment. An inspection may be deemed comprehensive as a result of professional judgment even though not all potentially hazardous conditions, operations, and practices within those areas are inspected, https://www.osha.gov/Firm_osha_data/100006.html (Accessed December 2017).
5. An inspection whose focus is limited to certain potentially hazardous areas, operations, conditions, or practices at the establishment.
6. CPWR - The Center for Construction Research and Training. Hazard alert cards, https://www.cpwr.com/publications/hazard-alert-cards (Accessed August 2017).
7. Occupational Safety and Health Administration. Silica, https://www.osha.gov/dsg/topics/silicacrystalline/ (Accessed August 2017).
8. CPWR - The Center for Construction Research and Training. Toolbox talks, http://www.silica-safe.org/training-and-other-resources/toolbox-talks/ (Accessed August 2017).
9. Occupational Safety and Health Administration. 2016. Outreach training program growth, http://www.osha.gov/dte/outreach/outreach_growth.html (Accessed July 2017).
10. U.S. Department of Labor. 2016. U.S. Department of Labor's OSHA awards $10.5 million in workplace safety and health training grants to 77 organizations to help high-risk workers and their employers. News Release #16-1820-NAT, https://www.osha.gov/news/newsreleases/national/09132016 (Accessed July 2017).

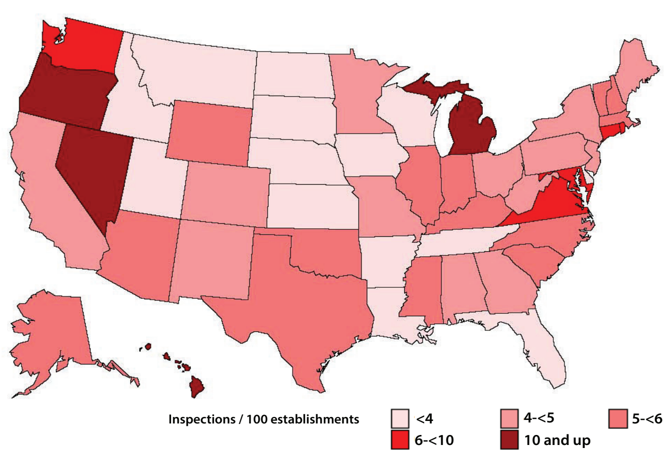
52a. Number and percentage of construction establishments inspected by federal OSHA, 2001-2015



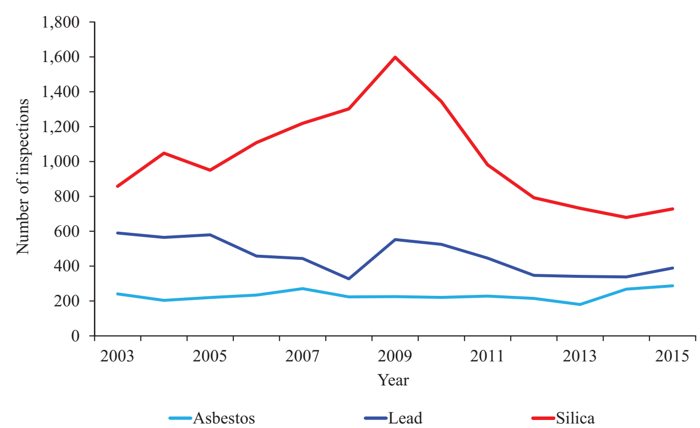
52b. OSHA federal inspections in construction, by inspection scope, 2010 versus 2015



52c. Rate of construction establishments inspected by OSHA federal and state-plans, by state, 2015



52d. OSHA federal and state-plan inspections in construction, selected health hazards, 2003-2015



Note: All charts – OSHA inspects payroll establishments only. Tabulations were based on calendar years and the North American Industrial Classification System (NAICS) for a better comparison over time. Therefore, the numbers reported here may be different from OSHA reports based on fiscal years.
Chart 52b – Totals may not add to 100% due to rounding.

Source: Charts 52a and 52c – Occupational Safety and Health Administration, http://www.osha.gov/pls/imis/industry.html (Accessed July 2017) and U.S. Census Bureau, County Business Patterns. Calculations by the CPWR Data Center.
Charts 52b– Occupational Safety and Health Administration, http://www.osha.gov/pls/imis/industry.html (Accessed July 2017). Calculations by the CPWR Data Center.
Chart 52d – Occupational Safety and Health Administration, 2003-2015 Integrated Management Information System. Calculations by the CPWR Data Center.

OSHA Enforcement of Construction Safety and Health Regulations: Federal Citations and Penalties

OSHA citations in construction followed a similar trend as its inspections in the past decade (*see* page 52), rising to about 58,000 in 2010 and then dropping to 34,100 by 2015 (chart 53a). As multiple citations may be issued during one inspection, the number of citations was much higher than the number of inspections. In 2015, the number of construction citations issued by federal OSHA was almost twice the number of inspections in the same year (*see* page 52).

Although the number of citations fell about 44% between 2003 and 2015 (chart 53a), the proportion of *serious, willful, and repeat* (SWR, *see* Glossary) violations (a measure of non-compliance with OSHA standards) in construction increased from 82.9% to 87.2% during this period. Violations with a high level (4-10) of *gravity* (or potential harm to workers, *see* Glossary) also increased from 38% to 89% over these years.[1] These statistics may reflect a change in targeting practices following the establishment of the OSHA Severe Violator Enforcement Program (SVEP) in 2010.[2,3]

In 2015, the most frequently cited construction violations were fall protection and scaffolding, in particular among Specialty Trade Contractors (NAICS 238, *see* page 1 for industrial classifications and codes; chart 53b). More than 85% of these two major citations were issued in this subsector, disproportionally higher than its share (67%) of construction payroll establishments (*see* page 2). More than half (54%) of the citations issued in Heavy and Civil Engineering Construction (NAICS 237) were violations of the OSHA trenching standards (764 out of 1,407) – a higher proportion than any other construction subsector.

The number of OSHA citations related to fall protection in construction increased to 12,274 in 2010, but decreased in the following years (chart 53c). Nevertheless, fall protection remained the most frequently cited workplace safety violation in each year from 2011 to 2016.[4] In 2015, 9,469 OSHA citations in construction were related to fall protection, 30% lower than the 2010 number; yet its share of all construction citations increased by 60%, from 17% in 2003 to 29% in 2015.

OSHA conducted fewer inspections for health hazards in construction than for all industries (*see* page 52). After a high point of 3,782 citations in 2009, the number declined, falling to a record low of 2,105 citations in 2015 (chart 53d). The percentage of health hazard citations fluctuated, hovering around 6% of all citations in construction since 2003.

In 2011, the average penalty per citation jumped to $2,790 (in 2015 dollars; chart 53e), a $928 increase from the year before, reaching a record high in the past decade and reflecting changes to the OSHA penalty structure.[3] In 2015, the average penalty was $2,567 per citation in construction, totaling $64 million in penalties for the industry.

The total amount of penalties roughly corresponds to the number of citations issued in each subsector. For example, Specialty Trade Contractors had the most citations for fall protection violations and the highest penalty amounts in 2015 ($21.2 million; chart 53f). However, Heavy and Civil Engineering paid nearly twice the penalties for trenching violations compared to Specialty Trade Contractors ($2.6 million versus $1.4 million, respectively), though the number of trenching violations was just 53% more in the former, indicating more severe violations compared to the latter.

Studies suggest that OSHA inspections and penalties have significantly reduced occupational injuries.[5] It is estimated that OSHA inspections led to about a 20% reduction in serious injuries among all industries combined,[6] and a recent systematic review found strong evidence that citations resulting from inspections led to a significant reduction in injuries.[5]

