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Work-Related Fatal and Nonfatal Injuries among U.S. Construction Workers, 1992-2008

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This research was made possible by a cooperative agreement with the National Institute for Occupational Safety and Health, NIOSH (grant 1 U60 OH009762-01). The research is solely the responsibility of the authors and does not necessarily represent the official views of NIOSH.

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Acknowledgments

The authors would like to thank Pete Stafford, the CPWR Executive Director, for his review and valuable comments, Alissa Fujimoto for her input in the completion of this work, Mary Watters for editing and Sharretta Benjamin for layout.

Abbreviations

BLS	Bureau of Labor Statistics
CBP	County Business Patterns
CFOI	Census of Fatal Occupational Injuries
DAFW	Days Away From Work
FTE	Full-time equivalent (2,000 hours worked per year)
NAICS	North American Industry Classification System
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
SIC	Standard Industrial Classification
SOC	Standard Occupational Classification
SOII	Survey of Occupational Injuries and Illnesses

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October 2010

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CPWR - The Center for Construction Research and Training has been monitoring construction safety and health to provide a basis for more effectively targeting injury and illness prevention efforts since 1990. This report summarizes work-related deaths and nonfatal injuries and illnesses among construction workers from 1992 through 2008, the most recent year for which data were available.

There were several substantial changes across the study period, including different industrial and occupational classification systems (NAICS), beginning in 2003. Therefore, statistics for a specific occupation may not be directly comparable prior to and after 2002 (*see Annex*). Some construction occupations are not presented individually since small numbers for those occupations would not be statistically reliable. Additionally, detailed information on injuries and illnesses among Hispanic construction workers were reported separately as a Data Brief, which can be found at the CPWR website: www.cpwr.com

Methods

Data on Fatal Injuries

Numbers of deaths were obtained from the Census of Fatal Occupational Injuries (CFOI) conducted by the U.S. Bureau of Labor Statistics (BLS). The CFOI is a federal-state cooperative program that has been implemented in all 50 states and the District of Columbia since 1992 (BLS 2010a). The CFOI data on deaths resulting from injuries are compiled from death certificates, workers' compensation reports, OSHA reports, medical examiner reports, newspaper articles, and other sources. Both the death and the work-relatedness of the death must be corroborated by at least two data sources or one data source and a follow-up questionnaire. States are allowed to revise the reports within one year. Deaths occurring during a commute to or from work are not considered work-related, but vehicle-related deaths during the course of work are included. Except where noted, the calculations of death rates in this report include the public and private sectors and self-employed workers. Thus, the numbers presented here may differ from those in some BLS publications, which include only deaths in the private sector.

From 1992 to 2002, the CFOI data coded the construction industry as 1500 to 1799 by the 1987 Standard Industrial Classification system (SIC; OMB 1987) and "CCCC" for construction sectors that could not be categorized in any SIC. Occupations were coded under the 1990 Census Occupational Classification System. Beginning with the 2003 data, the CFOI has coded the construction industry as 23 and detailed construction sectors as 23600 to 23899 using the North American Industry Classification System (NAICS; OMB 2002). Construction trades and extraction occupations were coded from 47-0000 to 47-5099 under the 2000 Standard Occupational Classification System (www.bls.gov/soc/home.htm).

Data on Nonfatal Injuries and Illnesses

The Survey of Occupational Injuries and Illnesses (SOII) provided cases of nonfatal injuries and illnesses. The SOII is a federal-state program in which employer reports are collected annually from private sector establishments and processed by state agencies cooperating with the BLS. Unlike the CFOI, the SOII measures nonfatal injuries and illnesses for private industries and excludes the self-employed, farms with fewer than 11 employees, private households, and employees in federal government agencies.

In addition to adopting the new industrial and occupational coding systems, the SOII has undergone several important changes in recent years, including changes in OSHA recording requirements (OSHA 2002), which may affect the data comparability across years. Since illnesses account for less than 3% of nonfatal cases in construction, this report occasionally refers to just the broad category of “injuries.”

Data on the Workforce

Employment and number of hours worked were obtained from the Current Population Survey (CPS). The CPS is a monthly survey of households conducted by the U.S. Census Bureau for the U.S. Bureau of Labor Statistics. Each month, basic demographic information is obtained from about 60,000 households across the United States, including age, gender, race, and Hispanic or Latino ethnicity. For those aged 16 years or older, the survey collects employment information, such as occupation, industry, and number of hours worked. The hours worked are self-reported by individual workers rather than by employers. Unlike the CFOI and the SOII, the CPS uses the Census Industrial and Occupational Classification codes, in which the construction industry is coded together, while construction trades and extraction occupations are coded from 6200 to 6700 by the 2002 Census codes.

The CPS incorporates new population controls into its estimates each year. The changes reflect an annual review of the components of population changes — births, deaths, and international migration — and of the methodology used to estimate the population (BLS 2010b). Substantial revisions to the population controls have created historical comparability problems. For example, the estimated Hispanic population increased by 8% for the 2002 data, while the overall employment decreased by nearly 1% for the 2009 data after the population controls changed. To smooth trend analyses, employment estimates were adjusted by taking such changes into account when calculating injury rates. As a result, the injury rates presented in this report are slightly different from previous publications (*see* CPWR 2005; NIOSH 2004; Dong and Platner 2004; CPWR 2002; Pollack and Chowdhury 2001).

Data on Establishments

Information on *establishments* (see Glossary) was obtained from County Business Patterns (CBP), an annual data collection of the U.S. Census Bureau. The CBP provides information on the number of employees by establishment size for payroll employment, but does not collect data on self-employed workers or government employees. Thus, deaths among self-employed construction workers were excluded from the CFOI data to match employment by establishment size from the CBP. Since the categories of establishment size in CBP differ from the CFOI, and the CBP does not indicate hours worked, only the proportions of deaths for certain establishment categories were provided.

Measuring Risk

Risk in construction is measured by rates of fatal and nonfatal injuries (and/or illnesses). Since some construction workers do not work full-time, rates are expressed as full-time equivalents or FTEs, defined as 2,000 hours worked per year (50 weeks x 40 hours per week). This measure facilitates comparisons with workers in different population groups and industries. Death rates are measured per 100,000 FTEs. Nonfatal rates are measured per 100 or 10,000 FTEs and, in this report, include only cases with *days away from work* (DAFW) (see Glossary). Injury rates by occupation or demographic group were calculated by matching the incidence number of an occupation or a group from the CFOI or the SOII to the FTEs in the corresponding group obtained from the CPS. Occupations were matched using a cross-walk between the two coding systems provided by the BLS.

Fatal and nonfatal injuries for construction occupations were reported in several ways. To understand the injury trends over time, annual rates of fatal and nonfatal injuries for selected construction occupations were reported individually. Rates may fluctuate from year to year, especially for fatality rates among small construction occupations. Therefore, the CFOI data for 2003-2008 were pooled together to obtain more reliable estimates for occupations. To distinguish risk for *production workers* (see Glossary) or blue-collar workers from the entire construction industry, workers in construction trades and production occupations were combined for rate estimates. Additionally, a death rate index was created to compare fatal falls with overall fatalities in construction across the years, in which death rates in 1992 were used as the baseline. For all data analyses, records with missing values (for instance, no ethnic group reported) were excluded from the rate calculation.

Results

Overall Trends in Construction

The construction sector continues to account for a disproportionate share of work-related deaths in the United States. Although fatalities dropped in 2008 due to the economic downturn, construction workers still suffered 20% of the nation's 5,214 reported work-related deaths, which is disproportionately high given that construction workers encompassed 8% of the total U.S. workforce that year. In general, construction employment fluctuated in tandem with the overall U.S. economy. Between 1992 and 2007, employment in construction increased by almost 70% from 7 million to nearly 12 million, and then lost more than 2 million jobs within two years (chart 1a). The employment changes were reflected in work-related fatalities in construction. The deaths from injuries in construction increased about 35%, from 963 in 1992 to 1,297 in 2006, and dropped 18% between 2007 and 2008 (chart 1b). Such variations were striking for Hispanic construction workers during this period. Hispanic employment in construction increased about five times when the housing market was booming and shrank greatly when the market plunged. The number of Hispanic fatalities was 360 in 2006 and dropped down to 250 in 2008, a 30.6% decrease (charts 1a, 1b).

In general, both fatal and nonfatal injury rates in construction have declined over time, but the extent of declining fatalities lags behind that of nonfatal injuries. The death rate of construction workers decreased 33% from 14.3 per 100,000 FTEs in 1992 to 9.6 per 100,000 FTEs in 2008 (chart 2a), while nonfatal injury and illness rates involving *days away from work* (DAFW) declined around 67% from 529.5 to 174.3 per 10,000 FTEs during the same time period (chart 2b). Between 2006 and 2008, the rate of fatal and nonfatal injuries decreased by 13.5% and 20.6%, respectively.

Compared with other *goods producing industries*, the construction fatality rate was lower than the rates for mining and agriculture, but higher than manufacturing in 1992 - 2008 (chart 2a). Although rates declined for the DAFW cases for the four major production industries across the years, rates for construction remained the highest of the four industries except for 2008 (chart 2b). Within construction, production workers consistently have a higher rate across years for both fatal and nonfatal injuries when compared with construction as a whole¹ (chart 3).

¹ The rates used for this comparison were estimated based on the employment numbers from the Current Population Survey (CPS), which were slightly lower than the BLS published rates.

Aging workforce. Following the trend of the aging workforce in the United States, construction workers are also growing older. In 2009, the average age of construction workers was 41 years, almost four years older than that in 1992 (chart 4), with the median age increasing from 36 to 41 during this period (The median age is the midpoint; half of the workers are older than the median and half are younger). The age gap between construction and all industries was also narrowed from 1.6 years in 2005 to less than 0.3 year in 2008 due to a large number of young Hispanic workers losing their construction jobs during the economic downturn.

The age structure of work-related deaths reflects the aging workforce. The largest proportion of work-related deaths shifted from the group aged 25 to 34 in 1992 to the group aged 35 to 44 in 2003, and then to the group aged 45 to 54 in 2008 (chart 5a). Similarly, the proportion of nonfatal cases for workers aged 25 to 34 dropped from 39.4% in 1992 to 30.2% in 2008; while the proportion of nonfatal cases for the age group 45 to 54 increased from 10.4% to 21.1% during the same period (chart 5b). In general, older construction workers had higher death rates than younger workers (chart 6a); while younger construction workers had higher nonfatal injury and illness rates than older workers (chart 6b).

Small establishments or contractors. The construction industry is composed mainly of small establishments; more than 80% of construction establishments have fewer than 10 employees (U.S. Census Bureau 2010). Small establishments appear to suffer a disproportionate share of work-related deaths from injuries. Establishments having fewer than 20 employees reported 56% of construction deaths from injuries (chart 7a), while employing only 38% of the wage-and-salary workforce in construction on average from 2003 to 2008 (U.S. Census Bureau 2005-2010). In 1992-2008, establishments with 10 or fewer employees showed 6,139 deaths, accounting for 41% of all construction deaths from injuries.²

By contrast, however, nonfatal injury rates for small establishments (1-10 employees) were consistently lower than for establishments having 11 to 249 employees (chart 7b). In fact, reported rates for small establishments have been continuously declining since 1994, which is the first year when the BLS reported injury rates by establishment size. Interestingly, injury rates for large establishments (1,000 or more employees) have stayed relatively constant with a slight decrease in recent years, but still remains the lowest of all sizes of construction establishments.

Leading causes of deaths from injuries. Falls remained the leading cause of death in construction, followed by transportation accidents, contact with objects, and exposure to harmful substances or environments (chart 8a). From 1992 to 2008, 6,304 construction workers were killed by injuries from falls, accounting for 32% of work-related deaths in the industry. About 97% (6,142) of these deaths from falls were caused by falls to a lower level (chart 9a). However, such deaths decreased from 435 in 2007 to 329 in 2008, a 24% drop within one year.

² Deaths reported without establishment size information (25%) and self-employed workers were excluded from this calculation.

Leading causes of nonfatal injuries. Patterns of leading causes for nonfatal injuries differ from those for fatal injuries. In 2008, “contact with objects” was the leading cause, responsible for just over one-third of the 120,240 nonfatal injuries and illnesses with days away from work in construction (chart 8b). More than half of the contact cases involved being struck by an object. Falls were the second most common cause of nonfatal injuries. Nearly one-fifth of nonfatal injuries were caused by overexertion (i.e., producing work-related musculoskeletal disorders) with a large proportion involving lifting. From 1992 through 2008, the rate of nonfatal injuries resulting from being struck by an object was consistently higher than other causes (chart 9b).

Trends of fatal and nonfatal injuries from falls. From 1992 to 2008, the rate of fatal falls remained high despite the fact that the overall death rate for construction workers declined (charts 10a and 10b). Nearly one-third of fatal falls in construction were due to falls from roofs including roof edges, roofs unspecified, and skylights (chart 11a). Overall, falls from roofs, ladders, and scaffolds caused about two-thirds of all fatal falls in construction. Falls on the same level ranked number one among nonfatal falls in construction, accounting for over one-third of the total number of nonfatal falls (chart 11b). When examining the rate of fatal falls by occupation, ironworkers and roofers were the top two dangerous occupations in construction (chart 12a) with 37.9 and 27.6 deaths per 100,000 FTEs, which is nearly 11 and 8 times the average for all construction (3.6 per 100,000 FTEs), respectively. In addition, risk of fatal falls varied among different age groups. Construction workers 65 years or older were almost 4 times likely to suffer a fatal fall compared with all construction workers on average (chart 12b). The risk of fatal falls for workers aged 16 to 19 was also higher than average, although less than 3% of fall decedents were found in this age group.

Time of injuries. From 1992 through 2008, a higher percentage of deaths were reported between 10 a.m. and 12 noon, and between 1 and 3 p.m. (chart 13a). In 2008, most of the nonfatal injuries in construction occurred in the morning (chart 13b). However, detailed time data on nonfatal injuries were unavailable. More research is needed to understand exactly what, if anything, these findings signify.

Fatal and Nonfatal Injuries among Construction Occupations

Fatal injuries among construction occupations. Between 2003 and 2008, the number of fatalities for construction laborers, the largest trade in construction, was the highest of all construction occupations (chart 14a). For the same time period, ironworkers and electrical power installers had the highest rates of work-related deaths at 64.7 and 60.9 per 100,000 FTEs, respectively (chart 14b). Roofers were the third most dangerous occupation with a death rate of 32.0 per 100,000 FTEs. Construction laborers had a death rate of 21.8 per 100,000 FTEs.

Nonfatal injuries among construction occupations. In 2008, construction laborers had the largest number (n = 27,150) of DAFW cases among all construction occupations (chart 15a), while sheet metal workers had the highest rate of such cases (506.7 per 10,000 FTEs) (chart 15b). In addition, insulators, ironworkers, and roofers had higher nonfatal rates than the average.

Trends among selected construction occupations, 1992 – 2008

- **Bricklayers:** Overall, fatal and nonfatal injury rates for this occupation were lower than those for all of construction (charts 16a, 16b). Falls to a lower level remained the leading cause of death for bricklayers (142 deaths, 51% of 276 deaths).

- **Carpenters:** This group had lower death rates than for all construction (chart 17a). Falls to a lower level were the leading cause of death for carpenters (838 deaths, 54% of 1,546 deaths), followed by being “struck by” an object, (147 deaths, 9%). Nonfatal injury rates for carpenters were slightly higher prior to 2006, but very similar to all construction in recent years (chart 17b).

- **Construction laborers:** The death rate for this occupation was consistently higher than for all construction (chart 18a). Falls to a lower level were the leading cause of death for this group (1,361 deaths, 28% of 4,928 deaths), followed by being struck by a vehicle (701 deaths, 14%) and being struck by an object (592 deaths, 12%). The nonfatal injury rate decreased substantially by 82% with 1,330 injuries per 10,000 FTEs in 1992 to a mere 234 per 10,000 FTEs in 2008 (chart 18b). Still, in 2008, construction laborers suffered a higher nonfatal rate than all construction workers combined.

- **Electrical power-line installers:** The death rates were consistently higher for this group than all of construction, but dropped substantially by almost 50% between 1992 and 2008 (chart 19a). Contact with electric current was the leading cause of death at 136 (52% of 260 deaths) for the past 17 years, followed by falls to a lower level at 74 (28%). The nonfatal rate constantly fluctuated over the years but, like the death rate, went down nearly 20% during this time period (chart 19b).

- **Electricians:** The death rate rose and fell over the years but notably decreased by 56% from 1992 to 2008 (chart 20a). The major cause of death for electricians was contact with electric current (596 deaths, 52% of deaths), followed by falls to a lower level (128 deaths, 17%). The nonfatal injury trend for this occupation was similar to the trend for all construction, but the rate was slightly lower than the entire construction industry, declining from 496 to 156 per 10,000 FTEs in 1992 - 2008 (chart 20b).

- **Excavating/loading machine operators:** The death rate varied over the years for this group and was higher than all of construction for most years (chart 21a). Being struck by an object was the leading cause of death for this occupation (26 of 204 deaths). Throughout the time period, the nonfatal rate was lower than for all construction, except for 2008 (chart 21b).

● **Ironworkers:** The death rate for this occupation was significantly higher than all construction, but declined gradually by 68% over the years (chart 22a). Falls to a lower level caused 453 deaths (68% of 666). The nonfatal injury rate for ironworkers decreased from 1992 to 2008 by 85%, from 1,750 to 256 per 10,000 FTEs. Despite this decline, the nonfatal injury rate still remained higher than the entire construction industry (chart 22b).

● **Operating engineers:** The death rate for this group varied over the years, but was generally higher than that for all construction (chart 23a). Being struck by an object was the leading cause of death for operating engineers, who operate and maintain heavy equipment (112 of 684 deaths, 16%). The nonfatal injury rate was lower than all construction during the study period, except for 1992 (chart 23b).

● **Painters:** Fatal and nonfatal injury rates for this occupation were lower than for all construction. The death rate decreased by nearly 20% and the nonfatal injury rate dropped 76% from 368 to 90 per 10,000 FTEs between 1992 and 2008 (charts 24a, 24b). Falls to a lower level caused 401 deaths (57% of deaths).

● **Plumbers:** The death rate was consistently low and decreased during this period (chart 25a). Falls to a lower level were the major cause of death (92 of 520 deaths, 18%). The trend of nonfatal injury rates was similar to all construction, and decreased by 56% from 504 to 220 per 10,000 FTEs in 1992 - 2008 (chart 25b).

● **Roofers:** Rates of death from injuries were consistently higher for this group than for all construction (chart 26a). Falls to a lower level caused 810 deaths in 1992 - 2008, which was 75% of all deaths among roofers during this period. Similar to the trend for all construction, the nonfatal injury rate for roofers decreased to 209.4 per 10,000 FTEs in 2008, but was still higher than that the rate (174.3 per 10,000 FTEs) for all construction (chart 26b).

● **Truck drivers:** From 1992 to 2008, the rates of death from injuries fluctuated but were consistently higher than for the construction industry as a whole (chart 27a). Half of the deaths (417 of 796 deaths) were caused by highway accidents. The nonfatal injury rate for this occupation was also higher than all construction in general, but decreased by 49% from 533 to 274 per 10,000 FTEs during the study period (chart 27b).

● **Welders/cutters:** The death rate was constantly higher for this group than for all construction, and increased by 18% from 22 to 26 per 100,000 FTEs in 1992 - 2008 (chart 28a). Falls to a lower level caused 143 deaths (35% of 403 deaths). The nonfatal injury rate fluctuated over the years with a final rate of 150 per 10,000 FTEs in 2008, which was close to the total construction average (chart 28b).

Discussion and Recommendations

The construction industry continues to face serious challenges in safety and health despite the declining rates over time and the significant drop in injuries during the current economic downturn. While overall rates of fatal injuries declined in construction, the rate of fatal falls remained high, especially among several occupations including ironworkers, roofers, welders, and construction laborers. Falls, particularly falls to a lower level, were still the leading cause of death, responsible for about one-third of all deaths in construction. Although during the study period the death rates for ironworker and electrical power-line installer declined by 68% and 50%, respectively, they still ranked as the highest risk occupations. Also, death rates were more than double, or at least 50% higher, for construction laborers, truck drivers, welders, and operating engineers compared with construction as a whole. Training and proven interventions should be adopted for these high-risk construction occupations and activities involving the risk of falls.