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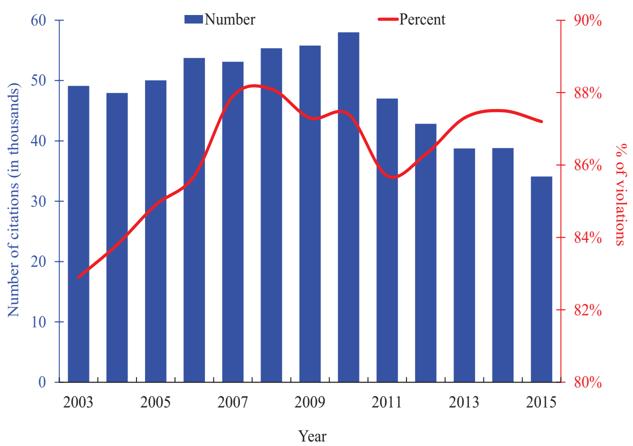
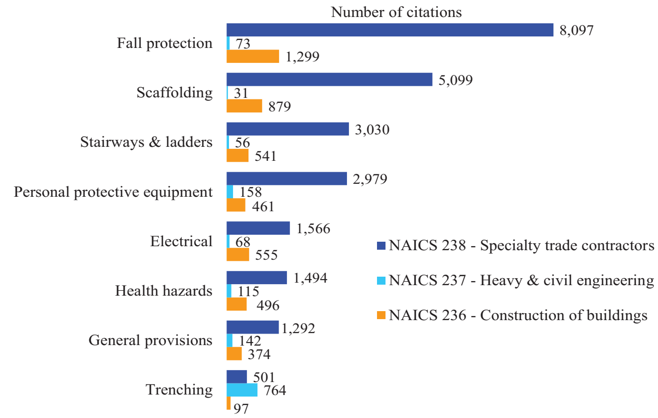
1. Occupational Safety and Health Administration. 2003-2015 Integrated Management Information System. Calculations by the CPWR Data Center. OSHA inspects payroll establishments only. Tabulations were based on calendar years and the North American Industrial Classification System (NAICS) for a better comparison over time. In calendar year 2015, the number of federal inspections was 18,114 by NAICS (23). Therefore, the numbers reported here may be different from OSHA reports which are based on fiscal years. State-plan inspections were not included in the tabulations.
2. Occupational Safety and Health Administration. 2010. Federal Severe Violators Enforcement Program, https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=4503 (Accessed July 2017).
3. Occupational Safety and Health Administration. 2010. OSHA enforcement: Committed to safe and healthful workplaces, http://www.osha.gov/dep/2010_enforcement_summary.html (Accessed July 2017).
4. MSDS Online. 2016. Top 10 OSHA violations of 2016, https://www.msdsonline.com/blog/msds-chemical-management/2016/10/18/osha-top-10-most-cited-violations-of-2016 (Accessed August 2017).
5. Tompa E, Kalcevich C, Foley M, McLeod C, Hogg-Johnson S, Cullen K, MacEachen E, Mahood Q, Irvin E. 2016. A systematic literature review of the effectiveness of occupational health and safety regulatory enforcement. American Journal of Industrial Medicine, 59(11): 919-933.
6. Li L, Singleton P. 2017. The effect of workplace inspections on worker safety. Center for Policy Research - The Maxwell School, www.maxwell.syr.edu/uploadedFiles/cpr/publications/working_papers2/wp201.pdf (Accessed July 2017).

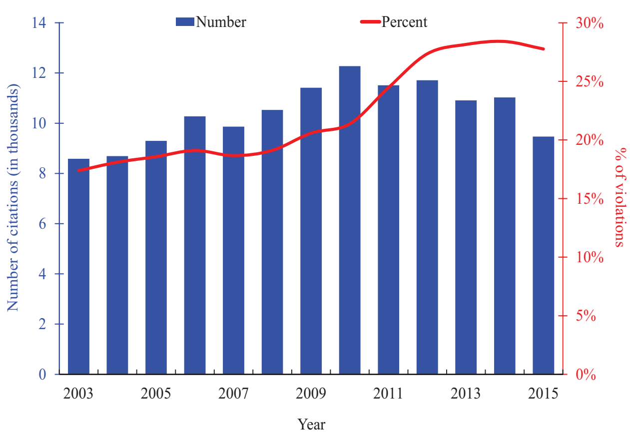
53a. OSHA federal citations and percentage of serious, willful, and repeat violations in construction, 2003-2015



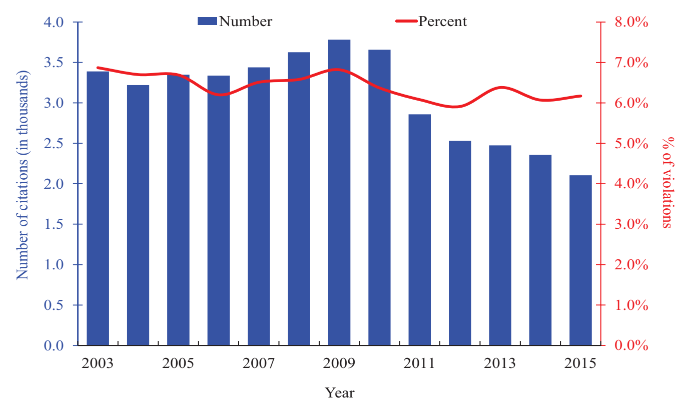
53b. OSHA federal citations by major violation category and construction sector, 2015



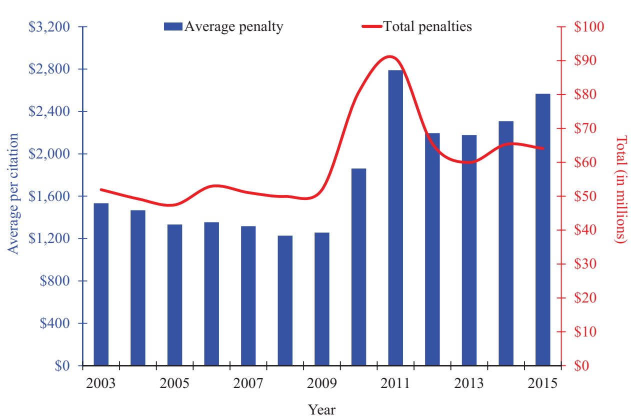
53c. Number and percentage of OSHA citations on fall protection in construction, 2003-2015



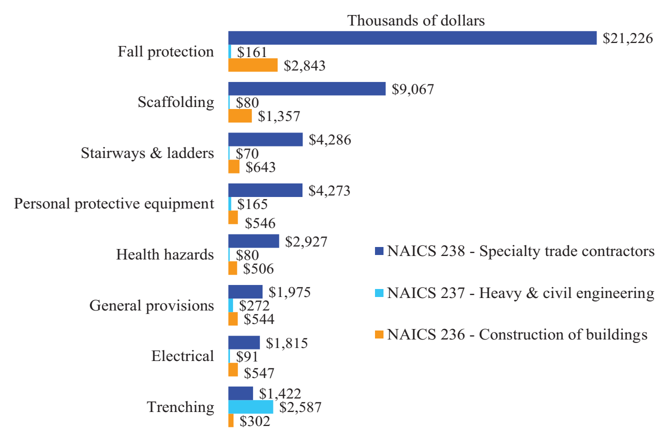
53d. Number and percentage of OSHA citations on health hazards in construction, 2003-2015



53e. Average penalty per federal citation and total penalties in construction, 2003-2015 (2015 dollars)



53f. Total penalties for OSHA federal citations by major violation category and construction sector, 2015



Note: Charts 53b and 53f – "Scaffolding" refers to citations within subpart L, "fall protection" refers to citations within subpart M, "stairways and ladders" refers to citations within subpart X, "trenching" refers to citations within subpart P, "personal protective equipment" refers to citations within subpart E, "electrical" refers to citations within subpart K, "general provisions" refers to citations within subpart C, and "health hazards" refers to citations within subparts D and Z. Citations issued in construction using general industry standards were also included in the tabulations.

Source: Charts 53a, 53c, 53d, and 53e – Occupational Safety and Health Administration. 2003-2015 Integrated Management Information System. Calculations by the CPWR Data Center.
Charts 53b and 53f – Occupational Safety and Health Administration. 2015 Integrated Management Information System. Calculations by the CPWR Data Center.

Workers' Compensation in Construction and Other Industries

Workers' compensation programs were initiated to reduce litigation for work-related injuries, illnesses, and deaths; and were designed to cover employees if their incidents happened in the workplace as a result of and in the course of workplace activities.[1] These programs vary among states. Thus, it is difficult to document costs of workers' compensation at the national level.

Workers' compensation data are an important source for evaluating costs associated with work-related injuries. The National Academy of Social Insurance (NASI) estimated that workers' compensation programs paid $61.9 billion in worker benefits to about 135.6 million workers across all industries in 2015, an increase of 0.7% from 2011.[2] In construction, 3.6% of employer compensation costs were spent on workers' compensation, 71% higher than the percentage for the overall goods producing industries combined, and more than twice the average costs for employers in all industries (chart 54a).[3]

Workers' compensation costs differ by construction subsector. In Ohio and Washington State, the *median* (*see* Glossary) compensation claim cost in the Heavy and Civil Engineering subsector (NAICS 237) was $1,050, and the *mean* or average claim cost was $13,540 in 2015, the highest among the three major construction subsectors (chart 54b). The substantial difference between the median and mean indicates that the costs of some claims could be exceptionally high.[4]

By injury type, nearly half of compensation claims among construction workers in Ohio and Washington were due to contact with objects or equipment (47%; chart 54c). Falls, slips, and trips were the next most common cause of compensation claims, comprising one quarter (25%) of all claims in 2015. However, transportation injury claims had the highest costs, with an average of $20,540 per claim, followed by falls, slips, and trips (chart 54d).