This report documented that the construction workforce is continually aging, which is reflected in the age shift for both fatal and nonfatal injuries during the study period. Risk variations were observed among different age groups. Construction workers aged 55 years and older had a higher risk of fatal falls. Given the increasing aging workforce in the construction industry, job redesign for older construction workers should be considered and fall protections for them should be enhanced. Younger workers were more likely to suffer from nonfatal injuries, and the risk of fatal falls was higher for younger workers under 20 years old. Age factor should be definitely taken into account when developing training and intervention programs.

Meanwhile, small construction establishments with fewer than 20 employees shared nearly 60% of construction deaths from injuries, which was disproportionately high considering that less than 40% of construction workers were employed in such establishments. Given the large proportion of small establishments in the construction industry and the considerable number of deaths in those establishments, improved safety and health interventions and OSHA enforcement are urgently needed, especially for small construction establishments.

This report has several limitations. One of major limitations is the lack of reliable data (i.e., hours worked) to estimate injury rates. Comparing injury and illness rates at the major industry level, rates based on the CPS data were about 10% lower than rates from the SOII, which suggests that self-reported hours worked in the CPS data were overestimated. Since the CPS is conducted via telephone, there is likely some undercounting of migrant and mobile workers and those who rent or lack permanent U.S. addresses, for example, recent immigrants and very low income workers. In addition, some construction workers are misclassified in non-construction industries. For instance, workers from temporary work agencies are classified in “services” under NAICS and SIC. Moreover, most illnesses have a long latency period, such as cancers and asbestos-related diseases. The overwhelming majority of reported illnesses only include cases relatively easy to link with workplace activity such as contact dermatitis or carpal tunnel syndrome. Considering the possible

underreporting and underestimation, the numbers presented in this report should be interpreted and used with caution.

This report highlights the prominent difference between fatal and nonfatal injury trends in construction, especially for small establishments. While risk factors for fatal and nonfatal injuries are not necessarily the same, the difference might be explained by several factors, including possible underreporting in nonfatal injuries and illnesses. The results from the SOII data are inconsistent with findings from other data sources that show a consistent negative correlation between establishment size and injury rate (McVittie et al. 1997; McVittie 2003; CPWR 2008, chart 33b; Dong et al. 2010). Studies have suggested that lower injury rates in small establishments do not have any explanation other than underreporting in the SOII (Oleinick et al. 1995; Morse et al. 2004). The SOII estimates the number and frequency of occupational injuries and illnesses based on logs kept by private sector employers. The accuracy of the logs depends largely on employers' understanding of which cases are work-related and on the accuracy of recording and reporting. Another factor may be that underreporting is motivated in part by employers' desire to avoid increases in workers' compensation premiums linked to reported injuries (*see* CPWR 2008, page 32; Leigh et al. 2004). Also, the SOII excludes self-employed workers, which is a significant limitation for counting injuries and illnesses in the construction industry since one-fourth of construction workers are self-employed. It is recommended that the BLS collect nonfatal injury and illness data on self-employed construction workers even if it is for selected years; and validate the completeness of reporting, particularly for small construction establishments. Further research should be conducted to examine underreporting issues, explore the relative risks of fatal and nonfatal injuries, and improve the accuracy of injury and illness data.

Glossary

Cases of days away from work - involve at least one full day away from work, with or without job transfer or restriction, as a result of work-related injury or illness.

Establishment - According to the U.S. Census Bureau, a private sector economic unit producing goods and services at one permanent physical location, not the same as a construction project or construction site. If a company has more than one fixed place of operation and maintains separate offices, each location is considered a separate establishment and is classified according to its major activity. (In some cases, where there are two or more distinct economic activities at one location, each "primary activity" may be categorized separately as an establishment.) Thus, there are more establishments than construction companies or proprietors. Establishments are either payroll or nonemployer (without payroll). A nonemployer establishment is a partnership, sole proprietorship, or corporation without employees.

Goods producing industries - include Agriculture (NAICS 11), Mining (NAICS 21), Construction (NAICS 23), and Manufacturing (NAICS 31-33).

Hispanic or Latino ethnicity - refers to people who identify themselves as being Spanish, Hispanic, or Latino. Someone who is Hispanic or Latino may be of any race.

Other recordable cases - are recordable injury or illness cases under OSHA recordkeeping rules that do not involve death, days away from work, or days of restricted work activity or job transfers.

Production workers (or blue-collar workers) - include workers employed in construction trades (e.g., carpenters, roofers, laborers, etc.) and other production occupations (e.g., truck drivers, installation, maintenance, and repair workers, etc). Managerial, professional (e.g., architects, accountants, lawyers), and administrative support staff are excluded from this category.

References

- CPWR - The Center for Construction Research and Training. 2008. *The Construction Chart Book: The U.S. Construction Industry and Its Workers, Fourth Edition*. Silver Spring, MD.
- Center to Protect Workers' Rights (CPWR). 2002. *The Construction Chart Book: The U.S. Construction Industry and Its Workers, 3rd Ed.* Silver Spring, MD.
- Dong X, Men Y, Ringen K. 2010. Work-related injuries among Hispanic construction workers—Evidence from the Medical Expenditure Panel Survey. *American Journal of Industrial Medicine* 53:561–569
- Dong X, Men R, Haile E. 2005. Work-Related Deaths and Injuries/Illnesses among the U.S. Construction Workers, 1992-2003. MD: The Center to Protect Workers' Rights, August 2005. <http://www.cpwr.com/publications/krtrendsfinal.pdf>
- Dong, X, James W. Platner. 2004. Occupational fatalities of Hispanic construction workers from 1992 to 2000. *American Journal of Industrial Medicine*, 45:45-54.
- Leigh , JP, JP Marcin, and TR Miller. 2004. An estimate of the U.S. government's undercount of nonfatal occupational injuries. *Journal of Occupational and Environmental Medicine*, 46 (1): 10-18.
- McVittie, DJ. 2003. The effect of company size on injury frequency in construction (Poster session), NOIRS 2003: 3rd National Occupational Injury Research Symposium, October, Pittsburgh, Pa.
- McVittie, Douglas J., Harry Banikin, and Wayne Brocklebank. 1997. The effects of firm size on injury frequency, in construction. *Safety Science*, 27(1): 19-23.
- Morse, T., C. Dillon, J. Weber, N. Warren, H. Bruneau, and R. Fu. 2004. Prevalence and reporting of occupational illness by company size: population trends and regulatory implications. *American Journal of Industrial Medicine*, 45(4): 361-70.
- National Institute for Occupational Safety and Health (NIOSH). 2004. *Worker Health Chartbook, 2004*. Department of Health and Human Services, Centers for Disease Control and Prevention.
- Occupational Safety & Health Administration (OSHA). 2002. *Major changes to OSHA's recordkeeping rule*, <http://www.osha.gov/recordkeeping/RKmajorchanges.html>.

Office of Management and Budget (OMB), Executive Office of the President, 1987. *Standard Industrial Classification Manual*. Springfield, VA: National Technical Information Service.

— .2002. *North American Industry Classification System*.
<http://www.census.gov/eos/www/naics/>

Oleinick, A, J.V. Gluck, and K.E. Guire. 1995. Establishment size and risk of occupational injury. *American Journal of Industrial Medicine*, 28(1): 1-21.

Pollack, Earl S. and Risana T. Chowdhury. 2001. *Trends in work-related death and injury rates among U.S. construction workers, 1992-98*. Silver Spring, MD: The Center to Protect Workers' Rights.

U.S. Bureau of Labor Statistics (BLS), U.S. Department of Labor. 1992-2008. *Census of Fatal Occupational Injuries*, research files obtained through an agreement between CPWR and BLS.

— .1992-2008. *Current Population Survey*. <http://www.bls.census.gov/cps/cpsmain.htm>.

— .2010a. <http://www.bls.gov/iif/oshfat1.htm>. Retrieved June 2010.

— .2010b. <http://www.bls.gov/cps/cpspopsm.pdf>. Retrieved June 2010.

U.S. Census Bureau, Department of Commerce. 2005-2010. *County Business Patterns: United States, 2003-2008*. U.S. Department of Commerce Economics and Statistics Administration. <http://www.census.gov/econ/cbp/>

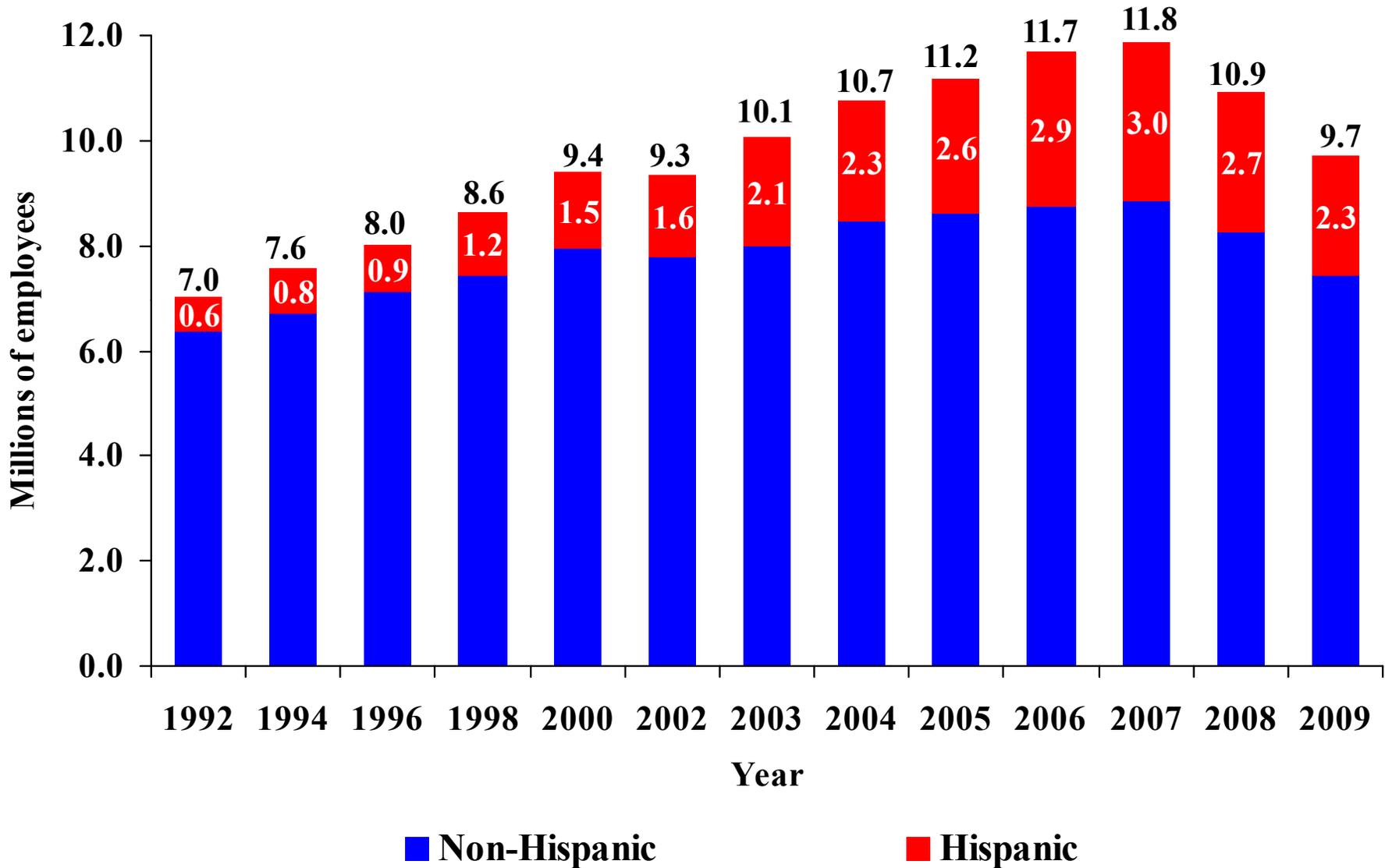
Annex: Comparison between the 1990 Census Occupational Classification and 2000 Standard Occupational Classification for selected occupations

1990 Code	1990 Title	2000 Code	2000 Title
553	Supervisors, brickmasons, stonemasons, tile setters	47-1011	First-line supervisors/managers of construction trades and extraction workers
554	Supervisors, carpenters and related workers		
555	Supervisors, electricians and power transmission installers		
556	Supervisors, painters, paperhangers, and plasters		
557	Supervisors, plumbers, pipefitters, and steamfitters		
558	Supervisors, construction, n.e.c.		
613	Supervisors, extractive occupations		
563	Brickmasons, stonemasons	47-2020	Brickmasons, blockmasons, and stonemasons
564	Brickmasons, stonemasons apprentices		
		47-2021	Brickmasons and blockmasons
		47-2022	Stonemasons
567	Carpenters	47-2031	Carpenters
569	Carpenter apprentices		
573	Drywall installers	47-2080	Drywall installers, ceiling tile installers and tapers
		47-2081	Drywall and ceiling tile installers
		47-2082	Tapers
866	Helpers, construction trades	47-3000	Helpers, construction trades
		47-3011	<u>Helpers—Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters</u>
		47-3012	Helpers-carpenters
		47-3013	Helpers-electricians
		47-3014	Helpers—Painters, Paperhangers, Plasterers, and Stucco Masons
		47-3015	Helpers—Pipelayers, Plumbers, Pipefitters, and Steamfitters
		47-3016	Helpers-roofers
47-3019	Helpers, Construction Trades, All Other		

In the 2000 SOC system, apprentices and trainees were classified with the occupations for which they were being trained, whereas in the 1990 system they were grouped separately according to their occupation. In 2000, helpers and aides were classified separately by occupation, whereas in 1990 helpers of all occupations were classified in one group.

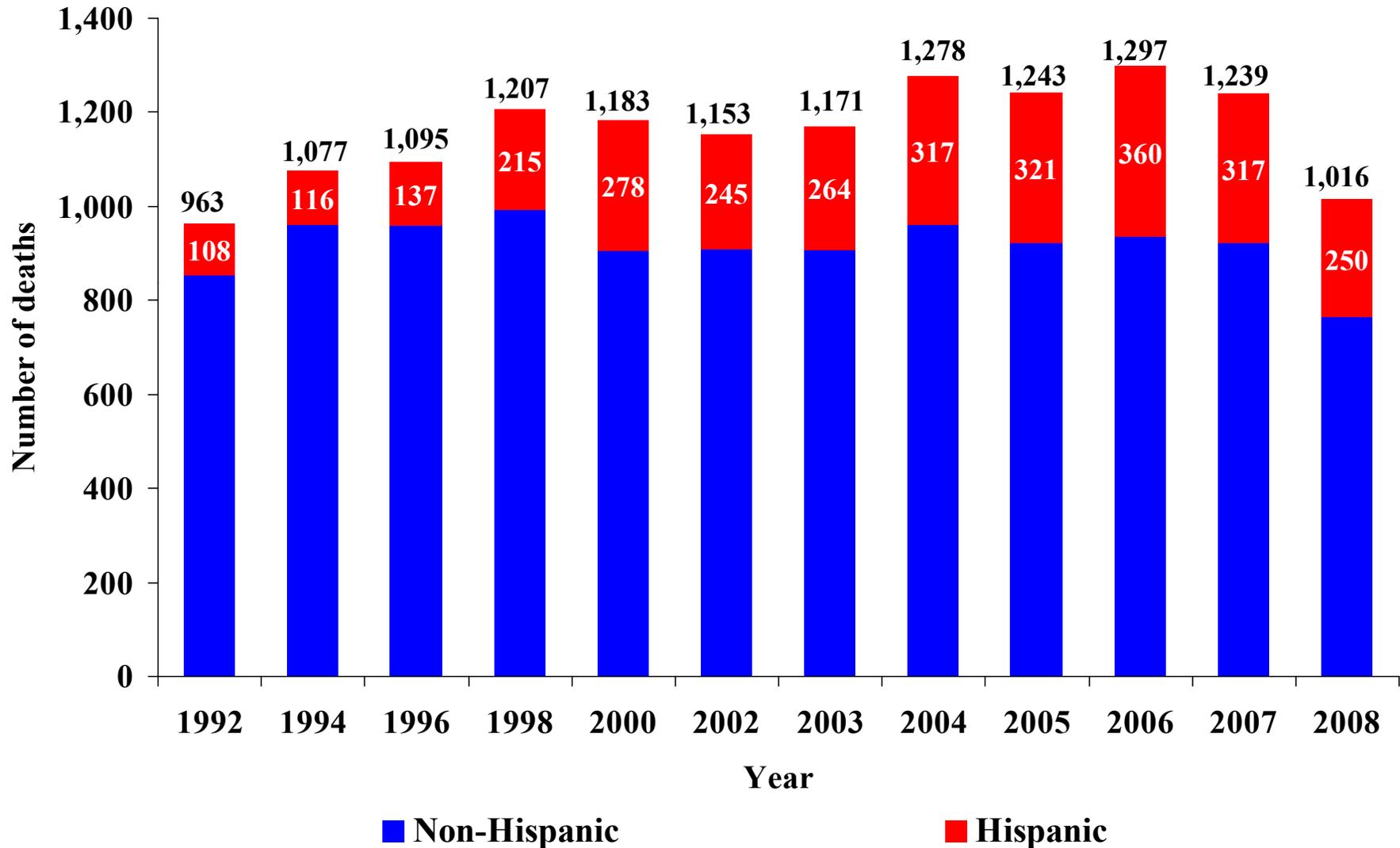
With the 2000 SOC system, first-line managers and supervisors of production, service, and sales workers who spend more than 80 % of their time performing supervision were classified as a supervisor category coded 47-1011; otherwise, they were classified with the workers they supervised. In the 1990 system, supervisors were grouped with their corresponding occupations separately regardless of their time on supervision.