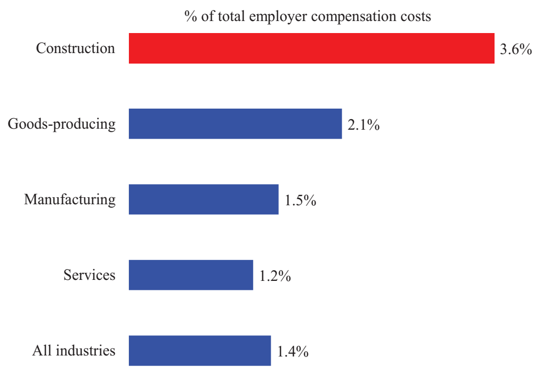
Workers' compensation costs increase with age. In Ohio and Washington, the average cost of a workers' compensation claim among construction workers under 21 years old was $3,130 in 2015, and jumped to $17,680 among those 61 years and older (chart 54e). As more construction workers remain employed later in life,[5] the impact of an aging workforce on workers' compensation costs could continue to grow for employers and providers.

Workers' compensation insurance rates vary widely among states and job types. According to the Workers Compensation Shop, an online workers' compensation insurance company, in 2016, the upper workers' compensation rate per $100 of payroll for residential carpentry was as high as $99.99 in Georgia compared to just $7.69 in Indiana (chart 54f). In the same year, the upper insurance rate for electrical work ranged from $17.76 in California to $1.90 in West Virginia. Rates of workers' compensation also vary considerably from one insurance carrier to the other in the same state. Additional factors, such as size of the employer's payroll and company's claims experience, are often used by insurance companies to determine their own premium rates.[6]

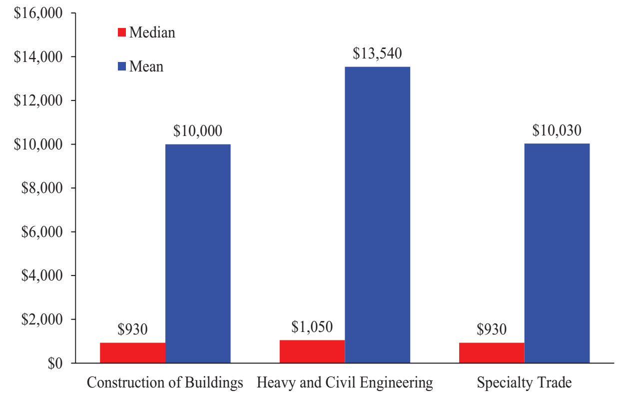
In attempts to control costs in all industries, the workers' compensation system has been repeatedly revised over the past two decades. As a result, workers have experienced increased difficulty in receiving adequate benefits.[7] In some states, disabled workers are required to prove that the workplace activity was the primary cause of the disability. This may discourage workers from pursuing these claims at all, or lead to more workers shifting care to private insurance,[8,9] since the workers' compensation process is costly and reimbursement is not guaranteed.

1. Insurance Information Institute. Workers' Compensation, http://www.iii.org/media/hottopics/insurance/workerscomp/ (Accessed August 2017).
2. National Academy of Social Insurance. 2017. Workers' Compensation: Benefits, Coverage, and Costs, https://www.nasi.org/sites/default/files/research/NASI_Workers%20Comp%20Report%202017_web.pdf (Accessed December 2017).
3. For insured and self-insured companies, employer compensation costs include workers' compensation premiums; self-insured companies may make direct payments or set aside funds to cover potential losses or to meet self-insurance requirements.
4. Wurzelbacher SJ, Meyers AR, Bertke SJ, Lampl MP, Robins DR, Bushnell PT, Tarawneh A, Childress D, Turnes J. 2013. Comparison of cost valuation methods for workers' compensation data. Published in Use of Workers' compensation data for occupational safety and health: Proceedings from June 2012 workshop. DHHS (NIOSH) Publication No. 2013-147 (May 2013).
5. Dong XS, Wang X, Ringen K, Sokas R. 2017. Baby boomers in the United States: Factors associated with working longer and delaying retirement. American Journal of Industrial Medicine, Apr; 60(4):315-328.
6. PrimePay. https://primepay.com/blog/how-your-workers-comp-rate-calculated (Accessed January 2018).
7. Pro Publica. The Demolition of Workers' Comp, https://www.propublica.org/article/the-demolition-of-workers-compensation (Accessed December 2017).
8. Sears J, Bowman S, Blanar L, Hogg-Johnson S. 2016. Industrial injury hospitalizations billed to payers other than workers' compensation: Characteristics and trends by state. Health Services Research, 52(2): 763-85.
9. Lipscomb H, Schoenfisch A, Cameron W, Kucera K, Adams D, Silverstein B. 2015. Contrasting patterns of care for musculoskeletal disorders and injuries of the upper extremity and knee through workers' compensation and private health care insurance among union carpenters in Washington State, 1989 to 2008. American Journal of Industrial Medicine, 58(9): 955-63.

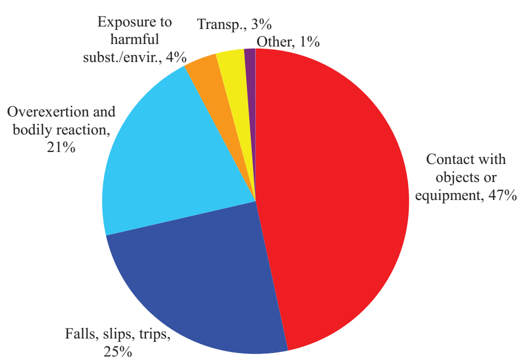
54a. Employer spending on workers' compensation, selected industries, 2015 (Private wage-and-salary workers)



54b. Workers' compensation claim costs, by construction subsector, 2015 (Ohio and Washington only)

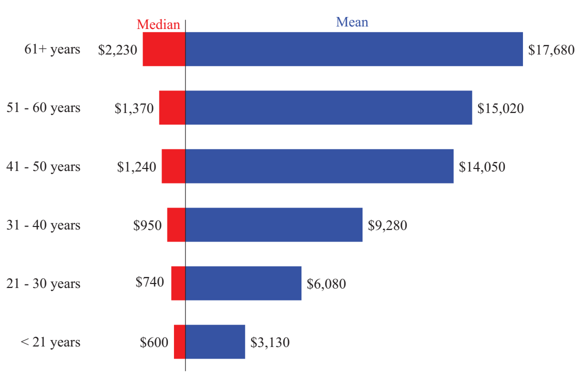


54c. Distribution of workers' compensation claim costs in construction, by major cause, 2015 (Ohio and Washington only)

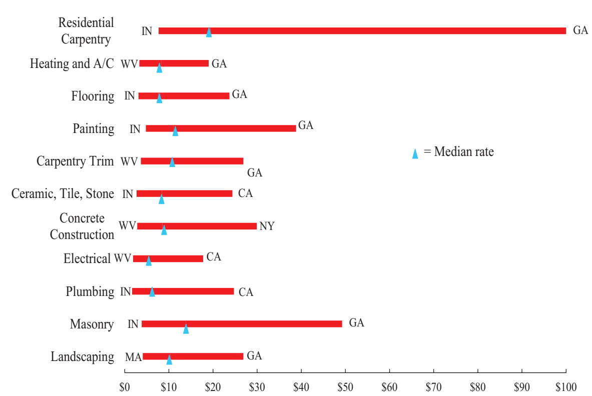


54d. Workers' compensation claim costs in construction, by major cause, 2015 (Ohio and Washington only)

54e. Workers' compensation claim costs in construction, by age group, 2015 (Ohio and Washington only)



54f. Workers' compensation insurance upper rates in 45 states, selected construction jobs, 2016



Note: Chart 54a – Employer costs are workers' compensation premiums for firms that buy insurance; for self-insured employers, costs are administrative expenses plus payments to workers, their survivors, and health care providers.
Charts 54b, 54d, and 54e – Charts represent median claim costs and mean cost per claim.
Charts 54b-54e – Charts cover claims for state-insured employers only. Claims are those reported, adjudicated, allowed/accepted, and valued as of 30 months post January 1, 2015. Zero-dollar claims are excluded. Around 1% (177 of 17,687) of claims did not report age and event data. Paid costs valued at 30 months do not reflect the ultimate cost of claims.
Chart 54f – Upper/high rates per $100 of payroll; effective as of March 1, 2017. Listings do not include Nevada, North Dakota, Ohio, or Washington. Job types are determined by "class codes" from the National Council on Compensation Insurance. (Note: The job categories are not available or are only available for certain pay levels in some states).

Source: Chart 54a – U.S. Bureau of Labor Statistics. 2015 National Compensation Survey – Compensation Cost Trends, Tables 5 and 6. https://www.bls.gov/ncs/ncspubs_2015.htm (Accessed July 2017).
Charts 54b-54e – Unpublished data. Ohio Bureau of Workers' Compensation, Washington State Department of Labor and Industries, and NIOSH.
Chart 54f – Workers Compensation Insurance by State. https://www.workerscompensationshop.com/ (Accessed December 2017).