1a. Construction employment in the United States, 1992-2009 (All types of employment)



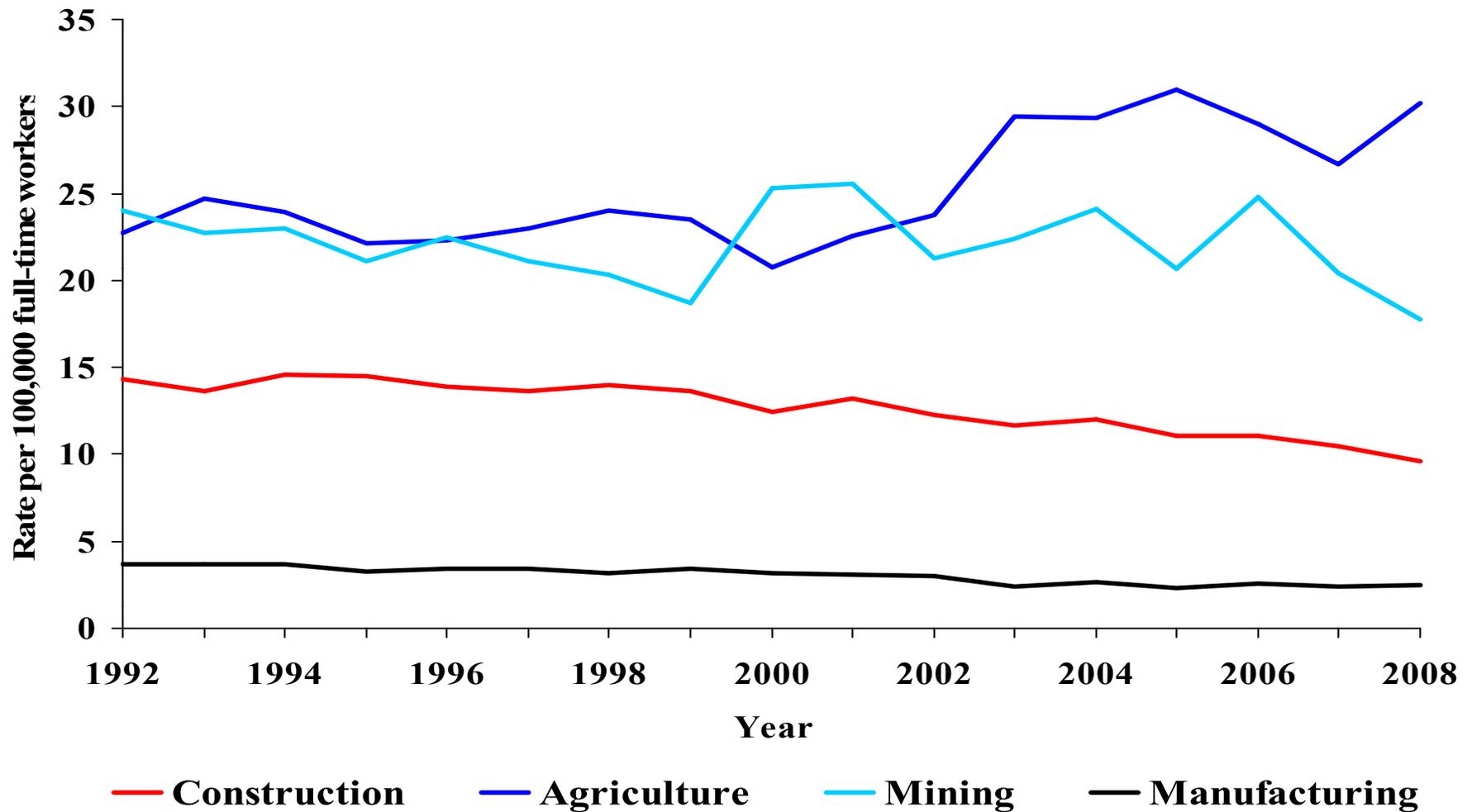
Source: U.S. Bureau of Labor Statistics, 1992-2009 Current Population Survey

1b. Number of deaths from injuries in construction, 1992-2008 (Private and public sectors)



Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries

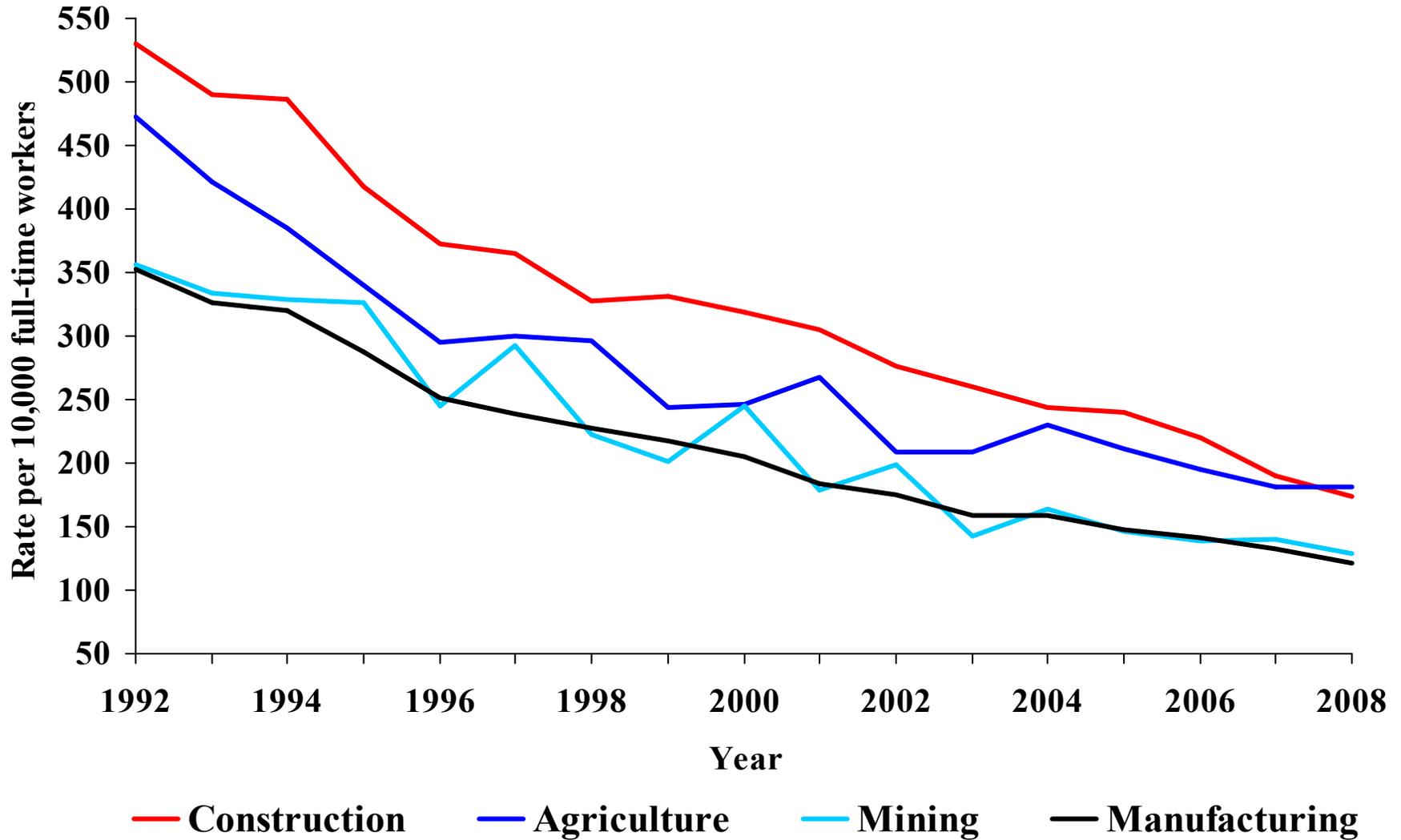
2a. Rate of work-related deaths from injuries, selected industries, 1992-2008



FTE = Full-time equivalent, defined as 2,000 hours worked per year

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

2b. Rate of nonfatal injuries and illnesses with days away from work, selected industries, 1992-2008

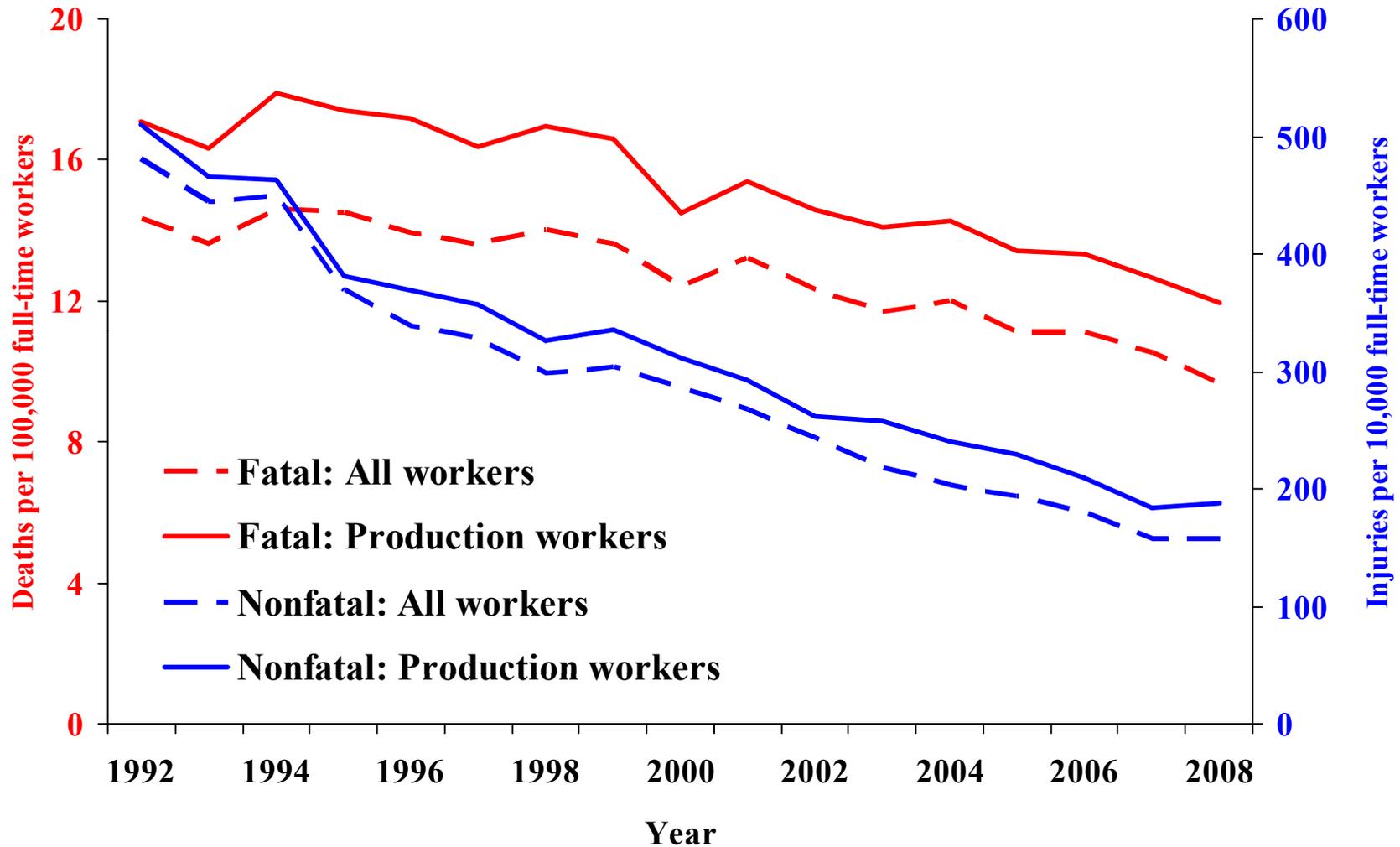


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses

3. Rates of fatal and nonfatal injuries and illnesses in construction, 1992-2008

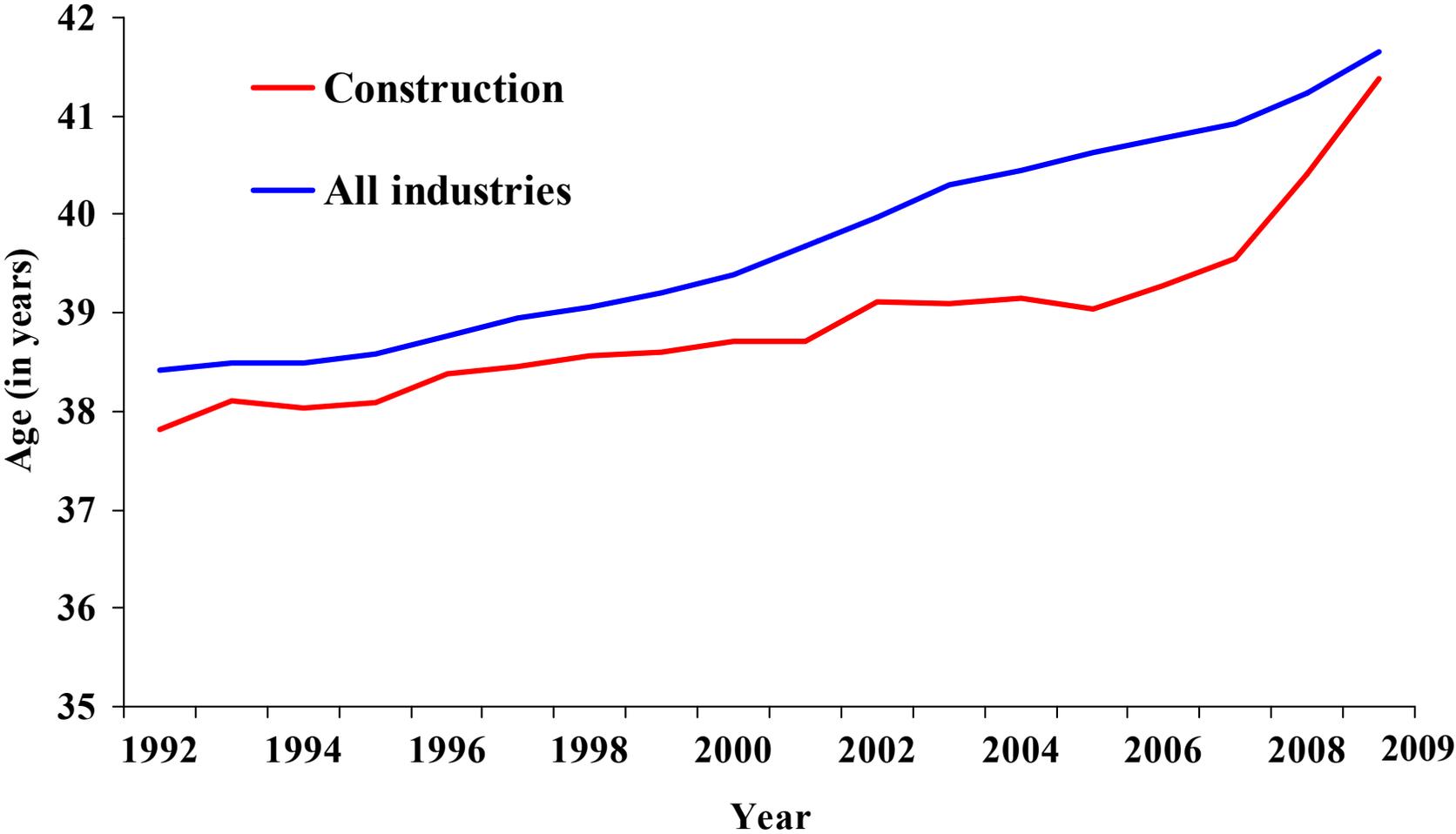


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Nonfatal data covers cases with days away from work and the private sector only; self-employed workers were excluded

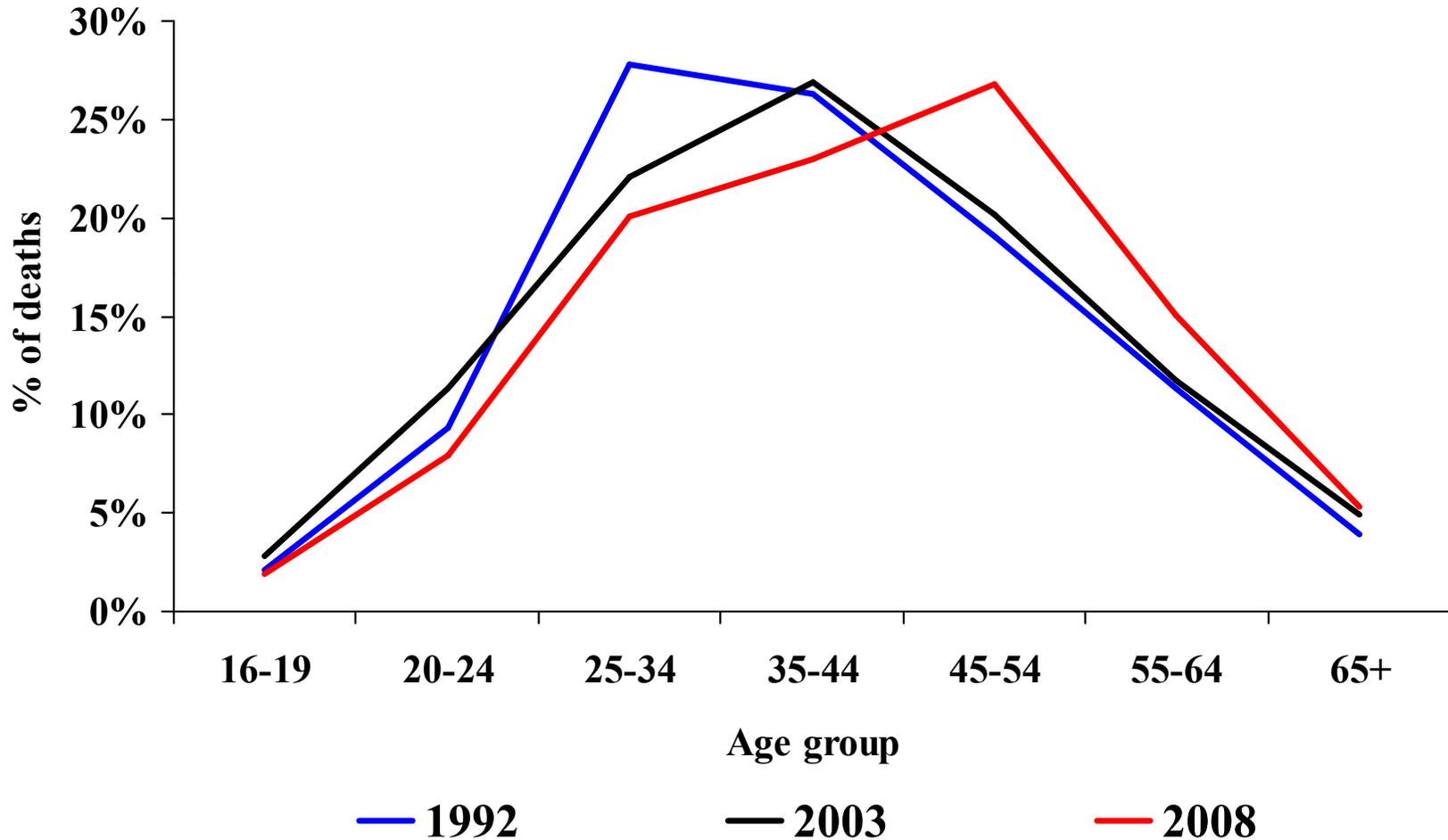
Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries, Survey of Occupational Injuries and Illnesses, and Current Population Survey

4. Average age of workers, construction versus all industries, 1992-2009 (All types of employment)



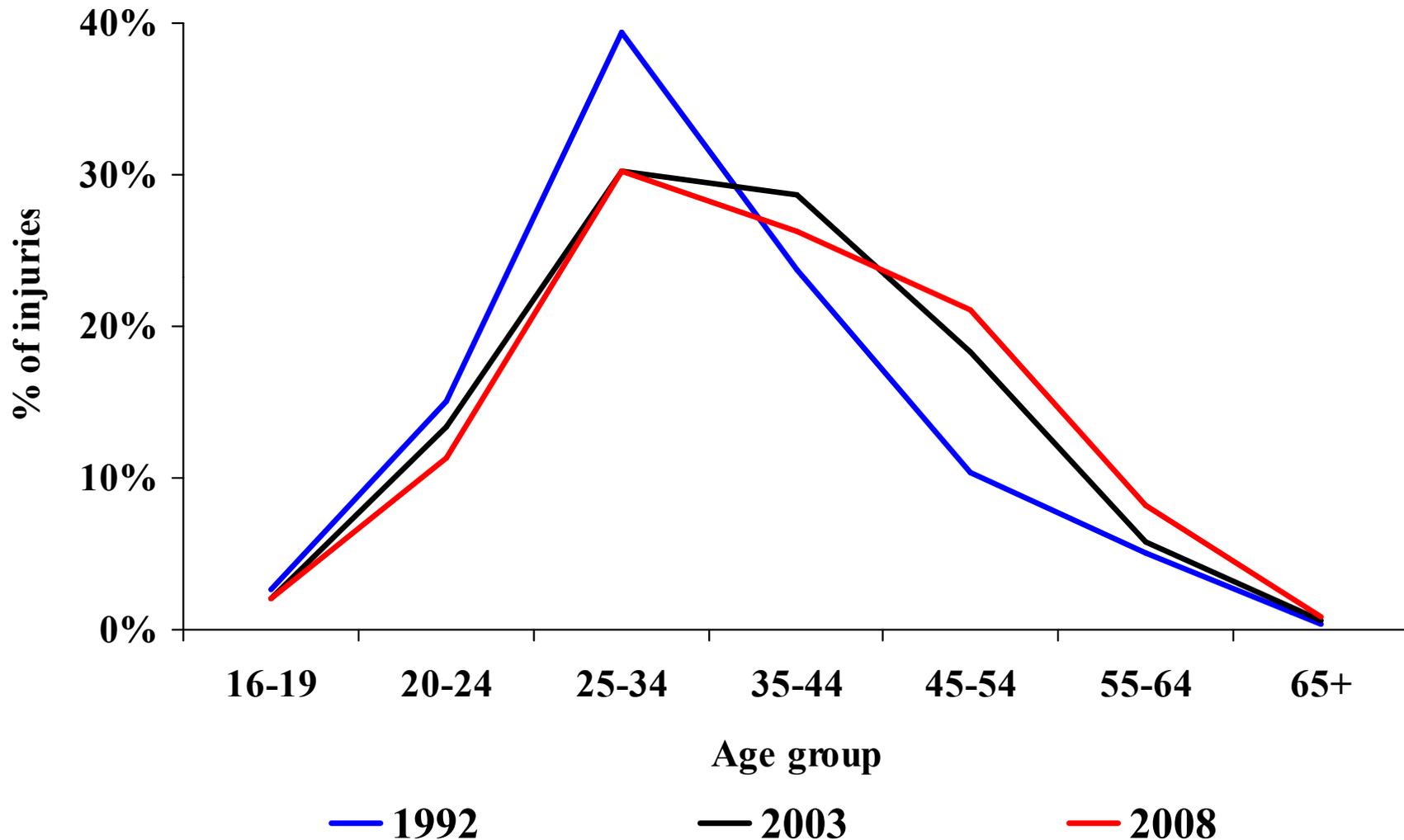
Source: U.S. Bureau of Labor Statistics, 1992-2009 Current Population Survey

5a. Distribution of work-related deaths from injuries in construction, by age group, selected years



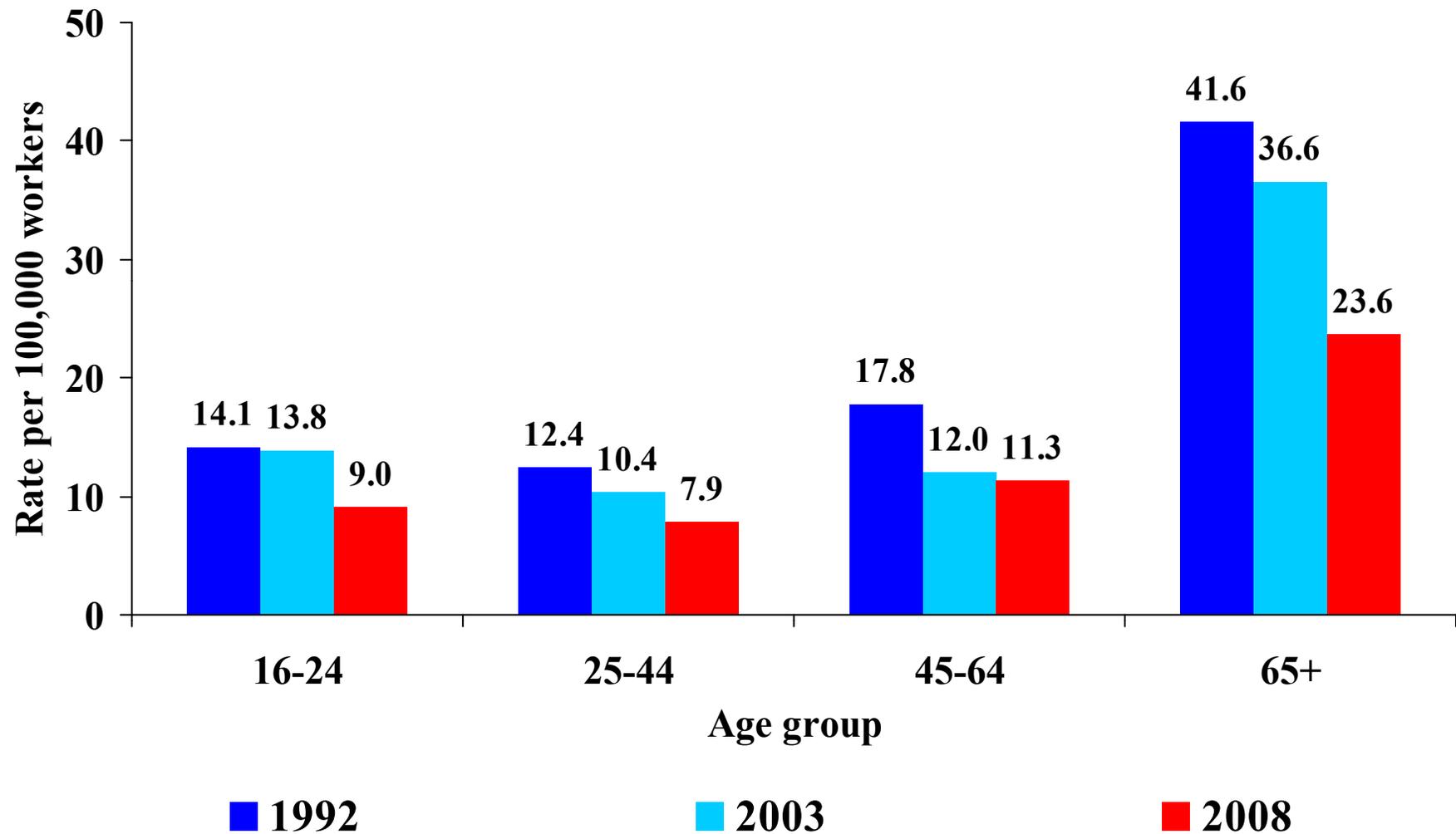
Source: U.S. Bureau of Labor Statistics, Census of Fatal Occupational Injuries

5b. Distribution of nonfatal injuries and illnesses resulting in days away from work in construction, by age group, selected years



Note: Data cover the private sector only and excludes self-employed workers
Source: U.S. Bureau of Labor Statistics, Survey of Occupational Injuries and Illnesses

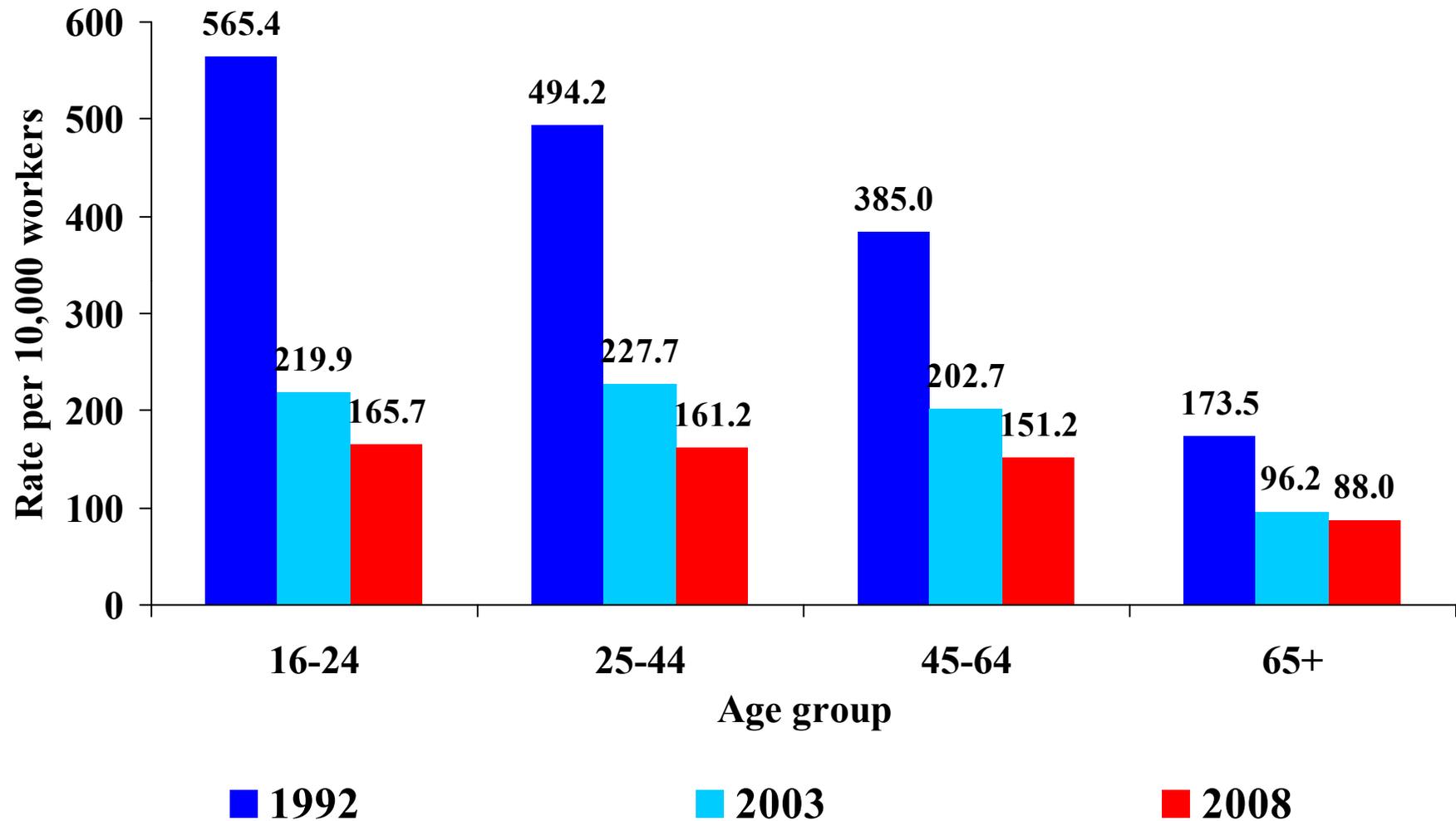
6a. Rate of work-related deaths from injuries in construction, by age group, selected years



FTE = Full-time equivalent, defined as 2,000 hours worked per year

Source: U.S. Bureau of Labor Statistics, Census of Fatal Occupational Injuries and Current Population Survey

6b. Rate of nonfatal injuries and illnesses resulting in days away from work in construction, by age group, selected years

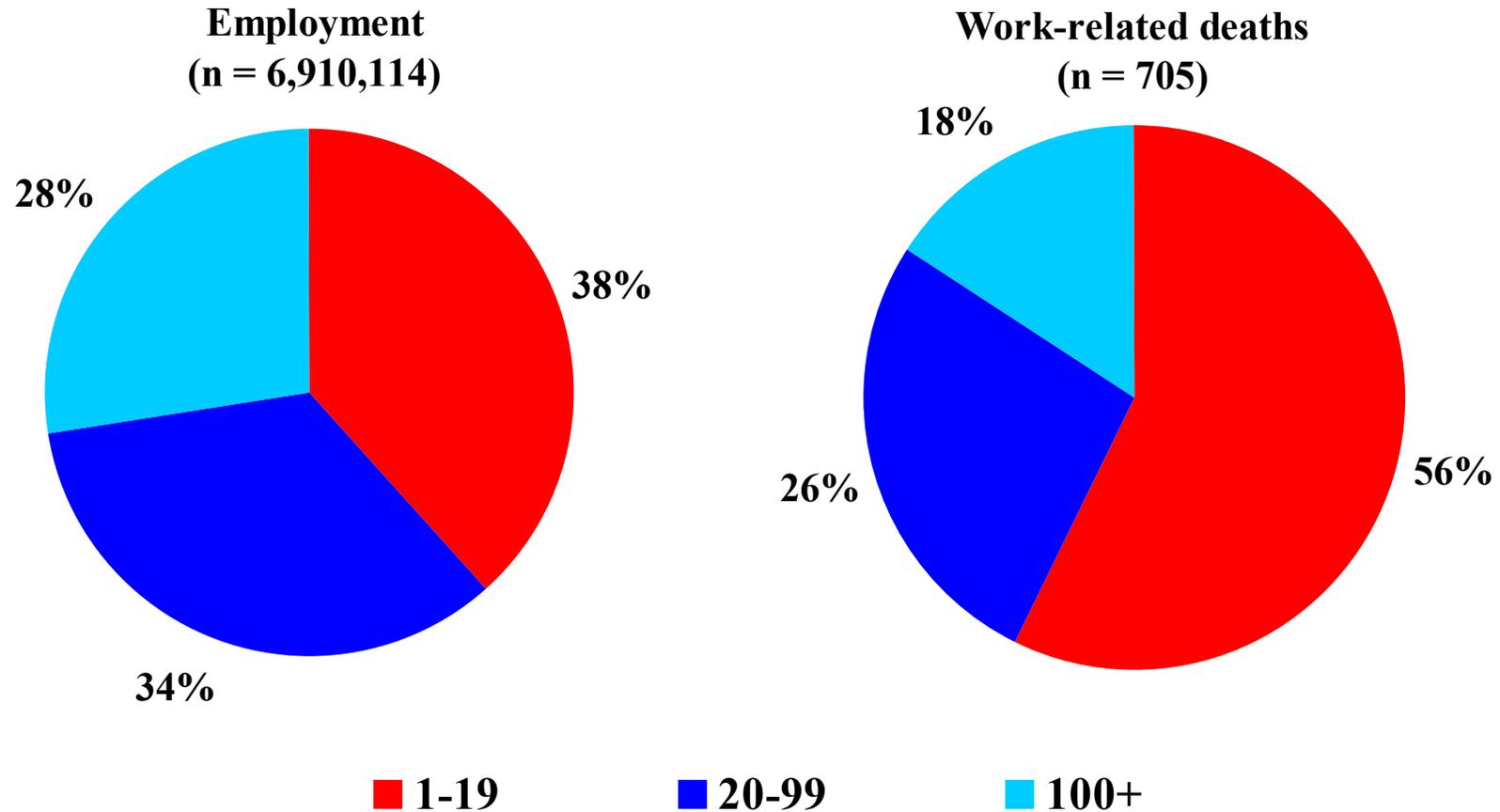


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, Survey of Occupational Injuries and Illnesses and Current Population Survey

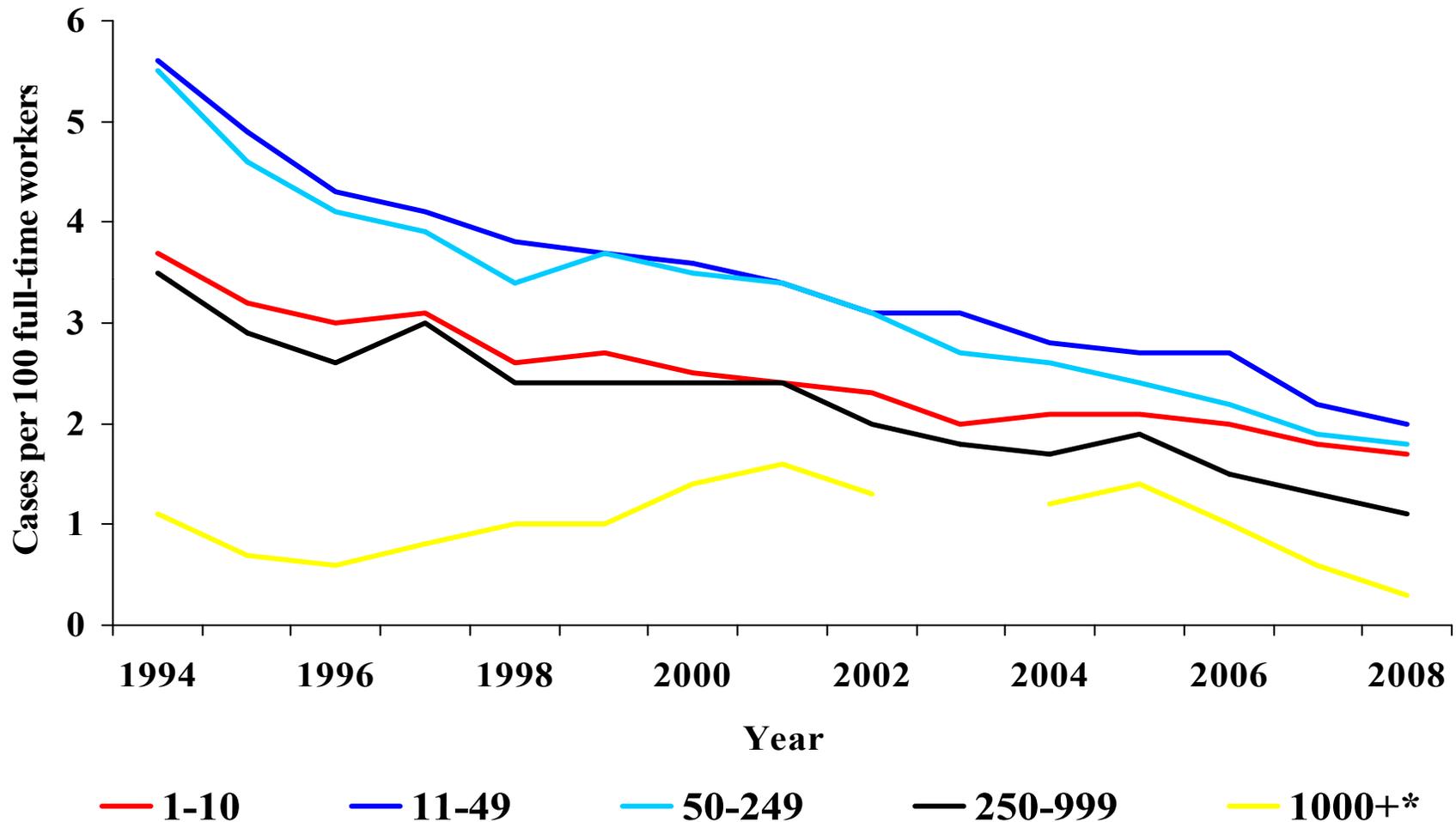
7a. Distribution of construction employment and work-related deaths from injuries, by establishment size, 2003-2008 average



Note: Data excludes self-employed workers and cases without establishment size information.

Sources: U.S. Census Bureau, 2003-2008 County Business Patterns; U.S. Bureau of Labor Statistics, 2003-2008 Census of Fatal Occupational Injuries.