Health Risk Factors and Chronic Illnesses among Construction Workers

Cigarette smoking, obesity, diabetes, and hypertension (high blood pressure) pose major risks to health.[1] Each of these factors may lead to serious health consequences and contribute separately or jointly to premature death.[1-3]

Although the prevalence of smoking in the U.S. has declined steadily over the past four decades, cigarette and tobacco use is still widespread in the construction industry. In 2015, nearly 24% of workers in the construction industry were current smokers, compared to about 15% of workers in all industries (chart 55a). Smoking is more common in some construction occupations. About 42% of workers in heating and air conditioning mechanic occupations reported that they were current smokers in 2015, higher than any other occupation in construction (chart 55b). However, the prevalence may not represent the entire construction workforce in the nation since just 25 states were included in the estimates. The risk of chronic lung disease and cancer among construction workers who smoke is magnified by exposure to occupational hazards, such as welding dust, silica, and asbestos[3-5] (*see* pages 34 and 51). Overall, cigarette smoking causes about one of every five deaths in the United States, and is responsible for 90% of all lung cancer deaths and 80% of deaths due to chronic obstructive pulmonary disease (COPD).[3]

Obesity has been linked to stroke, diabetes, and several other chronic conditions that are common causes of preventable death.[1,2,6-7] The prevalence of obesity among U.S. workers, measured by *body mass index* (BMI, *see* Glossary), jumped nearly 50%, from 21% in 2000 to 30% in 2015 (chart 55c). The percentage among construction workers fluctuated, but increased generally during this period, reaching 34% in 2015. Among construction workers aged 35-54 years, 79% were either overweight or obese, compared to 69% of workers in all industries in the same age group (chart 55d). A healthy weight can be reached through a nutritious diet and healthy lifestyle. Even modest weight loss is likely to produce health benefits, such as improvements in insulin sensitivity and reduced inflammation .[7]

Diabetes is a growing epidemic with a devastating physical, emotional, and financial burden to the nation.[8] In 2015, 30.3 million American adults had diabetes, accounting for over 9% of the population. Of these, 7.2 million were undiagnosed.[9] Following this trend, nearly 10% of construction workers had been diagnosed with diabetes in 2015, and the percentage was double (19%) among those aged 55 years and older (chart 55e). When left untreated, diabetes can lead to heart disease, as well as other complications such as kidney disease, nerve damage, and death. However, diabetes is preventable or treatable through lifestyle changes such as healthy eating and exercise.[8]

Hypertension is a heart disease risk factor. In 2015, 32% of construction workers had been diagnosed with hypertension, and 9% had a *heart condition* (*see* Glossary; chart 55f). Among construction workers aged 55 years and over, 53% had hypertension and 16% had a heart condition. Compared to the average of all industries, the higher prevalence of heart conditions in construction (9% versus 8%) is notable, considering that the high physical demands of construction work (*see* pages 32 and 33) may have already driven workers with such conditions to leave the industry (known as the healthy worker effect). These numbers may be underestimated since such conditions do not always exhibit obvious symptoms, and workers may be unaware that they have this risk.[8] Uncontrolled hypertension can damage blood vessels and lead to a heart attack, stroke, or other health complications over time.[8]

Controlling these risk factors is essential to improving the overall health of construction workers given that these workers are greatly exposed to occupational hazards (*see* pages 32-36) in special working environments (*see* pages 2, 20-22, and 26-28). To promote the overall health of workers, the National Institute for Occupational Safety and Health (NIOSH) has encouraged integrating safety and health interventions and other well-being activities in the workplace through the Total Worker Health™ program.[10]

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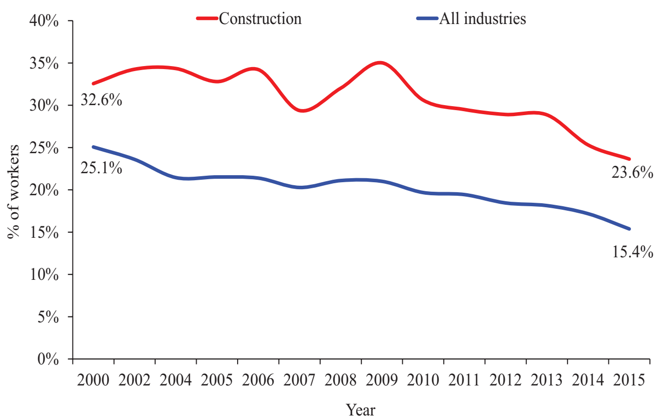
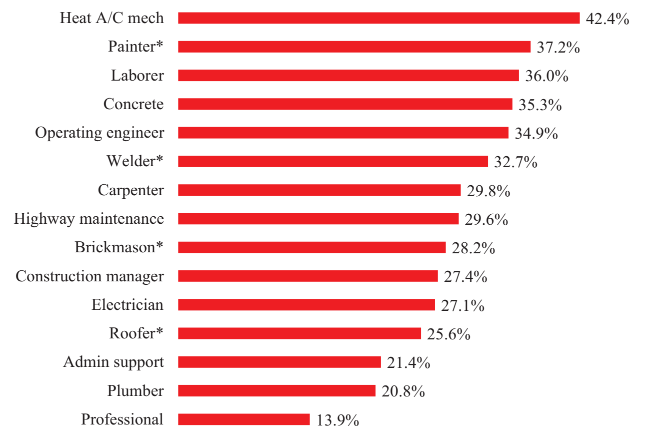
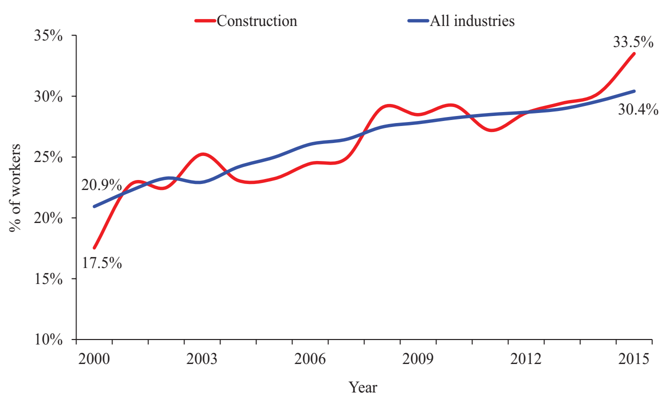
55a. Percentage of current smokers, construction versus all industries, 2000-2015, selected years



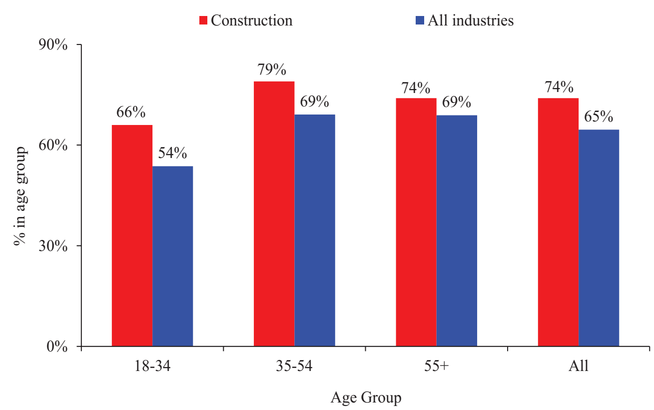
55b. Percentage of current smokers, selected occupations in construction, 2015 (25 states)



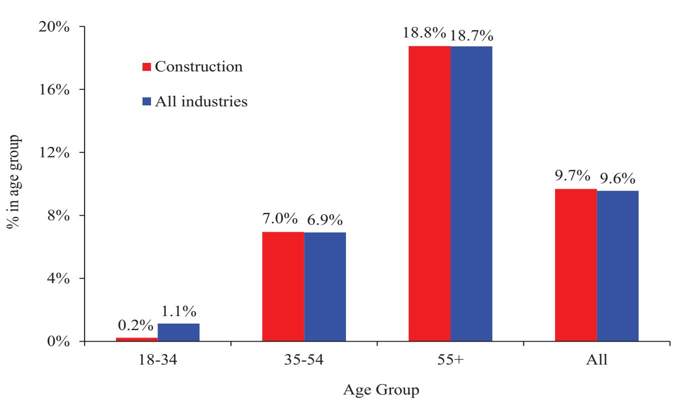
55c. Prevalence of obesity, construction versus all industries, 2000-2015



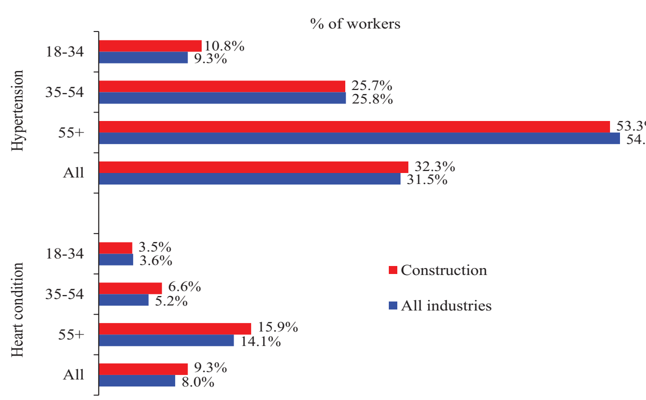
55d. Overweight and obesity among workers, by age group, construction versus all industries, 2015



55e. Prevalence of diagnosed diabetes among workers, by age group, construction versus all industries, 2015



55f. Prevalence of hypertension and heart condition among workers, by age group, construction versus all industries, 2015



Note: All charts – Data cover all employment.
Chart 55b – The following states are included in the tabulation: Colorado, Connecticut, Florida, Georgia, Idaho, Illinois, Iowa, Louisiana, Massachusetts, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Tennessee, Utah, Washington, West Virginia, and Wisconsin. An asterisk (*) indicates that estimates should be used with caution as the sample sizes are small and they do not meet standards of reliability/precision.
Charts 55c and 55d – A body mass index (BMI) between 25 and 29.9 is considered overweight, and a BMI of 30 or higher is considered obese. See Glossary for a full description of BMI or go to https://www.cdc.gov/healthyweight/assessing/bmi/index.html (Accessed July 2017).