7b. Rate of nonfatal occupational injuries and illnesses in construction resulting in days away from work, by establishment size, 1994-2008



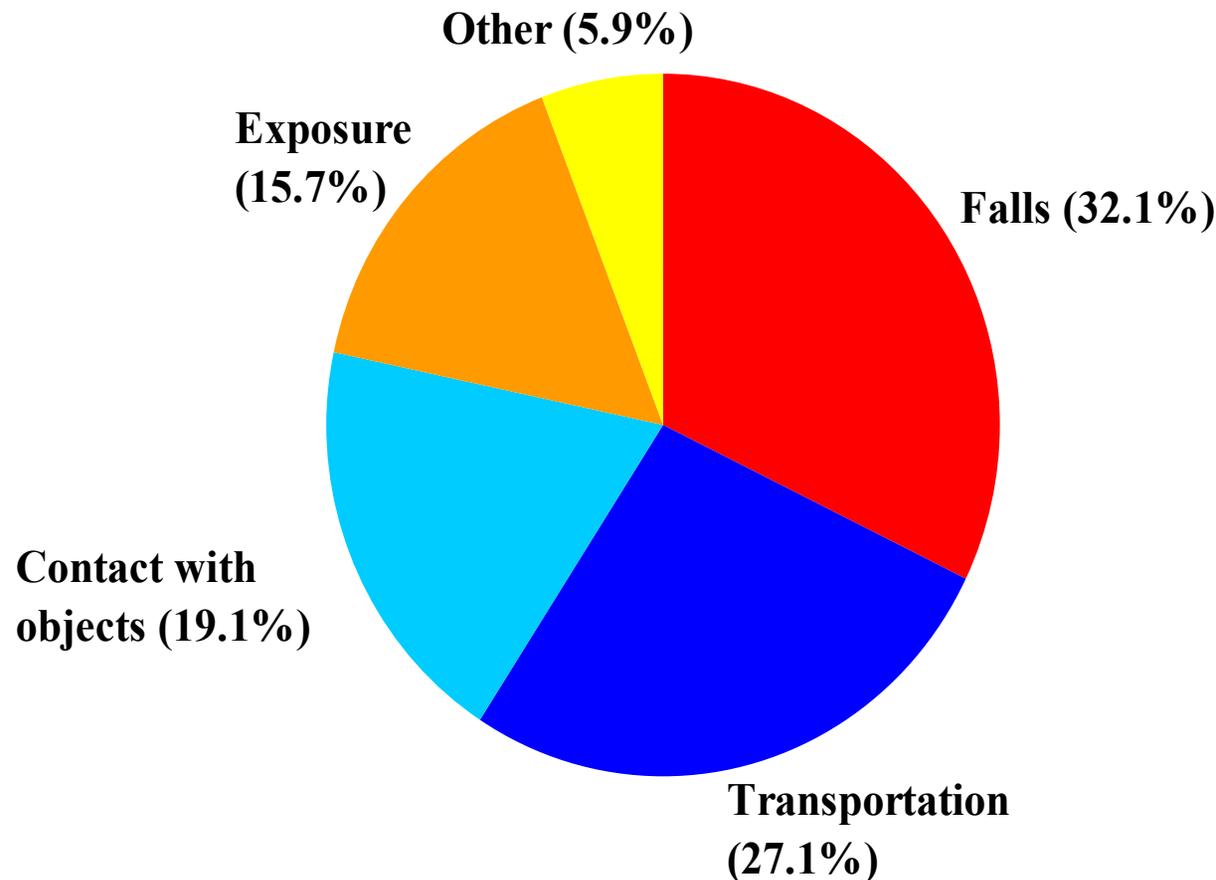
FTE = Full-time equivalent, defined as 2,000 hours worked per year

* Data not available for 1,000+ establishment size in 2003

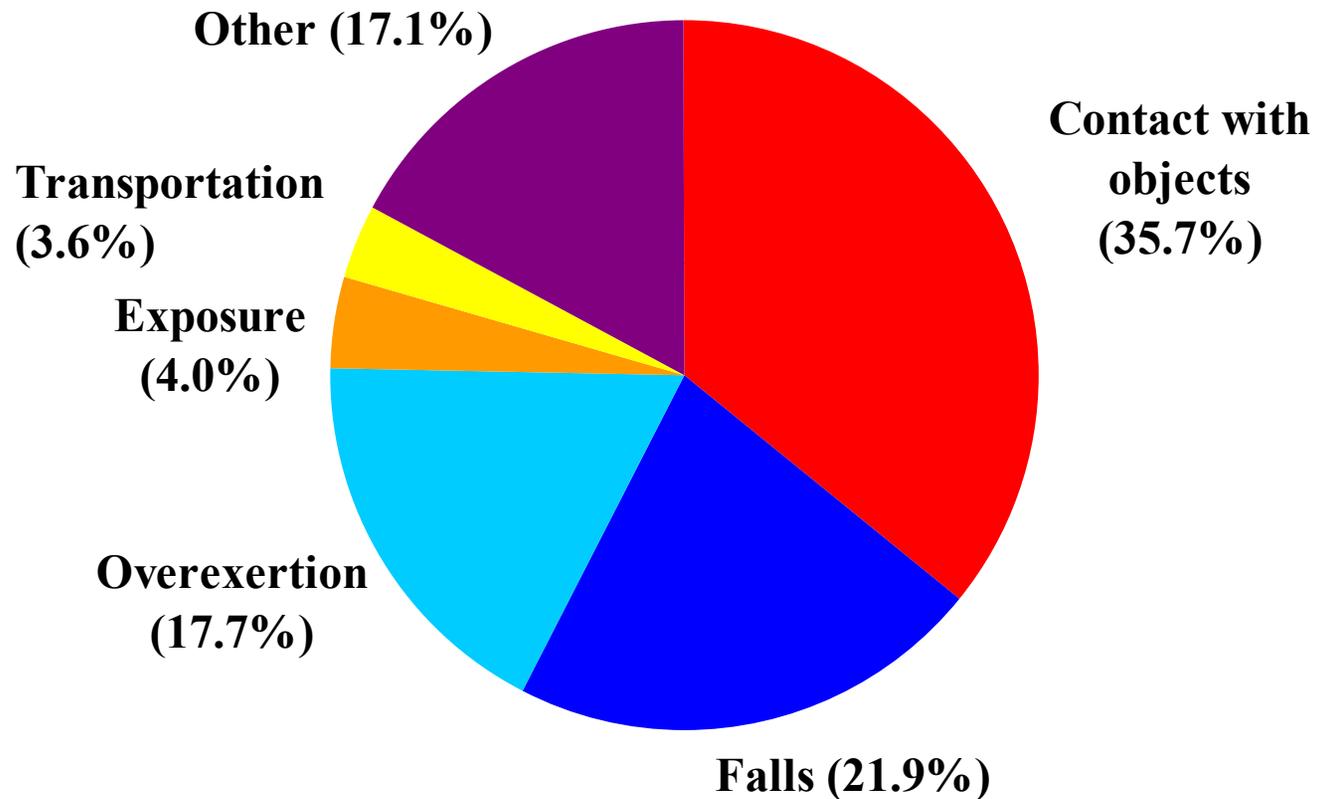
Note: Establishment size data are not available prior to 1994; data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1994-2008 Survey of Occupational Injuries and Illnesses

8a. Distribution of leading causes of work-related deaths from injuries, construction, 1992-2008

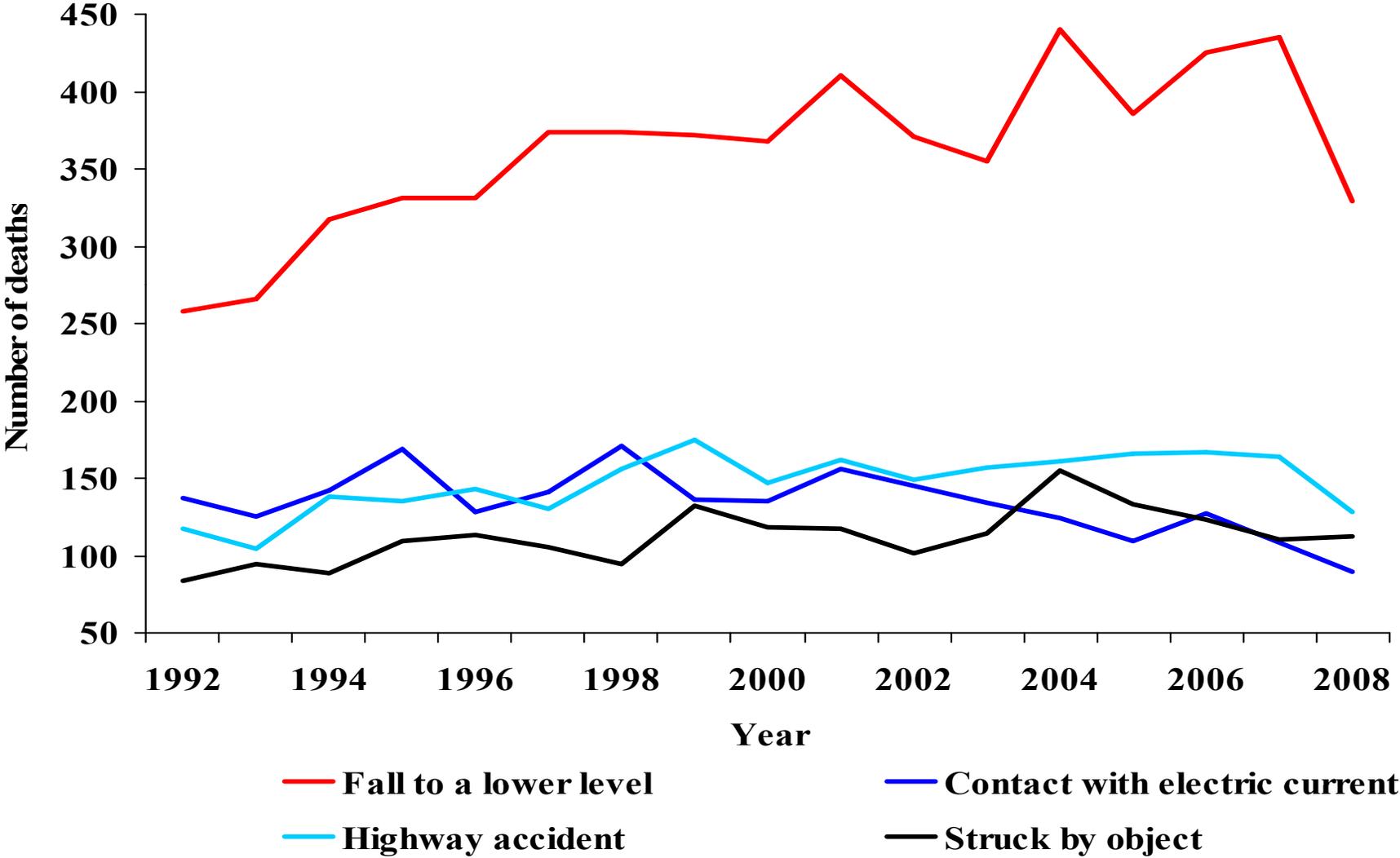


8b. Distribution of leading causes of nonfatal cases with days away from work, construction, 2008



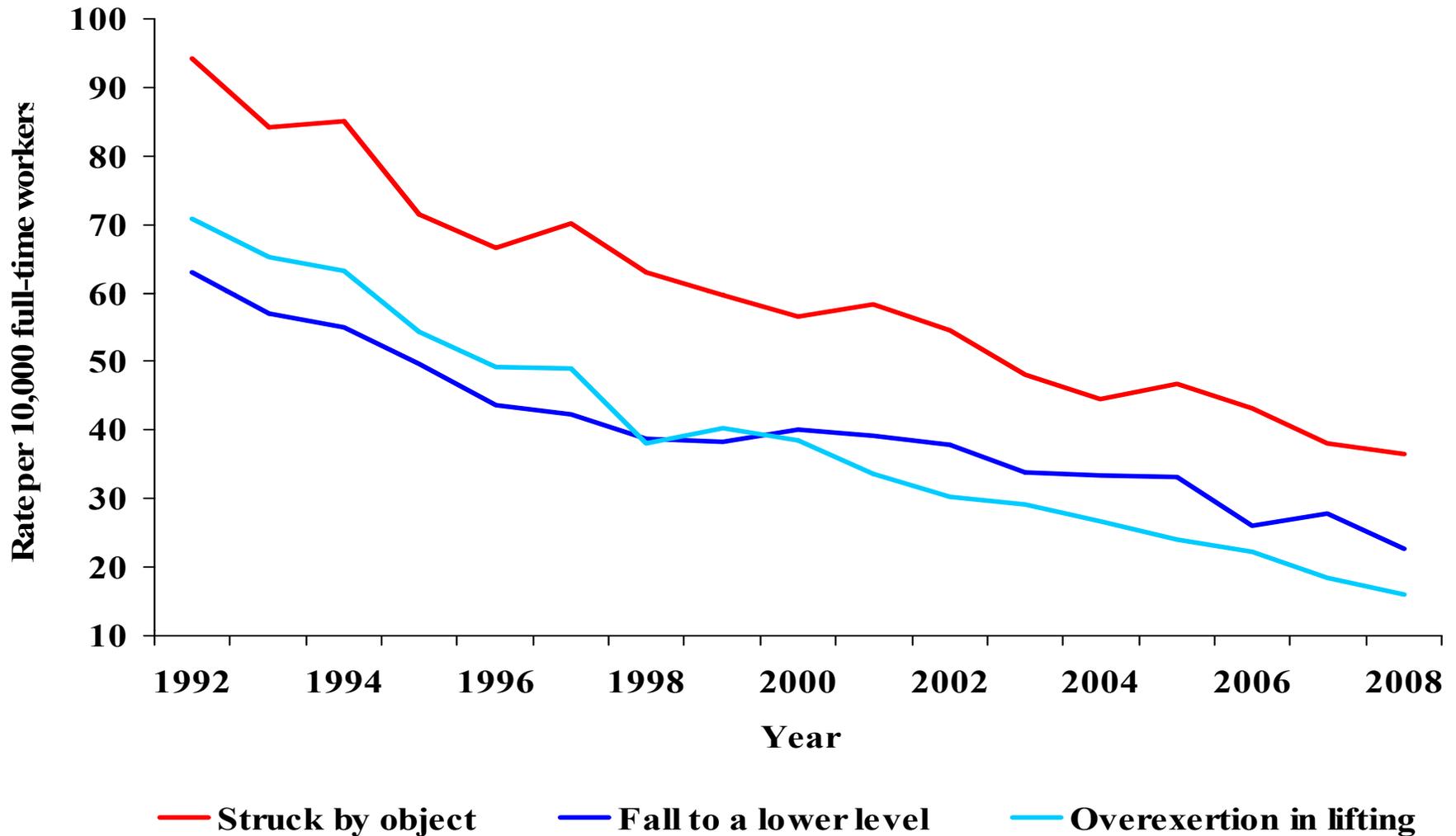
Note: Data cover the private sector only and excludes self-employed workers
Source: U.S. Bureau of Labor Statistics, 2008 Survey of Occupational Injuries and Illnesses

9a. The four events with the most frequent work-related deaths, construction, 1992-2008



Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries

9b. Rate of leading causes of nonfatal injuries and illnesses resulting in days away from work, construction, 1992-2008

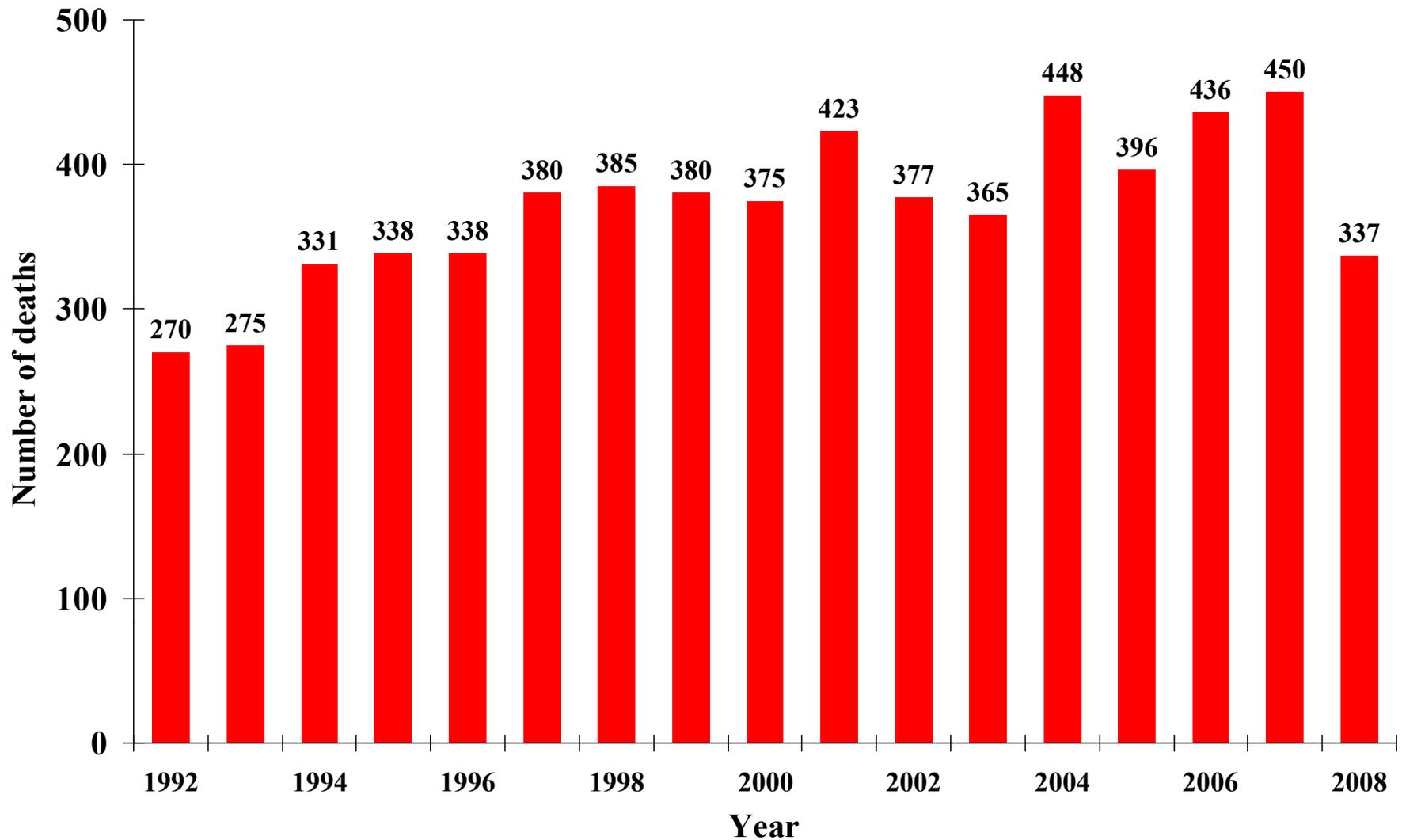


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

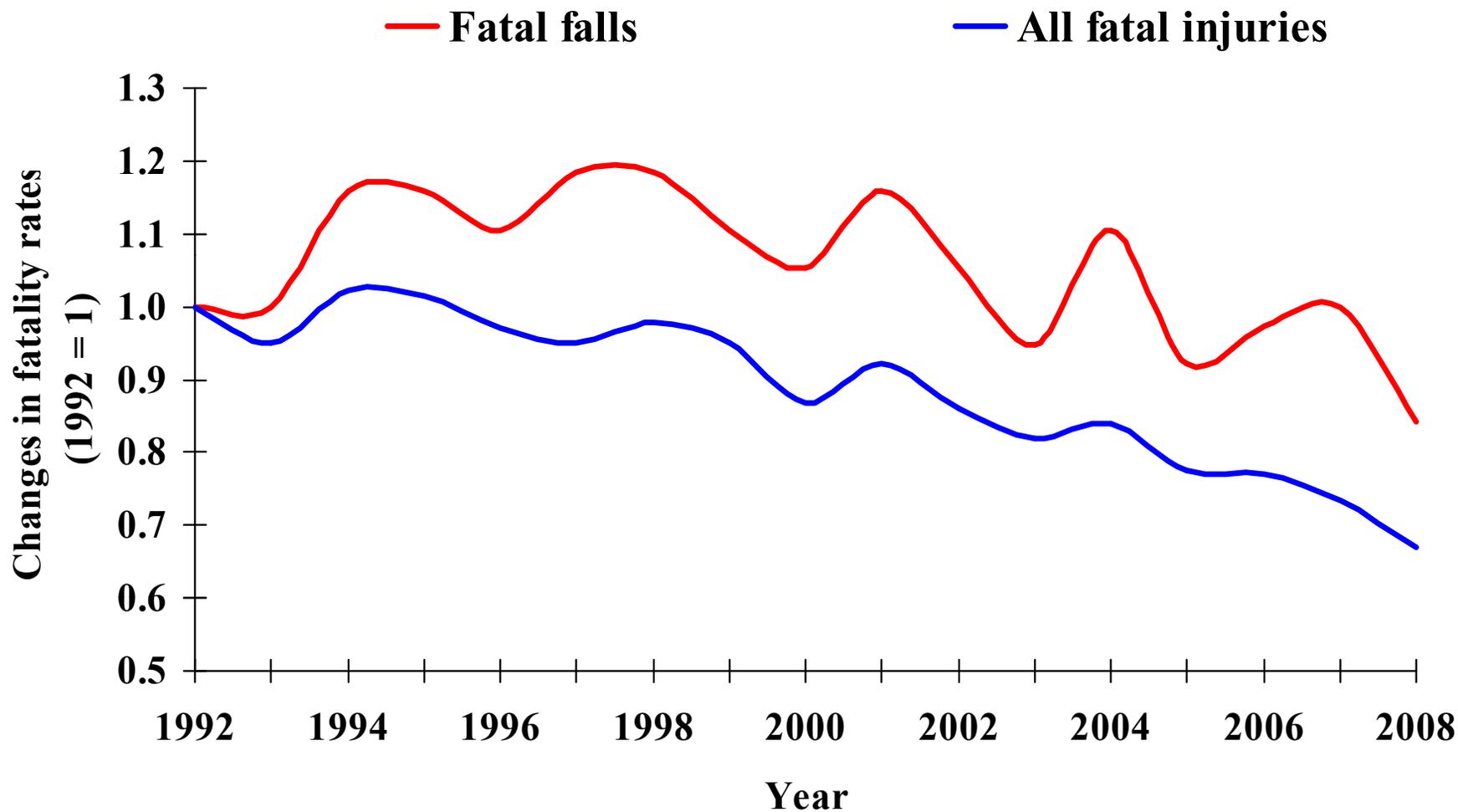
Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses

10a. Number of fatal falls from work-related injuries in construction, 1992-2008



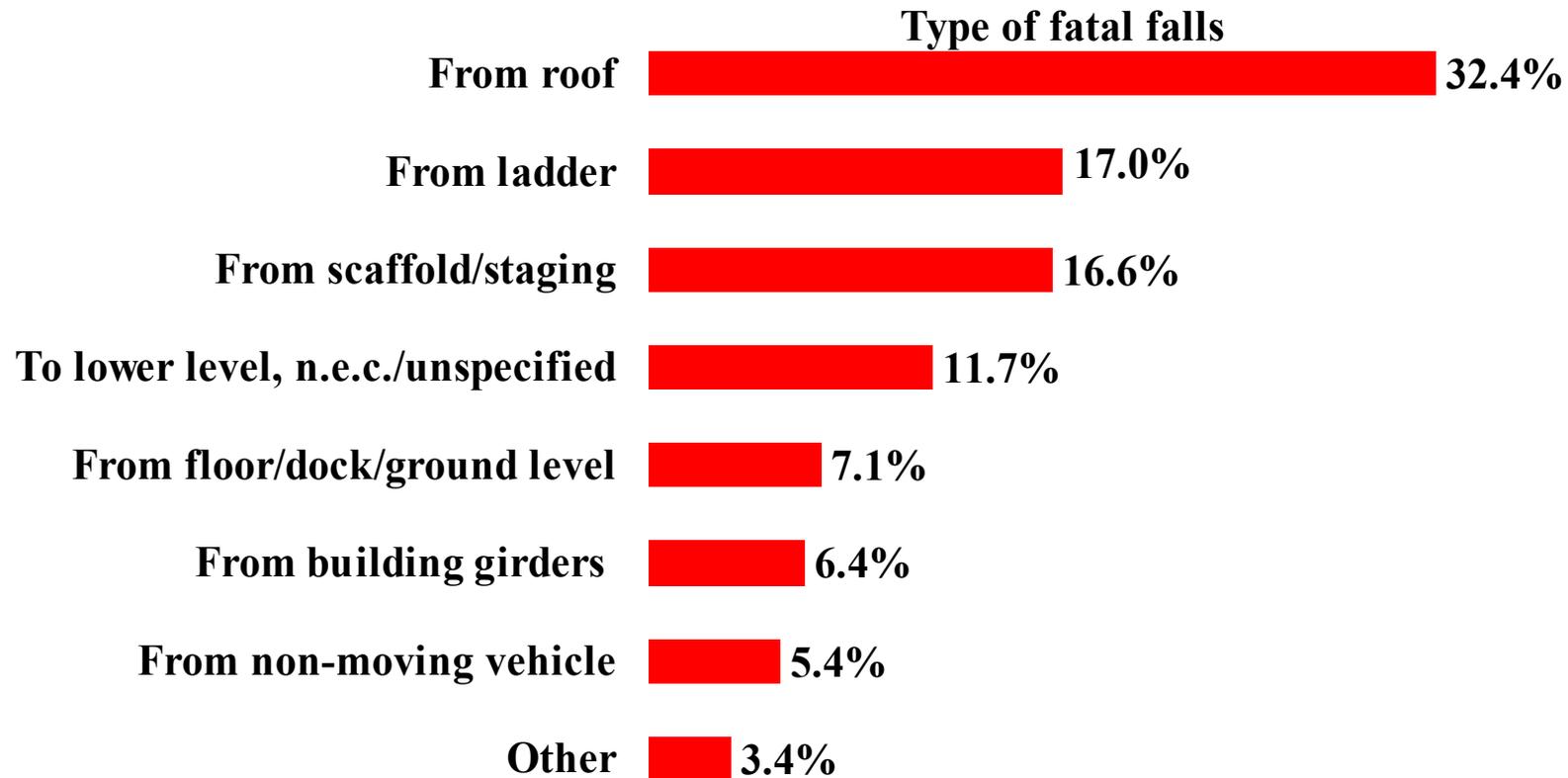
Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries

10b. Changes in fatality rates in construction, fatal falls vs. all fatalities, 1992-2008



Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

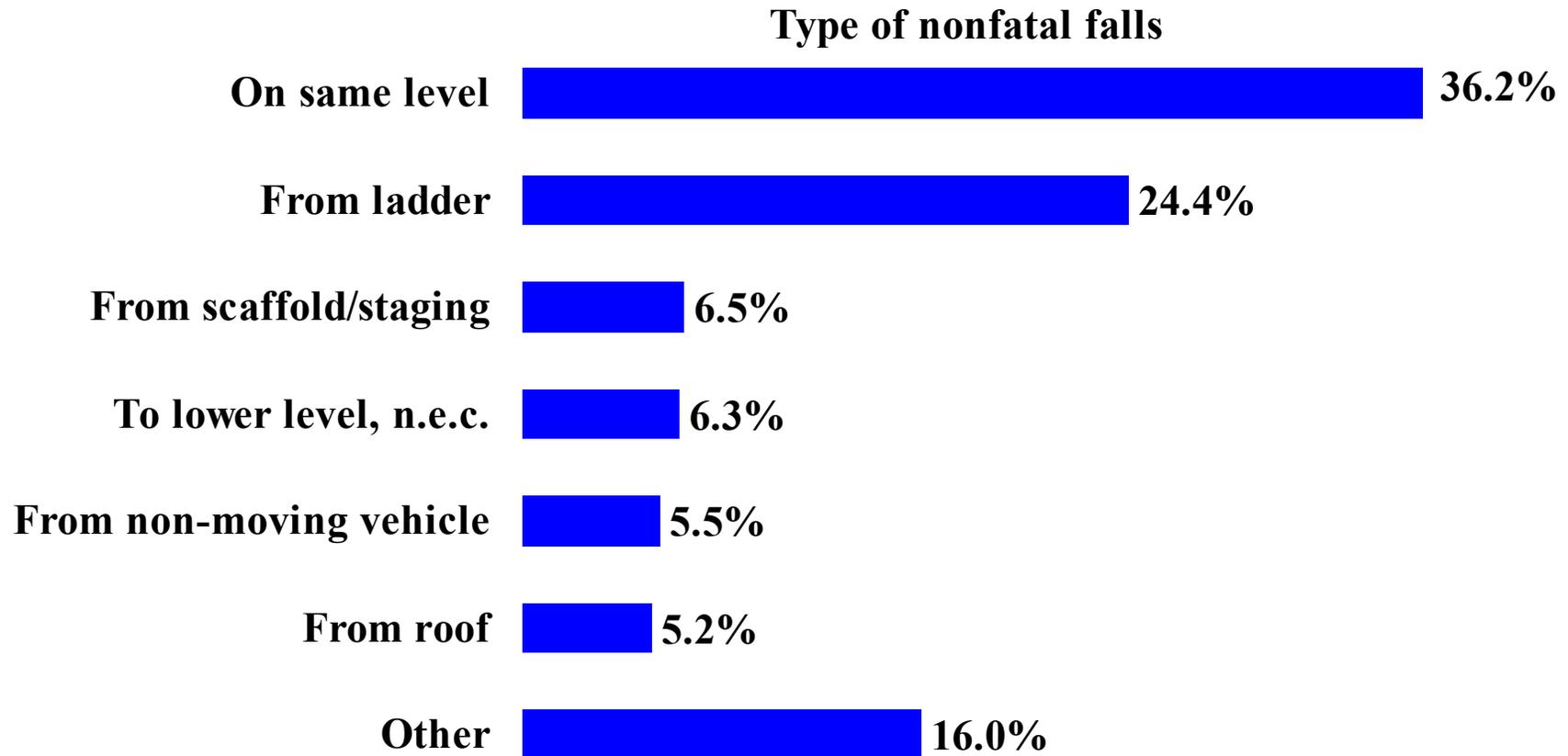
11a. Type of fatal falls in construction, 2003-2008



n.e.c. = not elsewhere classified

Source: U.S. Bureau of Labor Statistics, 2003-2008 Census of Fatal Occupational Injuries

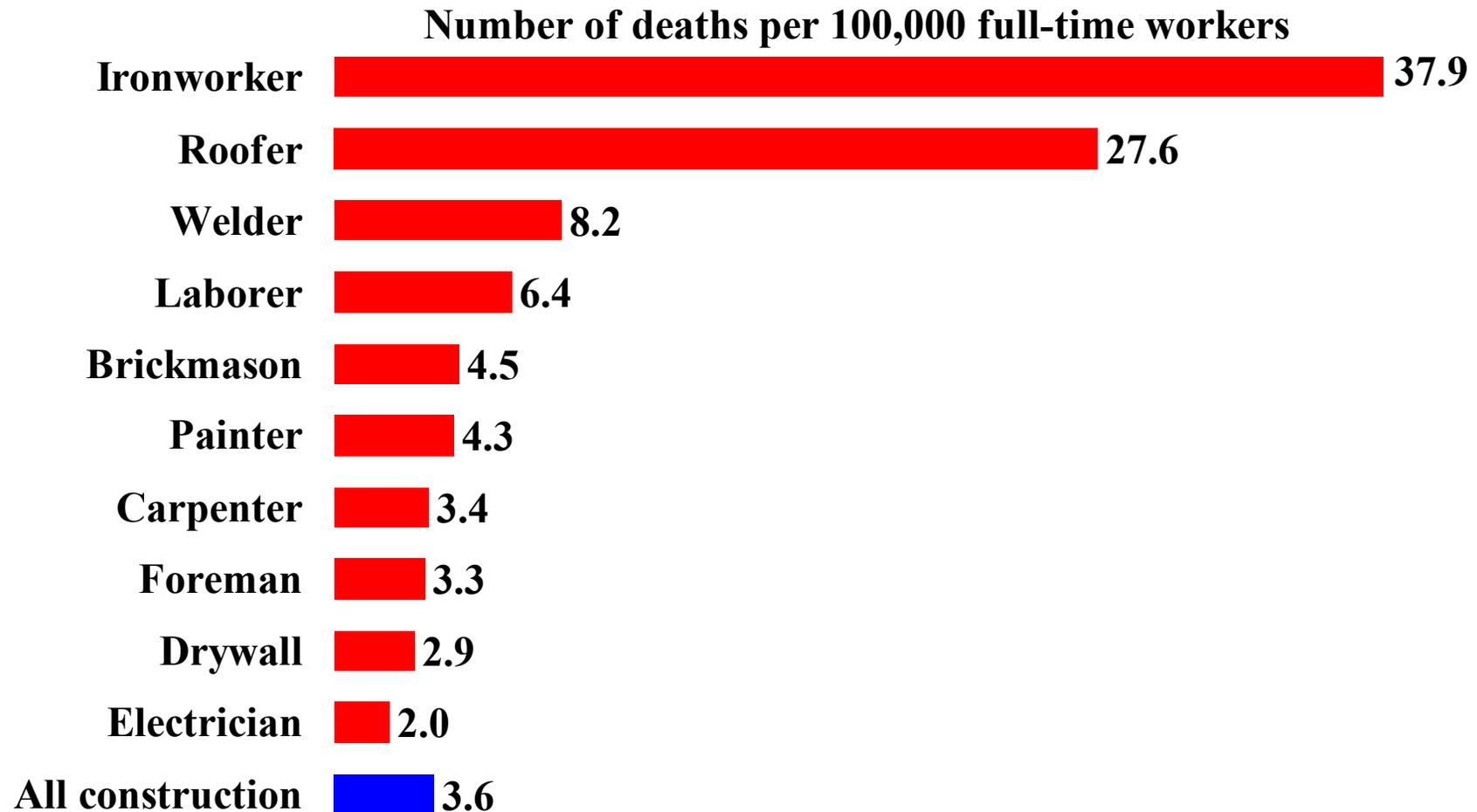
11b. Type of nonfatal falls in construction, 2003-2008



n.e.c. = not elsewhere classified

Source: U.S. Bureau of Labor Statistics, 2003-2008 Survey of Occupational Injuries and Illnesses

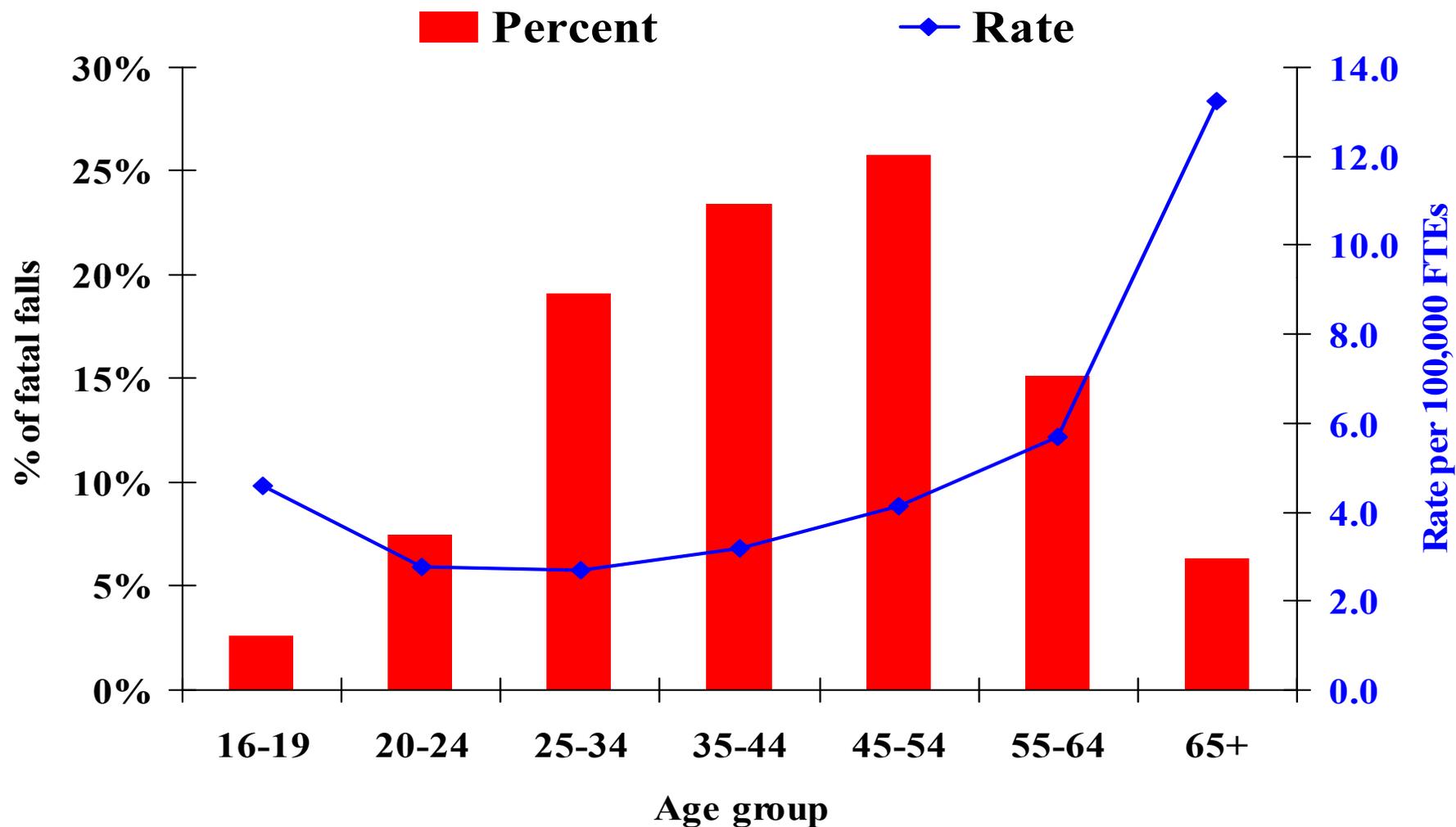
12a. Rate of fatal falls by occupation in construction, 2006-2008



FTE = Full-time equivalent, defined as 2,000 hours worked per year

Source: U.S. Bureau of Labor Statistics, 2006-2008 Census of Fatal Occupational Injuries and Current Population Survey

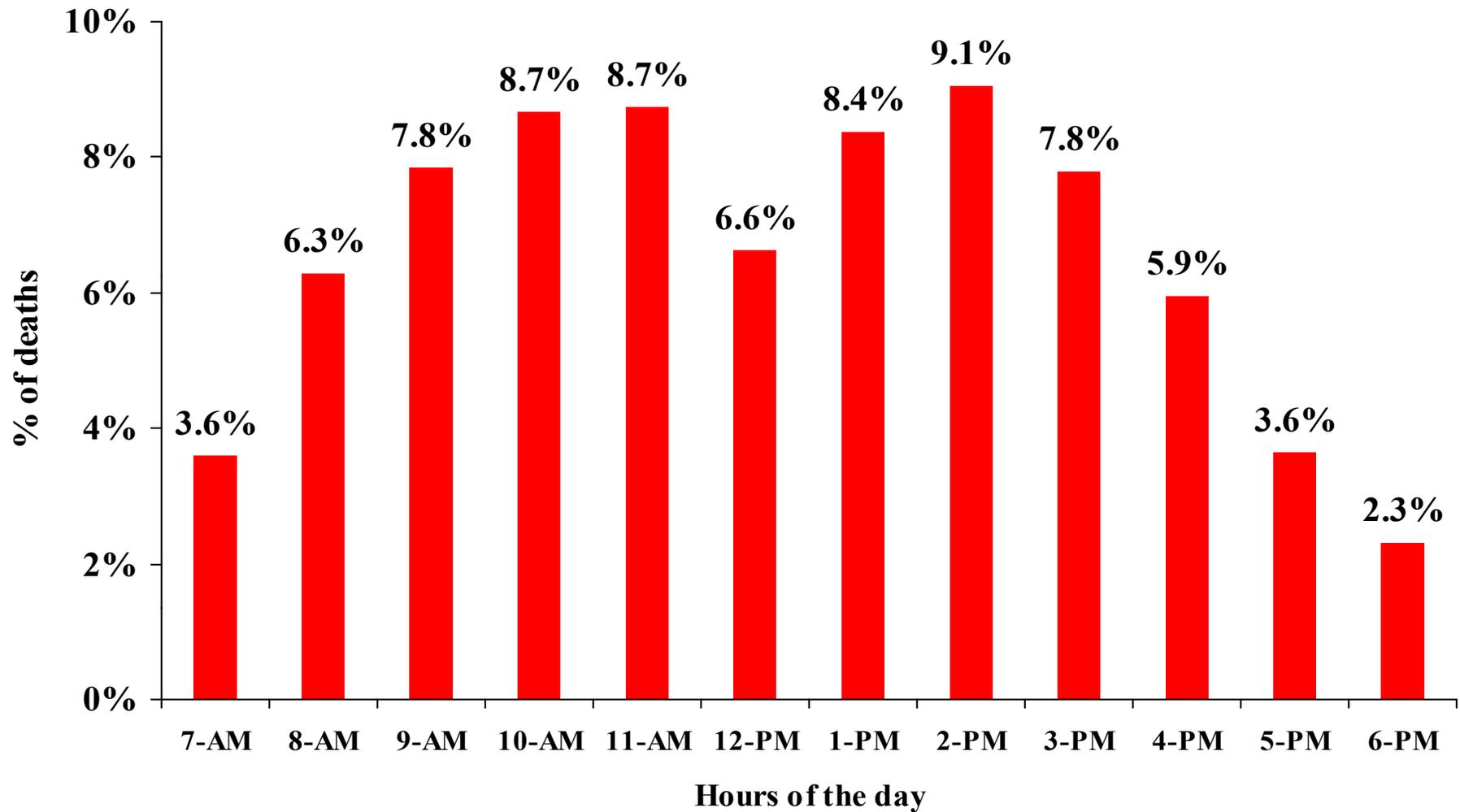
12b. Fatal falls by age group in construction, 2003-2008 average