Source: Charts 55a and 55c – National Center for Health Statistics. 2000-2015 National Health Interview Survey. Calculations by the CPWR Data Center.
Chart 55b – 2015 Behavioral Risk Factor Surveillance System (25 states), National Institute for Occupational Safety and Health, unpublished data (November 2017). Contact: Winifred Boal, wob1@cdc.gov.
Charts 55d, 55e, and 55f – National Center for Health Statistics. 2015 National Health Interview Survey. Calculations by the CPWR Data Center.

Impact of Health Insurance on Healthcare and Medical Expenditures among Construction Workers

Healthcare services are necessary for managing and preventing disease, disability, and premature death.[1] Unfortunately, many construction workers fail to receive the care they need because they lack health insurance coverage from any source (*see* page 26).

Health insurance coverage has a particularly large impact on use of healthcare.[2] In 2015, about 55% of uninsured (*see* page 26) construction workers did not have a usual source of care when sick, compared to 12% among their counterparts with health insurance (chart 56a). About 60% of Hispanic workers that had no health insurance lacked a usual source of care when sick, while the percentage reduced to less than 15% among Hispanic workers that had insurance. A similar pattern was found among white, non-Hispanic workers.

Lack of health insurance significantly increases the likelihood of using emergency room services. On average over a three-year period, more than 9% of uninsured construction workers usually visited the hospital emergency room for healthcare when sick, compared to less than 1% of their insured counterparts (chart 56b). Although ethnic disparities remain, the gap in healthcare access and utilization is narrower among insured workers. These findings are consistent with research on the impact of the Affordable Care Act.[3-6]

Having health insurance also affects frequency of care. Construction workers without health insurance have fewer visits to healthcare providers. In 2015, 58% of uninsured Hispanic construction workers had not seen a doctor or health professional in more than 12 months, compared to just 24% of insured Hispanics and 17% of insured white, non-Hispanics (chart 56c). As a result, close to half (45%) of uninsured Hispanic workers did not receive any preventive care, such as a regular physical exam or check-up, flu shot, etc., within the past year, compared to only 13% of insured Hispanic workers (chart 56d).

Health insurance status plays an important role in the payments made to healthcare providers and institutions, also known as *medical expenditures* (*see* Glossary). Among uninsured construction workers, the average medical expenditures for both Hispanics and white, non-Hispanics were much lower than those of their insured counterparts. Insured Hispanics had more than five times, and white, non-Hispanics more than four times the medical expenditures of their uninsured counterparts (chart 56e).

In addition to ethnicity and insurance coverage, medical expenditures are also affected by age. Medical expenditures among insured workers increased steadily with age and soared after age 65 (chart 56f). Older workers are more likely to have medical conditions (*see* page 55), which can significantly increase overall medical costs in a worker's later years.[7] Another explanation could be that uninsured older workers may delay health services until they are eligible for Medicare.[8] Given that retirement is a time when many workers experience a loss of employment-based health insurance, workers retiring or losing jobs prior to age 65 are at a higher risk for lack of healthcare access.

The data used for this page were obtained from the National Health Interview Survey (NHIS) and the Medical Expenditure Panel Survey (MEPS). The NHIS provides more detailed information on health behaviors, while the MEPS data cover healthcare use, expenditures, and sources of payment.

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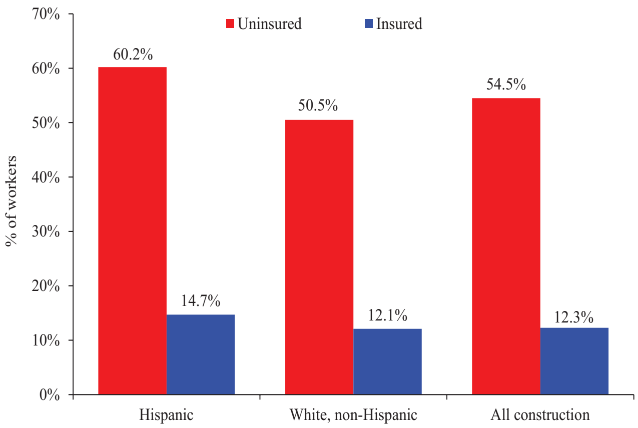
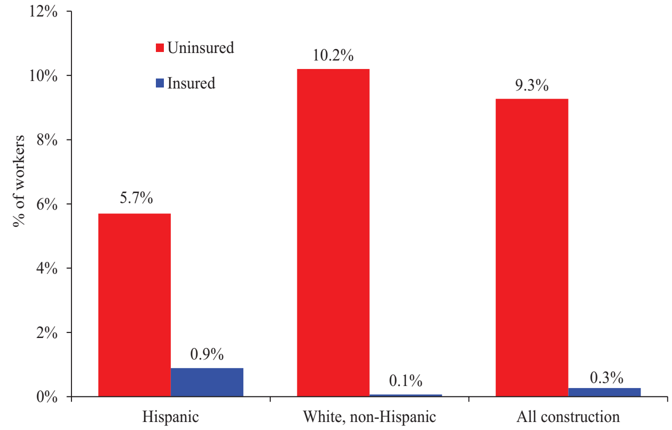
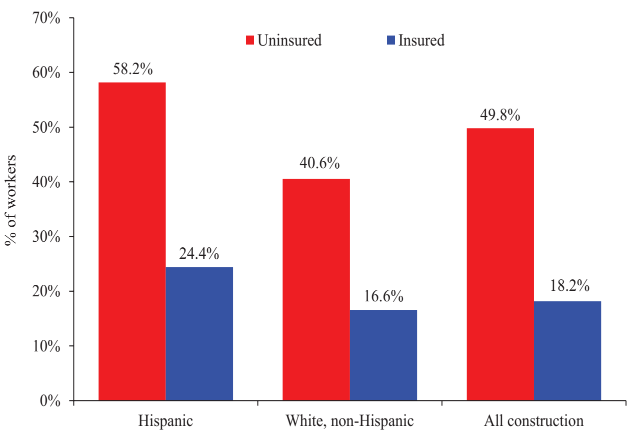
56a. Percentage of construction workers who had no consistent place to receive care when sick, by insurance status and Hispanic ethnicity, 2015



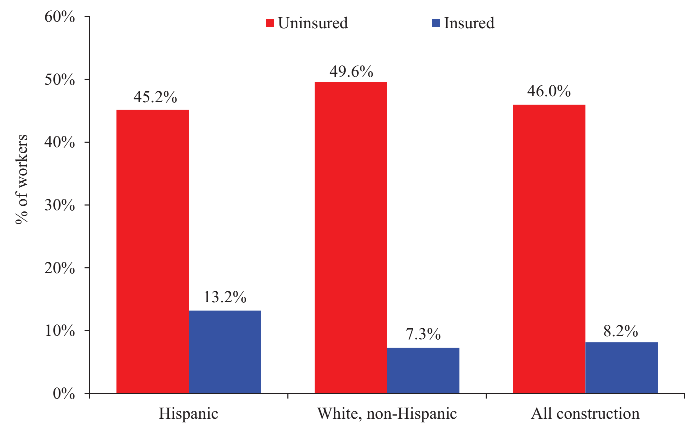
56b. Percentage of construction workers using hospital emergency rooms when sick, by insurance status and Hispanic ethnicity, 2013-2015 average



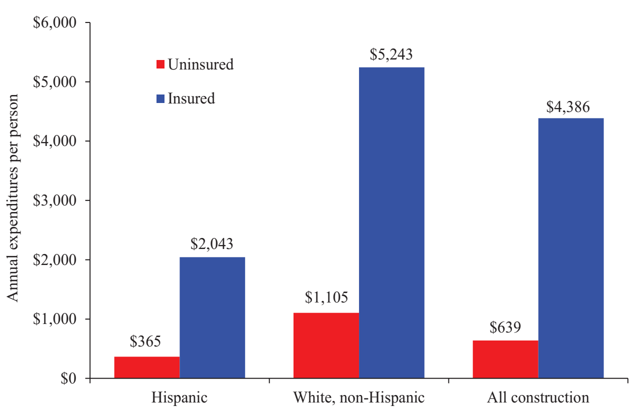
56c. Percentage of construction workers whose last contact with a doctor or other health professional was more than one year ago, by insurance status and Hispanic ethnicity, 2015