FTE = Full-time equivalent, defined as 2,000 hours worked per year

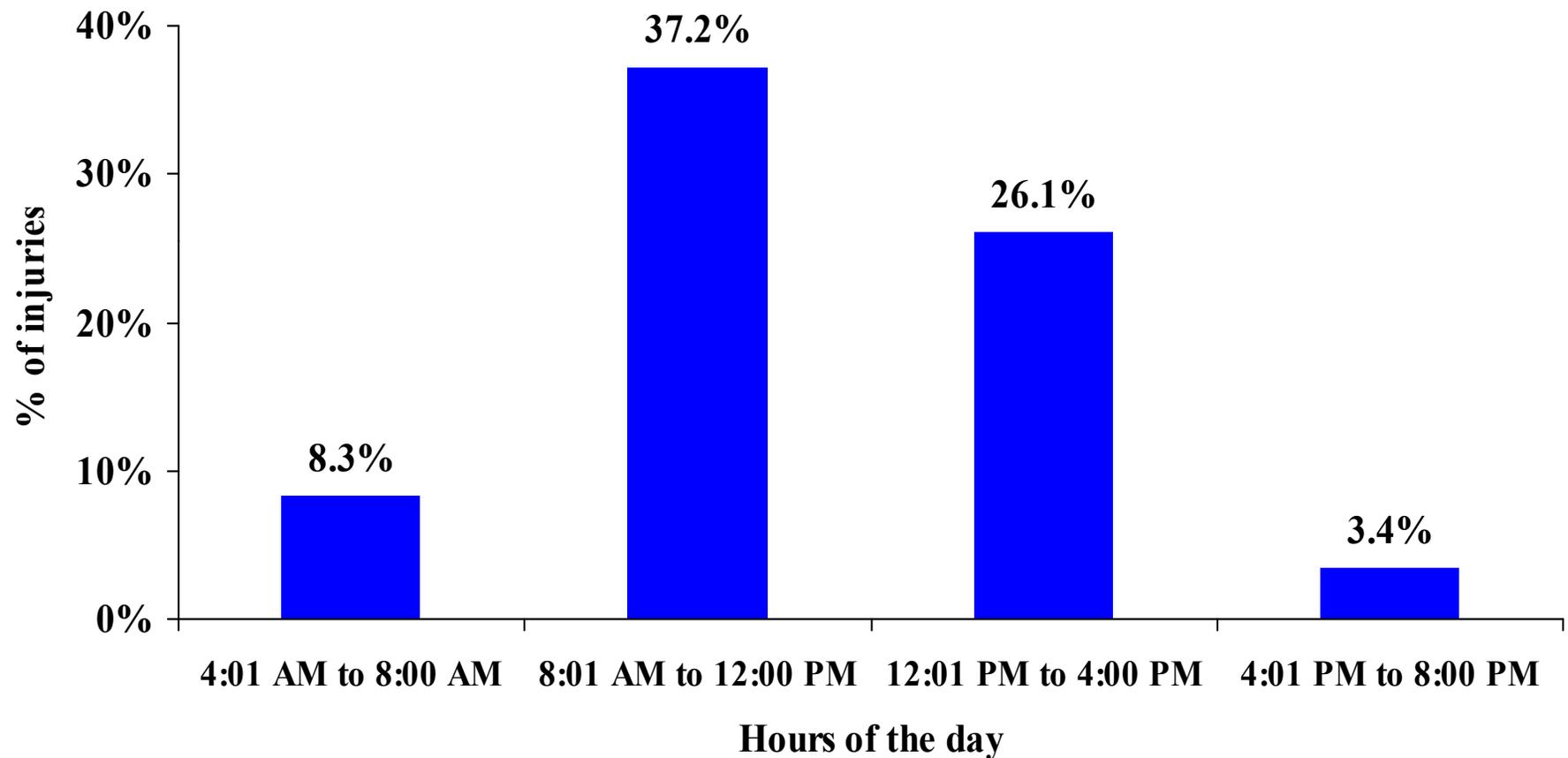
Source: U.S. Bureau of Labor Statistics, 2003-2008 Census of Fatal Occupational Injuries and Current Population Survey

13a. Percentage of work-related deaths from injuries for all construction, by hour, 1992-2008 average



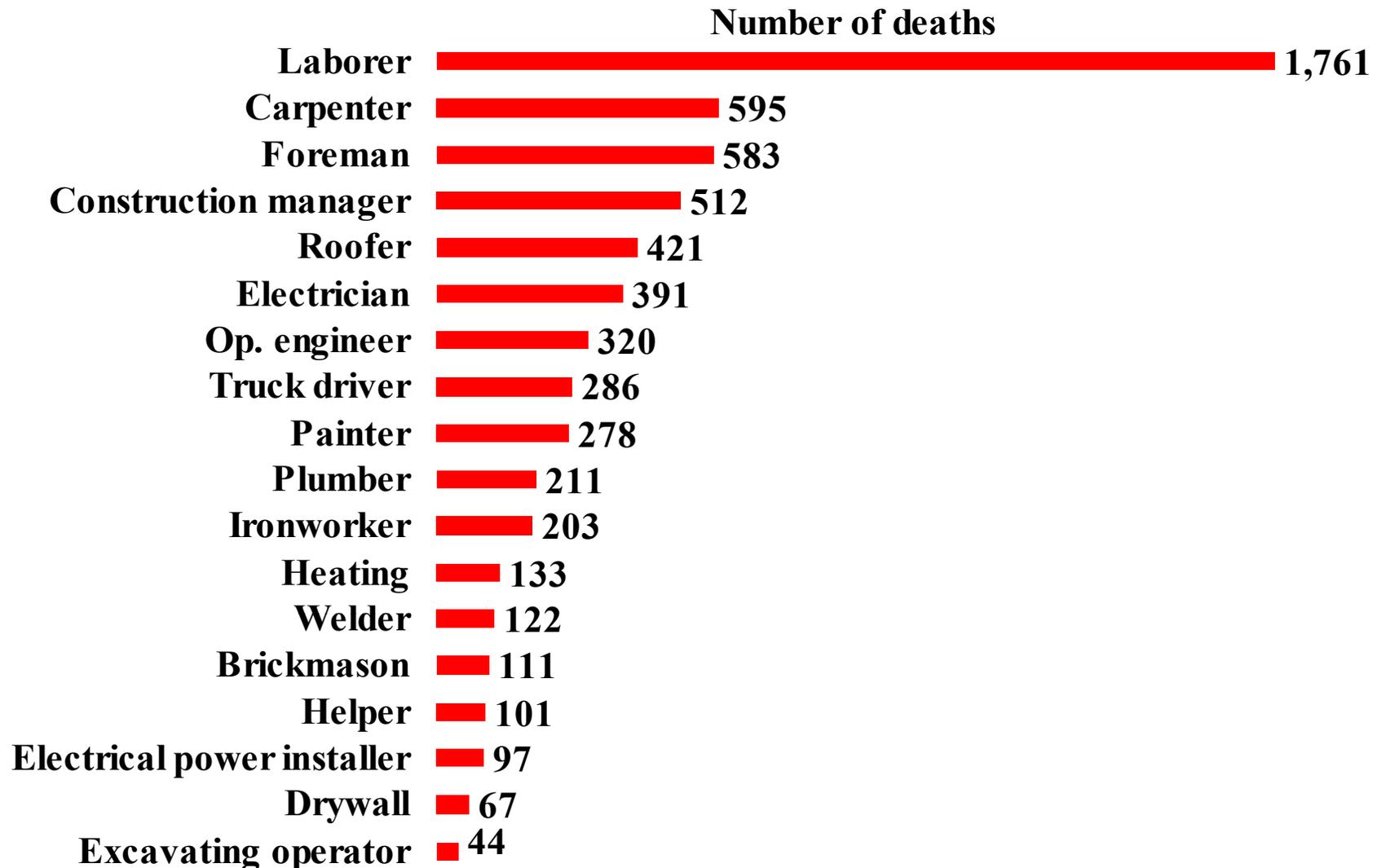
Note: Total of 19,619 deaths. Cases without information on time of day when injury occurred (< 13%) were excluded
Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries

13b. Nonfatal injuries in construction by time of day event occurred, 2008



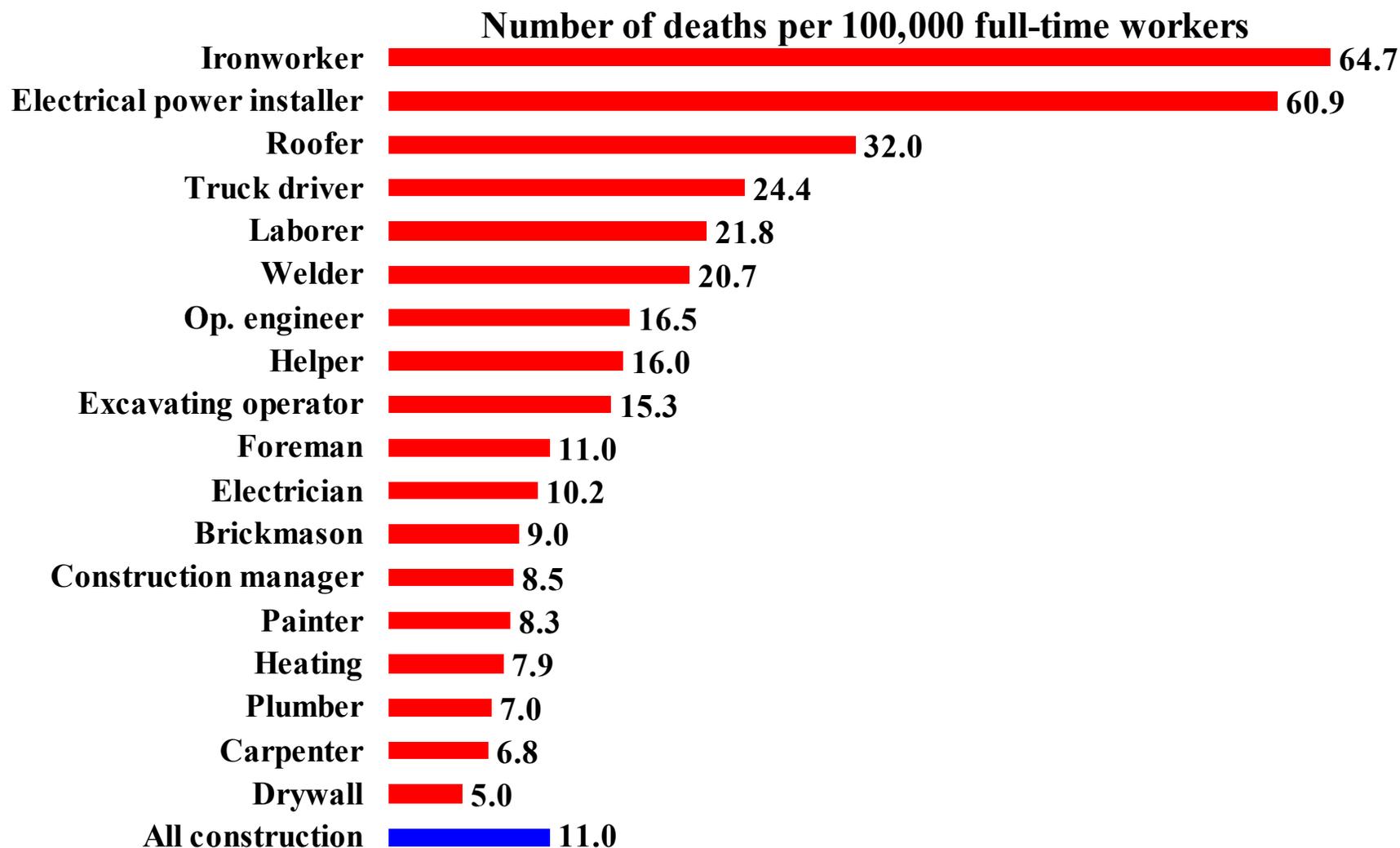
Note: Total of 120,240 DAFW cases. Cases without information on time of day when injury occurred (< 24%) were excluded
Source: U.S. Bureau of Labor Statistics, 2008 Survey of Occupational Injuries and Illnesses

14a. Number of work-related deaths from injuries, selected construction occupations, 2003-2008



Source: U.S. Bureau of Labor Statistics, 2003-2008 Census of Fatal Occupational Injuries

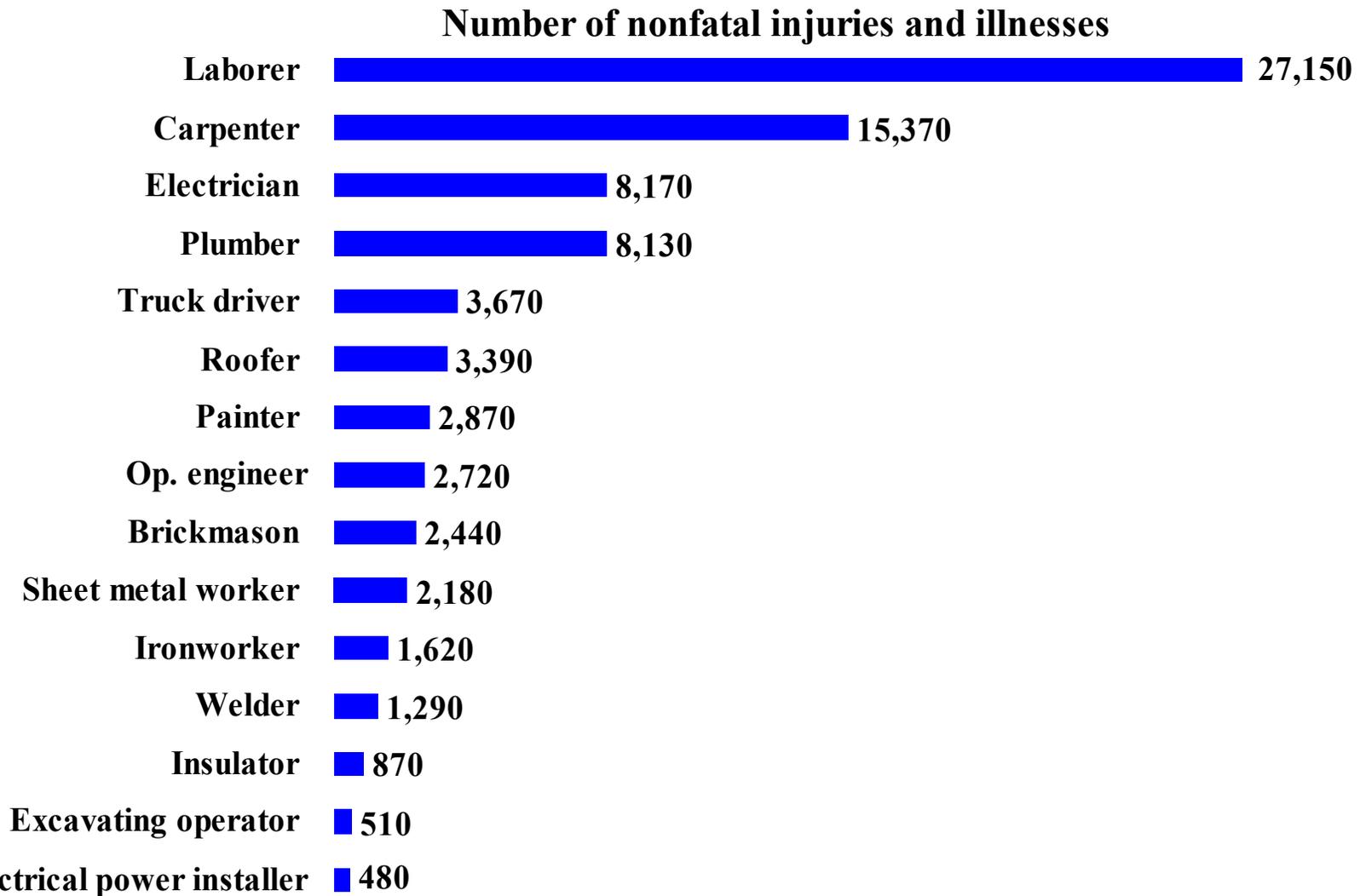
14b. Rate of work-related deaths from injuries, selected construction occupations, 2003-2008 average



FTE = Full-time equivalent, defined as 2,000 hours worked per year

Source: U.S. Bureau of Labor Statistics, 2003-2008 Census of Fatal Occupational Injuries and Current Population Survey

15a. Number of nonfatal injuries and illnesses involving days away from work, selected construction occupations, 2008

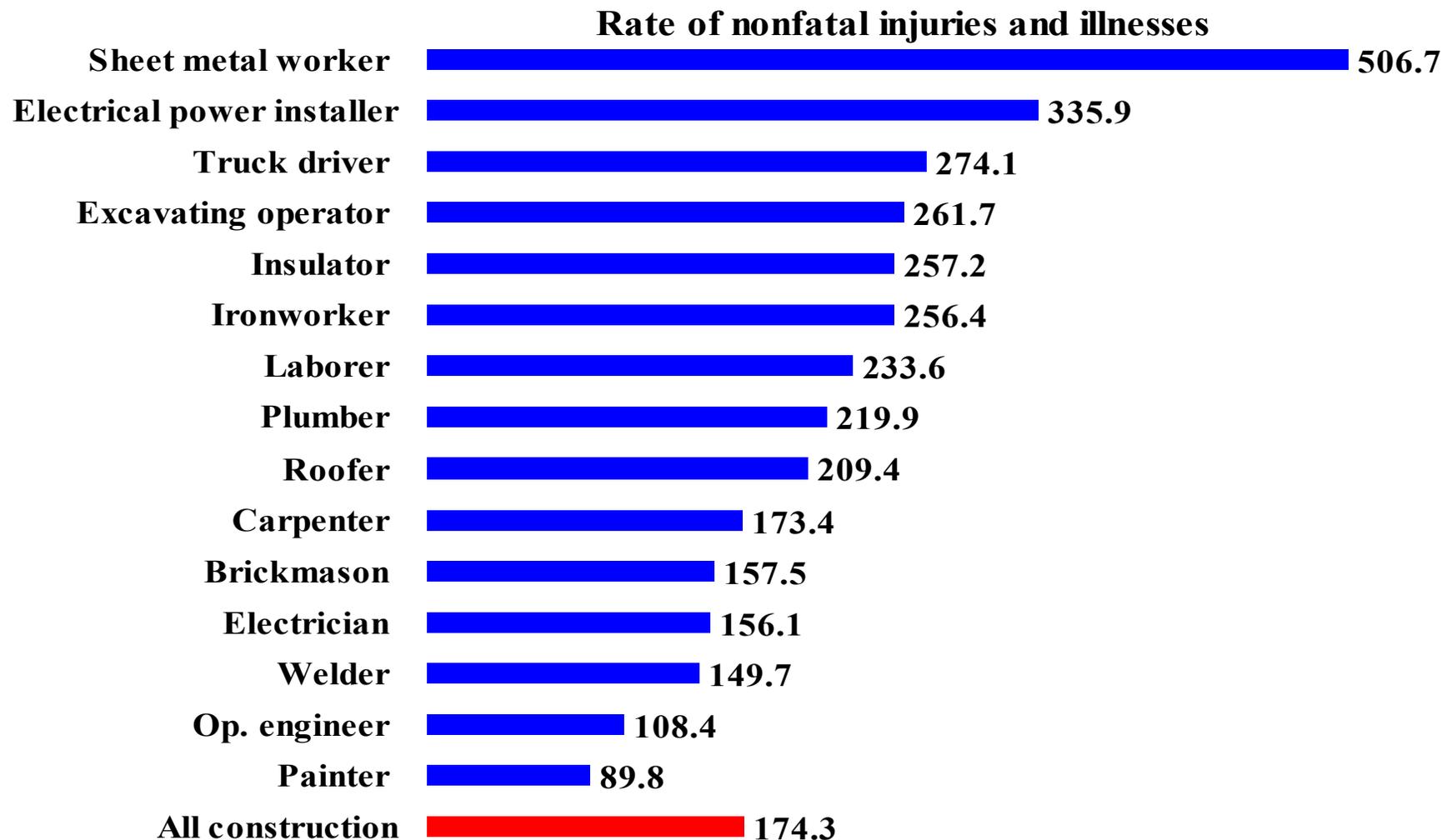


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Total of 120,240 cases. Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 2008 Survey of Occupational Injuries and illnesses