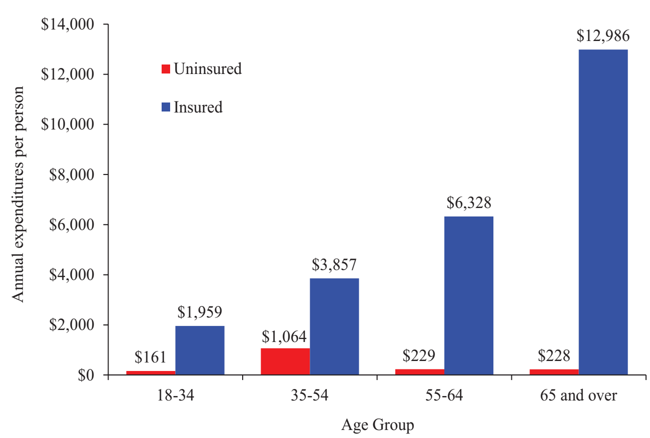
56d. Percentage of construction workers that did not receive preventive care of any kind within the past 12 months, by insurance status and Hispanic ethnicity, 2015



56e. Average medical expenditures among construction workers, by insurance status and Hispanic ethnicity, 2015



56f. Average medical expenditures among construction workers, by insurance status and age group, 2015



Note: All charts – Data cover all employment.

Source: Charts 56a-56d – National Center for Health Statistics. 2015 National Health Interview Survey. Calculations by the CPWR Data Center.
Charts 56e and 56f – Agency for Healthcare Research and Quality. 2015 Medical Expenditure Panel Survey. Calculations by the CPWR Data Center.

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Annex: How to Calculate the "Real" Wage

The current dollar value refers to dollars in the year they were received or paid, unadjusted for inflation. To figure out the real wage, or compare the purchasing power of wages from year to year, wages need to be adjusted by taking inflation into account.

Real income or real wage can be calculated by using the Consumer Price Index (CPI) reported monthly by the Bureau of Labor Statistics (BLS). The CPI shows overall changes in the prices of all goods and services bought for use by urban households. User fees (such as water and sewer service) and sales and excise taxes paid by the consumer also are included. The index does not include income taxes and investment items, such as stocks, bonds, and life insurance. There are two indexes, the CPI-U for all urban consumers and the CPI-W for urban wage earners and clerical workers.

Wage earners can use wages from two different years and the consumer price index for those years to learn how much ground (if any) has been gained or lost from the first year to the later one. (The index with the most up-to-date figures is available from the BLS, at (202) 691-7000 or https://www.bls.gov/data/inflation_calculator.htm) For instance, given:

Month and Year	Wage	CPI-W
August 2006	$22.25	197.11
August 2016	$28.24	234.10

Convert the wage in 2006 to 2016 dollars to figure out the real wage:

- **Multiply:** 2006 wage times the 2016 price index
  22.25 x 234.10 = 5,208.73

- **Divide:** Previous answer by the 2006 price index
  5,208.73/ 197.11 = 26.43

$26.43 is the purchasing power – how much the August 2006 wage ($22.25) can buy in August 2016.

To find out how much purchasing power was gained or lost during the 10 years:

- **Subtract:** The August 2016 wage *minus* the purchasing power in August 2016 of the old wage
  $28.24 – $26.43 = $1.81

- **Divide:** Previous answer by purchasing power in August 2016 of the old wage
  $1.81 / $26.43 = 0.0685 ≈ 6.9%

(Move the decimal point two places to the right to get a percentage.)
The real wage in this scenario has grown by 6.9% in 10 years.
The purchasing power of the 2016 wage ($28.24) is 106.9% of what it was 10 years ago.

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Glossary

American Community Survey (ACS) – A nationwide survey of households collecting information on demographics, employment, income, residence, and other socioeconomic issues. The large sample size allows for small population group and geographic area estimates.

A-weighted decibels (dBA) – The A-weighting mimics the sensitivity of the human ear to different frequencies.

Blood Lead Levels (BLLs) – A standardized measurement determined by a medical test that screens a person's blood sample for exposure to lead.

Body Mass Index (BMI) – From the National Health Interview Survey: a measure of body weight relative to height. It is calculated as weight in kilograms divided by height in meters squared. Healthy weight for adults is defined as a BMI of 18.5 to less than 25; overweight as a BMI greater than or equal to 25; obesity as a BMI greater than or equal to 30.

Census of Fatal Occupational Injuries (CFOI) – A data collection from the U.S. Bureau of Labor Statistics that provides detailed information on those who were killed at work in the United States due to a traumatic injury. The program uses diverse data sources to identify, verify, and describe fatal work injuries.

Civilian labor force – From the Current Population Survey: includes all those who have jobs or are seeking a job, are at least 16 years old, are not serving in the military, and are not institutionalized (such as in penal and mental facilities, homes for the elderly, and prisons).

Class-of-worker – Assigns workers to one of the following categories: wage-and-salary workers, self-employed workers, or unpaid family workers.

Company – *See* **corporation**.

Complete inspections – From the Occupational Safety and Health Administration: a substantially complete inspection of the potentially high hazard areas of the establishment. An inspection may be deemed comprehensive even if, as a result of the exercise of professional judgment, not all potentially hazardous conditions, operations, and practices within those areas are inspected, https://www.osha.gov/Firm_osha_data/100006.html.

Construction managers – Construction managers plan, coordinate, budget, and supervise construction projects from start to finish.

Construction work done – From the Economic Census: this measure may include new work, additions, alterations, or maintenance and repairs.

Corporation – From the Internal Revenue Service: a business that is legally separate from its owners (which may include individuals or other corporations) and workforce and thus, among other things, forms contracts and is assessed income taxes.

Current dollar value – Dollars are not adjusted for inflation (*see* Annex).

Current Population Survey (CPS) – A monthly household survey conducted by the U.S. Census Bureau for the U.S. Bureau of Labor Statistics, the CPS provides comprehensive information on the employment and unemployment experience of the U.S. population, classified by age, sex, race, and a variety of other characteristics based on interviews with about 60,000 randomly selected households.

Day laborers – Workers hired and paid one day at a time through employment agencies that specialize in short-term contracts for manual labor, or directly hired by contractors and home owners less formally, such as by waiting for work at public street corners, commercial parking lots, etc. Such workers can arrive and be assigned to a job on the spot.

Defined benefit pension plans – A type of pension plan in which an employer/sponsor promises a specified pension payment, lump sum, or combination thereof on retirement that is predetermined by a formula based on the employee's earnings history, tenure of service, and age, rather than depending directly on individual investment returns.

Defined contribution retirement plans – A retirement plan in which the amount is based on employer and employee contributions, plus or minus investment gains or losses on the money in the account. Examples of such plans include 401(k) plans, 403(b) plans, employee stock ownership plans, and profit-sharing plans.

Disability-Adjusted Life Year (DALY) – From the World Health Organization: refers to the number of years living with a disability, and measures the gap between actual and ideal health in a population.

Dollar value of business done – From the Economic Census: the sum of the value of construction work done (including fuel, labor, materials, and supplies) and other business receipts (such as rental equipment, legal services, finance, and other non-construction activities).

Economic Census – An economic survey on private sector establishments in the North American Industry Classification System (NAICS) conducted by the U.S. Department of Commerce every five years.

Employed – From the Current Population Survey: those who during the reference week 1) did any work for pay or profit or worked 15 hours or more as an unpaid worker in a family enterprise, or 2) had a job but were not working because of illness, bad weather, vacation, labor-management dispute, or because they were taking time off for personal reasons, whether or not they were paid for the time off or were seeking other jobs.

Employment Cost Index (ECI) – A quarterly economic series measuring changes in labor costs in the United States. ECI is prepared and published by the U.S. Bureau of Labor Statistics (BLS).

Establishment – From the Economic Census: a single physical location, where business is conducted and services or industrial operations are performed. A construction establishment 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. Construction sites, projects, fields, or lines are not considered to be establishments. Establishments are either with or without payroll (*see* **nonemployer**).

Ethnicity – From the Current Population Survey and the American Community Survey: it is categorized as 1) Hispanic or Latino, and 2) Not Hispanic or Latino. The federal government considers race and Hispanic origin to be two separate and distinct concepts. Hispanics and Latinos may be of any race.

Event or exposure – From the Occupational Injury and Illness Classification System: signifies the manner in which the injury or illness was produced or inflicted, for example, overexertion while lifting or fall from a ladder, https://www.bls.gov/iif/oshdef.htm.

Fatality rate – Represents the number of fatal injuries per 100,000 full-time equivalent workers.

Foreign-born – Refers to individuals who reside in the U.S., but were born outside the country or one of its outlying areas and to parents who were not U.S. citizens, including legally admitted immigrants, refugees, temporary residents such as students and temporary workers, and unauthorized (or undocumented) immigrants.

Full-time equivalent workers (FTEs) – It is used to convert the hours worked by part-time employees into the hours worked by full-time employees for risk comparison. FTEs is determined by the hours worked per employee on a full-time basis assuming a full-time worker working 40 hours per week, 50 weeks per year, or 2,000 hours per year, https://www.bls.gov/iif/oshdef.htm.

Goods-producing industry – Consists of Agriculture, Forestry, Fishing and Hunting (NAICS 11), Mining, Quarrying, and Oil and Gas Extraction (NAICS 21), Construction (NAICS 23), and Manufacturing (NAICS 31-33).

Gravity – From the Occupational Safety and Health Administration: the level of potential harm to workers, ranging from 0 to 10, with higher numbers representing more serious violations.

Great Recession – Refers to the period from December 2007 to June 2009, as defined by the National Bureau of Economic Research's Business Cycle Dating Committee.

Green construction – Construction that uses environmentally responsible and resource-efficient technology and practices. Green construction is often certified by a green building rating system, such as Leadership in Energy and Environmental Design (LEED).

Gross Domestic Product (GDP) – From the Bureau of Economic Analysis: the market value of goods and services produced by labor and property in the United States, regardless of nationality.

Health and Retirement Study (HRS) – A biennial longitudinal national survey on Americans over the age of 50 that collects information on labor force participation, health status, retirement, and many other items.

Hearing impairment – Refers to the definition of hearing loss used by the 2013 Global Burden of Disease study: an average decibel hearing threshold of at least 20 across 500, 1,000, 2,000, and 4,000 Hz in the better ear.

Hearing trouble – From the National Health Interview Survey: refers to those who reported that without the use of hearing aids or other listening devices, had "a little trouble hearing, moderate trouble, a lot of trouble, or [were] deaf."

Heart condition – For the purposes of this Chart Book, defined as individuals who answered "Yes" to the National Health Interview Survey question: "Have you EVER been told by a doctor or other health professional that you had ...any kind of heart condition or heart disease?"

Hispanic – A term used by the U.S. Census Bureau and the U.S. Bureau of Labor Statistics to refer to persons who identified themselves in the enumeration or survey process as being Spanish, Hispanic, or Latino. Persons of Hispanic or Latino ethnicity may be of any race.

Hispanic-owned – Hispanics of any race own 51 percent or more of the stock or equity of the business.

Immigrant workers – Workers who enter the U.S. and settle down in the country.

Incidence rate – From the Survey of Occupational Injuries and Illnesses: represents the number of injuries and/or illnesses per 100 (or 10,000) full-time equivalent workers (*see* **FTEs**).

Incorporated self-employment – Refers to people who work for themselves in corporate entities. They are more likely to have paid employees.

Incorporated worker – *See* **self-employed**.

Independent contractor – An individual is an independent contractor if the payer has the right to control or direct only the result of the work and not what will be done and how it will be done. The earnings of an independent contractor are subject to self-employment tax (see self-employed).

Individual proprietorship – Referred to as a "sole proprietorship," or an unincorporated business with a sole owner. Also included in this category are self-employed persons.

Leadership in Energy and Environmental Design (LEED) – From the U.S. Green Building Council: a voluntary, consensus-based, market¬-driven program that provides third-party verification of green buildings.

Managers (except construction managers) – Refers to all other managerial occupations, including architectural and engineering managers, equipment managers, financial managers, human resources mangers, etc.

Mean – Or average; the sum of all the numbers in the set divided by the amount of numbers in the set.

Median – The numerical value separating the higher half of a sample from the lower half. If there is an even number of observations, then the median is the average of the two middle values.

Medical expenditures – Include payments from all sources to hospitals, physicians, other medical care providers, and pharmacies for services received for medical conditions reported by respondents. Expenditures for hospital-based services include those for both facility and separately billed physicians' services. Over-the-counter drugs, alternative care services, and telephone contacts with medical providers are not included.

Medical Expenditure Panel Survey (MEPS) – A set of large-scale surveys of families and individuals, their medical providers, and employers across the United States. MEPS is a major source of data on the cost and use of health care and health insurance coverage in the U.S., https://meps.ahrq.gov/mepsweb/.

Migrant worker – A person who moves from place to place to get work; refers to those who enter the U.S. for work but usually do not have an intention to stay permanently in the country.

Multiemployer plan – A collectively bargained plan maintained by more than one employer, usually within the same or related industries, and a labor union. These plans are often referred to as "Taft-Hartley plans" (ERISA Secs. 3(37) and 4001(a)(3)), https://www.pbgc.gov/prac/multiemployer/introduction-to-multiemployer-plans.

Musculoskeletal disorders (MSDs) – From the U.S. Bureau of Labor Statistics (2011 onward): in the category of **Nature**, MSDs include an injury or illness from pinched nerve; herniated disc; meniscus tear; sprains, strains, and tears; hernia (traumatic and non-traumatic); pain, swelling, and numbness; carpal or tarsal tunnel syndrome; Raynaud's syndrome or phenomenon; and musculoskeletal system and connective tissue diseases and disorders. In the category of **Event or exposure**, MSDs include an injury or illness due to overexertion and bodily reaction; overexertion involving outside sources; repetitive motion involving microtasks; other and multiple exertions or bodily reactions; and being rubbed, abraded, or jarred by vibration; https://www.bls.gov/iif/oshdef.htm.

Nanomaterials – From the National Nanotechnology Initiative: all nanoscale materials or materials that contain nanoscale structures internally or on their surfaces. These can include engineered nano-objects (such as nanoparticles, nanotubes, or nanoplates) and naturally occurring nanoparticles (such as volcanic ash, sea spray, or smoke). The nanoscale is the dimensional range of approximately 1 to 100 nanometers.

Nanotechnology – From the National Nanotechnology Initiative: a new technology that deals with developing materials, devices, or other structures with at least one dimension sized from 1 to 100 nanometers (or one billionth of a meter).

Nature (of injury or illness) – From the U.S. Bureau of Labor Statistics (2011 onward): identifies the principal physical characteristic(s) of an injury or illness, https://www.bls.gov/iif/oshdef.htm.

Noise-induced hearing loss (NIHL) – Hearing loss that can be attributed to exposure to hazardous levels of noise. The U.S. Bureau of Labor Statistics defines it as a change in hearing threshold relative to the baseline audiogram of an average of 10 decibels (dB) or more in either ear at 2,000, 3,000, and 4,000 hertz and the employee's total hearing level is 25 dB or more above the audiometric zero (also averaged at 2,000, 3,000, and 4,000 hertz) in the same ear(s), https://www.bls.gov/iif/oshdef.htm.

Nonemployer – From the U.S. Census Bureau: a business with no payroll or paid employees, with annual business receipts of $1,000 or more ($1 or more in the construction industry), and subject to federal income taxes. Most nonemployers are self-employed individuals operating very small unincorporated businesses. Nonemployers can be partnerships, sole proprietorships, or corporations without employees.

Non-white, non-Hispanic – From the Current Population Survey and the American Community Survey: those who chose to identify and report themselves in ethnicity as non-Hispanic and in race as black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, or some race other than white.

North American Industry Classification System (NAICS) – A system used to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data in the United States, Canada, and Mexico. Under NAICS, the construction industry is coded as 23. This system is updated every five years.

Occupational Information Network (O*NET) – A free online database that contains hundreds of occupational definitions to help job seekers, businesses, and workforce development professionals to understand today's world of work in the United States, https://www.onetonline.org/.

Overexertion – Cases of injury or illness that occur when excessive physical effort (such as lifting or carrying) is exerted on an outside source (such as a heavy container).

Paid employees – From the Economic Census: consists of full- and part-time employees, including salaried officers and executives of corporations, who are on payroll in the pay period including March 12. Included are employees on paid sick leave, holidays, and vacations; not included are proprietors and partners of unincorporated businesses.

Partial inspections – From the Occupational Safety and Health Administration: an inspection whose focus is limited to certain potentially hazardous areas, operations, conditions, or practices at the establishment.

Permissible exposure limit (PEL) – A limit established by the Occupational Safety and Health Administration of the legally allowable exposure of an employee to a chemical substance or physical agent.

Production worker – In this Chart Book, same as blue-collar worker. From the Current Population Survey: all workers, except managerial, professional (architects, accountants, lawyers, etc.), and administrative support staff. Production workers can be either **wage-and-salary or self-employed workers**.

Racial minorities – From the Current Population Survey and the American Community Survey: those who chose to identify themselves as black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, or some race other than white. Persons who select more than one race are counted as racial minorities in this Chart Book.

Recommended Exposure Limit (REL) – From the National Institute for Occupational Safety and Health: based on risk evaluations using human or animal health effects data as well as an assessment of what can be feasibly achieved by engineering controls and measured by analytical techniques.

Regions – From the U.S. Census Bureau: The 50 states and the District of Columbia are divided into four regions: Northeast, South, Midwest, and West, https://www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html#regions.

Road construction sites – Includes construction, maintenance, or utility work on a road, highway, or street based on the definition used in the Census of Fatal Occupational Injuries by the U.S. Bureau of Labor Statistics.

Seasonal adjustment – A statistical technique which eliminates the influences of weather, holidays, and other recurring seasonal events from economic time series. This permits easier observation and analysis of cyclical, trend, and other non-seasonal movements in the data.

Self-employed – From the Current Population Survey: in this Chart Book, includes both incorporated and unincorporated. However, only the unincorporated self-employed are included in the self-employed category in the U.S. Bureau of Labor Statistics' publications.

Serious, willful, and repeat (SWR) – From the Occupational Safety and Health Administration: a serious violation is issued when a workplace hazard exists which has a high probability of causing death or serious physical harm and that employers knew or should have known about. A willful violation is issued when an employer knowingly does not abide by OSHA standards and makes no effort to rectify the situation. A repeated violation is when employers are repeatedly cited for the same OSHA violation.

Source (of injury) – The Source and Secondary Source identify any objects, substances, equipment, or other factors that were responsible for the injury or illness incurred by the worker or that caused the Event or Exposure, https://www.bls.gov/iif/oshoiics.htm.

Standard Industrial Classification (SIC) – This system was replaced by the North American Industry Classification System in 1997. The last version in 1987 included three major construction categories: general contractors (15), heavy and highway (16), and specialty contractors (17).

Standard Occupational Classification (SOC) – A system used by federal statistical agencies to classify workers into occupational categories according to their job description for the purpose of collecting, calculating, and disseminating data. Construction and Extraction Occupations (47-0000) is a major category in this system. The system is updated periodically.

Survey of Business Owners (SBO) – A data source collected by the U.S. Census Bureau on selected economic and demographic characteristics for businesses and business owners by gender, ethnicity, race, and veteran status.

Survey of Occupational Injuries and Illnesses (SOII) – An annual survey conducted by the U.S. Bureau of Labor Statistics, the SOII collects data on nonfatal injuries and illnesses from a sample of employers. For more serious cases which involve one or more days away from work, it also provides a description of the injury or illness circumstances as well as the characteristics of the affected workers.

Temporary workers – From the Medical Expenditure Panel Survey: respondents who answered "yes" to either of the two questions: "Is your current main job a temporary job?" or "Is your current main job a seasonal job?" Temporary workers could be full-time or part-time workers.

Unauthorized immigrants – Refers to all foreign-born non-citizens who are not legal residents. This definition reflects standard and customary usage by the U.S. Department of Homeland Security and academic researchers. The vast majority of unauthorized immigrants entered the country without valid documents or arrived with valid visas but stayed past their visa expiration date or otherwise violated the terms of their admission.

Unemployed – Those who did not work during the reference week, but were available for work and had actively looked for employment at some point in the previous four weeks. Individuals on layoff or waiting to report to work are considered unemployed.

Unemployment rate – The number of unemployed persons as a percent of the labor force.

Unincorporated self-employment – Refers to individuals who work for themselves, such as independent contractors, independent consultants, and freelance workers. Most often, they do not have paid employees (*see* **nonemployer**).

Unincorporated worker – *See* **self-employed**.

Union market share – Proportion of union workers (mainly in production occupations) in a given segment of an industry; similar to union membership as defined by the Current Population Survey.

Value-added prices – From the Economic Census: a measure of construction activity equal to the value of business done, less costs for construction work subcontracted out to others and costs for materials, components, supplies, and fuels.

Wage-and-salary – Workers who receive wages, salaries, commissions, tips, or pay from a private employer or from a government unit.

Acknowledgements

This book is a product of CPWR's Data Center: Xiuwen (Sue) Dong, DrPH, principal author; and Xuanwen Wang, PhD, and Rebecca Katz, MPH, co-authors. Gavin West, MPH, CPWR, and Bruce Lippy, PhD, CPWR, were contributing authors. Christina Trahan Cain, CIH, CPWR Executive Director, and Rosemary Sokas, MD, MOH, CPWR Interim Deputy Director, served as internal reviewers and provided input and support for this edition, along with other CPWR staff. Eileen Betit, CPWR Research to Practice Director, Sharretta Benjamin, CPWR Communications Coordinator, and Clayton Sinyai, PhD, CPWR Communications Research Manager, coordinated publication and dissemination.

We greatly appreciate the contribution of Christine Branche, PhD, Principal Associate Director, and Director, NIOSH Office of Construction Safety and Health; Scott Earnest, PhD, Deputy Director, NIOSH Office of Construction Safety and Health, and Coordinator of NORA Construction Sector; and Sharon Chiou, PhD, NIOSH Office of Extramural Programs, for their thorough review and constructive comments; Tom Kriger, PhD, Director of Research, NABTU, and Peter Philips, PhD, Professor of Economics, University of Utah, for their invaluable review and input; and Alissa Fujimoto, MA, for her careful review, feedback, and editing.

For reviewing selected text and charts, we wish to thank John Balmes, MD, University of California, San Francisco; Sherry Baron, MD, MPH, Queens College; Anila Bello, ScD, University of Massachusetts, Lowell; Dhimiter Bello, ScD, University of Massachusetts, Lowell; Cihan Bilginsoy, PhD, University of Utah; Ann Marie Dale, PhD, MSD, Washington University in St. Louis; Angela Delano, Economic Indicators Division, U.S. Census Bureau; Linda Forst, MD, MPH, University of Illinois at Chicago; David Fosbroke, BS, MSF, NIOSH; Matt Gillen, MS, CIH, NIOSH (retired); Jennifer Hess, PhD, University of Oregon; Laurel Kincl, PhD, Oregon State University; Douglas Myers, ScD, West Virginia University; Michael Reich, U.S. Census Bureau; Knut Ringen, DrPH, CPWR Senior Scientific Advisor; Jeffrey Waddoups, PhD, University of Nevada at Las Vegas; Gregory Wagner, MD, Harvard T.H. Chan School of Public Health; David Wegman, MD, MPH, University of Massachusetts, Lowell; and David Weissman, MD, NIOSH.

For providing direct information or data review, we thank Carey L. Peters, PhD, Executive Director, Construction Labor Research Council; Darrin Adams and David Bonauto MD, MPH, Washington Department of Labor and Industries (L&I); Walter Alarcon, MD, and Rebecca Tsai, PhD, Adult Blood Lead Epidemiology and Surveillance (ABLES), NIOSH; Ibraheem Al-Tarawneh, PhD, Michael Lampl, MS, Steven Naber, and David Robins, AAS, Ohio Bureau of Workers' Compensation (BWC); Stephen Bertke, PhD, and Steven Wurzelbacher, PhD, Center for Workers' Compensation Studies (CWCS), NIOSH; Winifred Boal, MPH, James Boiano, MS, CIH, Jia Li, MS, and Sharon Silver, MS, Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS), NIOSH; Timothy Bushnell, PhD, Office of the Director, NIOSH; Joe Coble, ScD, CIH, Office of Technological Feasibility, Occupational Safety and Health Administration (OSHA); John Dement, PhD, Duke University; Alexander Jordan, Employment and Training Administration (ETA), Department of Labor (DOL); Ryan Farrell, Economist, Thomas Moehrle, Economist, Henry Reeve, Economist, and Aisha Spencer, Economist, U.S. Bureau of Labor Statistics (BLS); Bill Perry, OSHA; and Keith Taylor, Data Coordinator, Federal Reserve Economic Data (FRED), Federal Reserve Bank of St. Louis.
This Chart Book includes a significant amount of information provided by a number of sources.

We are indebted to the assistance provided by staff at the U.S. Census Bureau, BLS, Building Trades National Medical Screening Program (BTMed), ETA DOL, NIOSH, OSHA, and the U.S. Green Building Council (USGBC).

We would also like to thank the members of CPWR's Technical Advisory Board (TAB) under the leadership of chair Erich J. (Pete) Stafford, former Executive Director of CPWR, for assistance in planning and guidance on the contents of this book. TAB members include Eula Bingham, PhD, Department of Environmental Health, University of Cincinnati Medical School; Letitia Davis, ScD, Director, Occupational Health Surveillance Program, Massachusetts Department of Public Health; Denny Dobbin, MSc, CIH, Environmental Advisor, Chapel Hill, NC; Mark Fullen, EdD, CSP, Safety and Health Extension, West Virginia University; Steven Hecker, MSPH, Associate Professor Emeritus, University of Oregon; James Melius, MD, DrPH, Administrator, New York State Laborers' Health and Safety Fund; Melvin Myers, MPA, University of Kentucky; Melissa Perry, ScD, MHS, Department of Environmental and Occupational Health, George Washington University; and Harry Shannon, PhD, Department of Clinical Epidemiology & Biostatistics, McMaster University. Dobbin, Fullen, Hecker, Melius, Perry, Shannon, and Stafford also served as reviewers.

Publication layout was performed by
Sharretta Benjamin, CPWR.
Proof reading by Sarah Wood.
Cover design by Carlton Creative.

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