15b. Rate of nonfatal injuries and illnesses involving days away from work, selected construction occupations, 2008

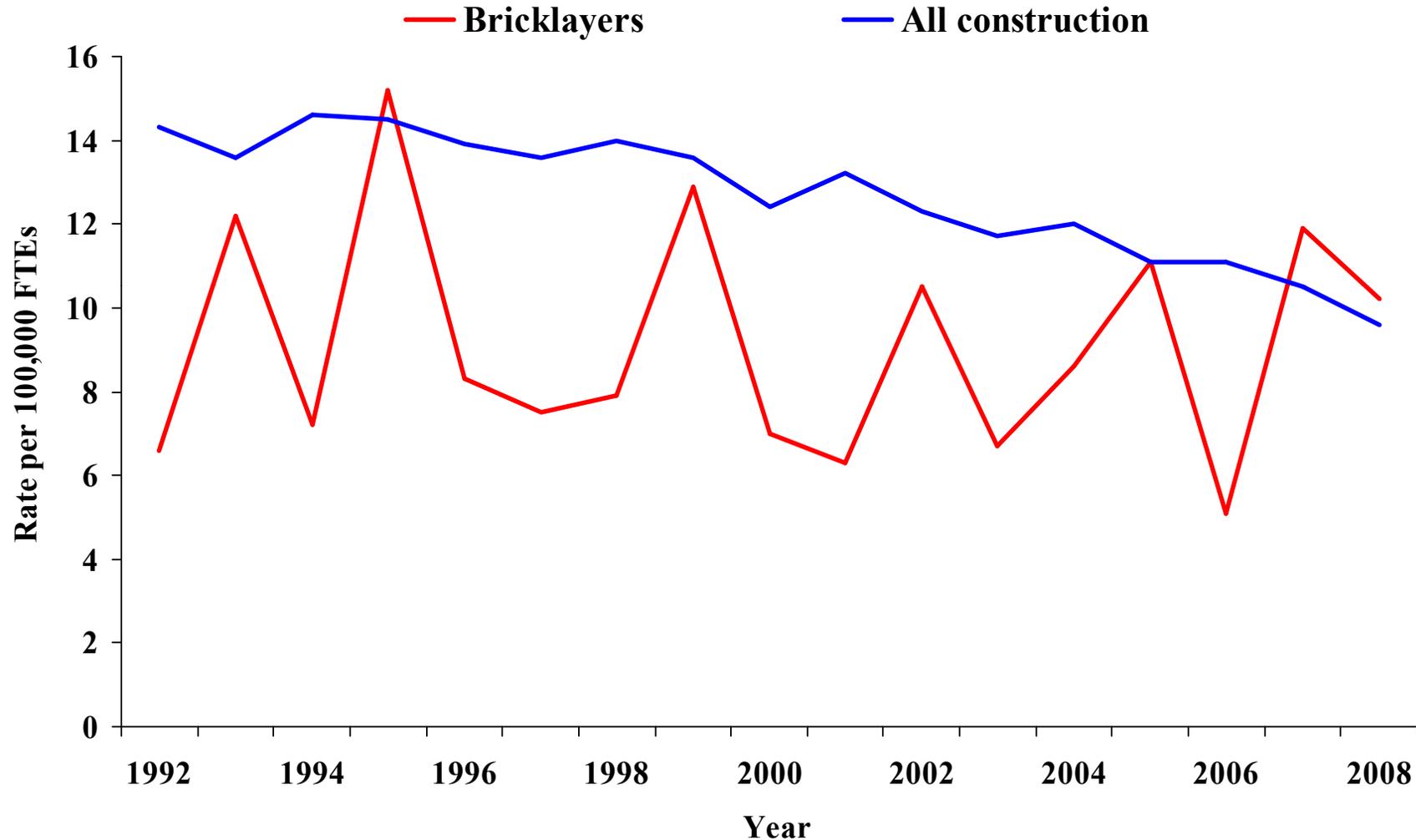


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Rate of 174.3 per 10,000 FTEs. Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 2008 Survey of Occupational Injuries and illnesses and Current Population Survey

16a. Rate of work-related deaths from injuries, bricklayers vs. all construction, 1992-2008

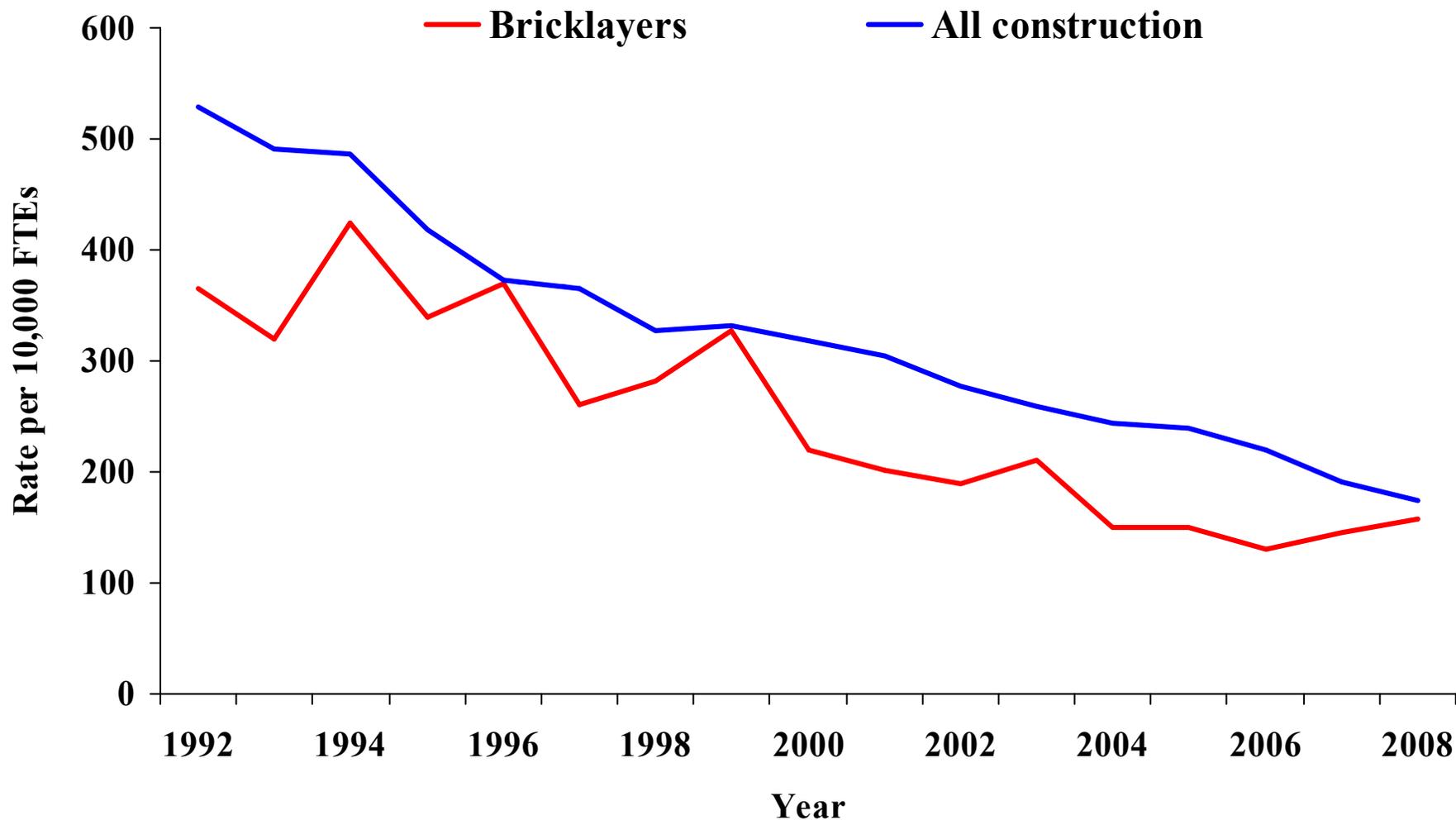


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Bricklayer data based on a total of 276 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

16b. Rate of nonfatal injuries and illnesses resulting in days away from work, bricklayers vs. all construction, 1992-2008

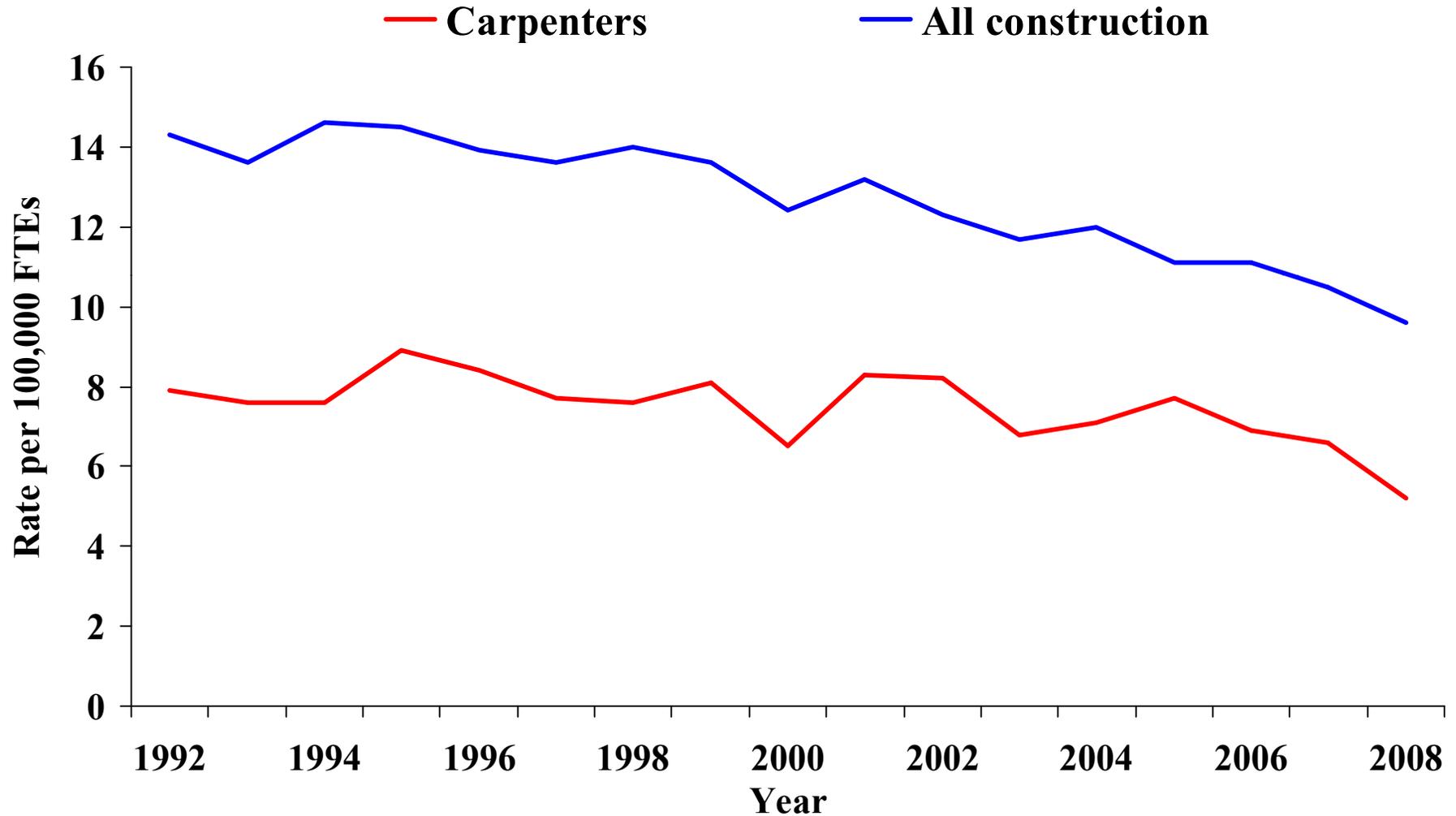


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

17a. Rate of work-related deaths from injuries, carpenters vs. all construction, 1992-2008

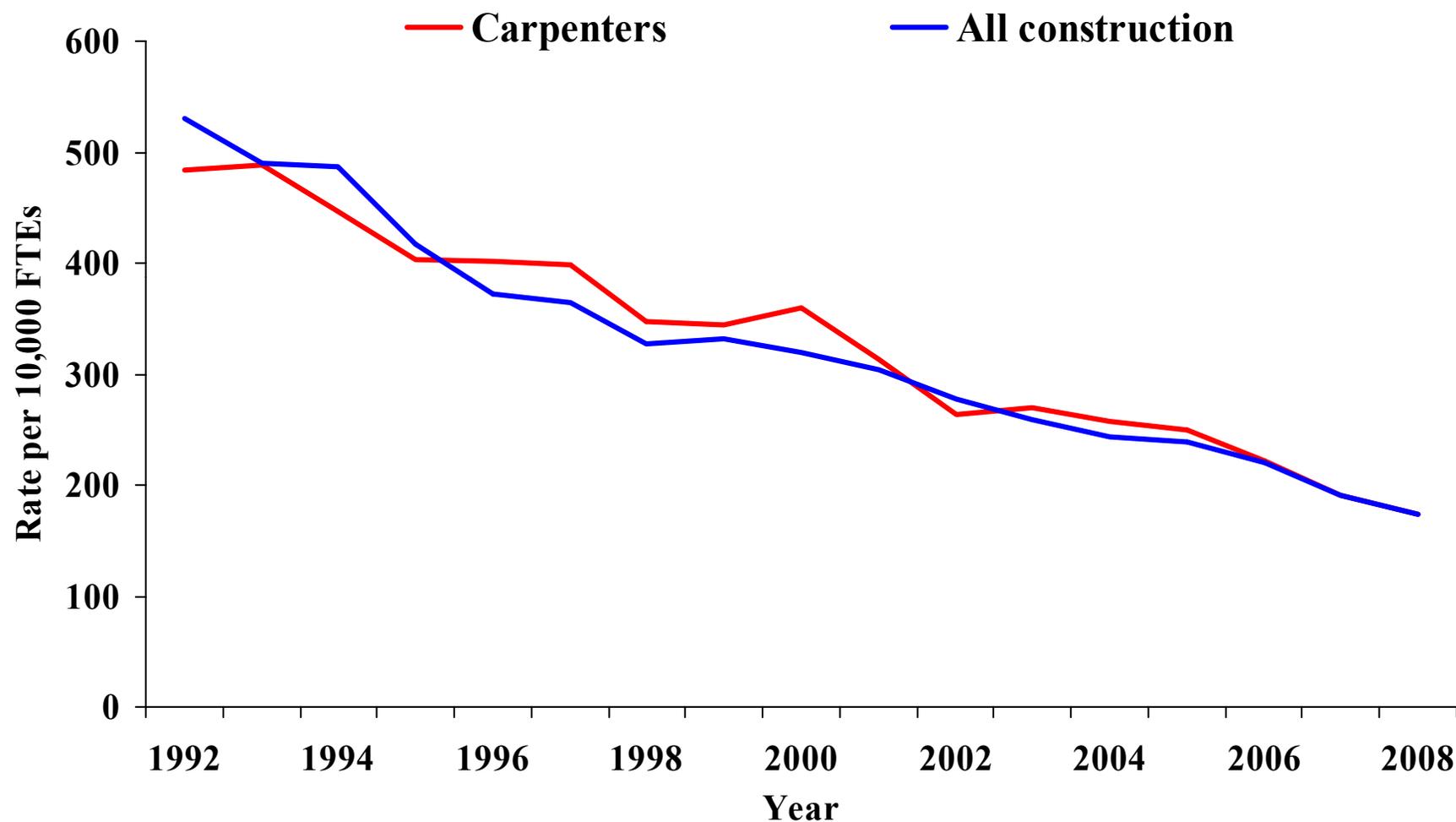


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Carpenter data based on a total of 1,546 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

17b. Rate of nonfatal injuries and illnesses resulting in days away from work, carpenters vs. all construction, 1992-2008

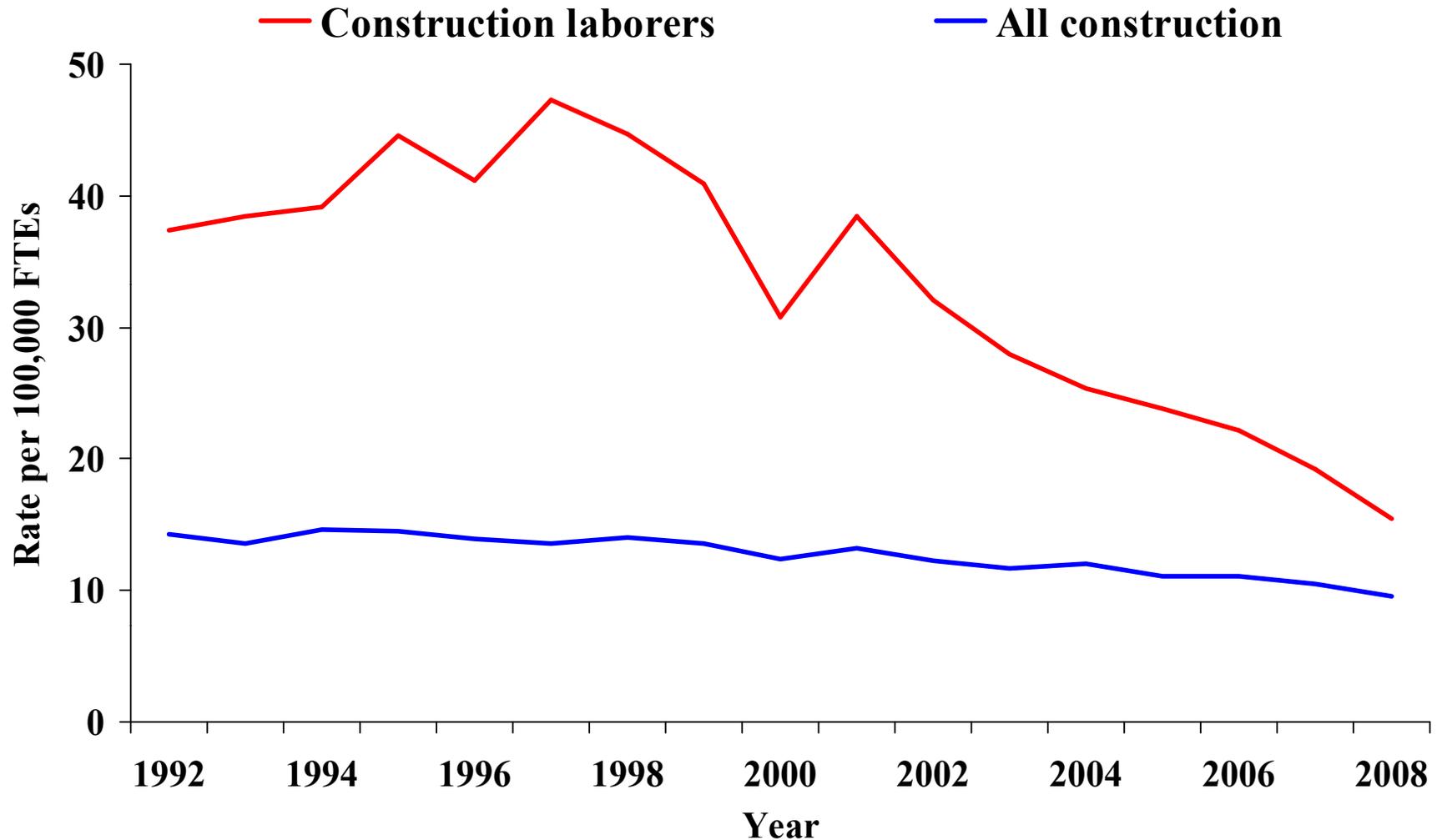


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

18a. Rate of work-related deaths from injuries, construction laborers vs. all construction, 1992-2008

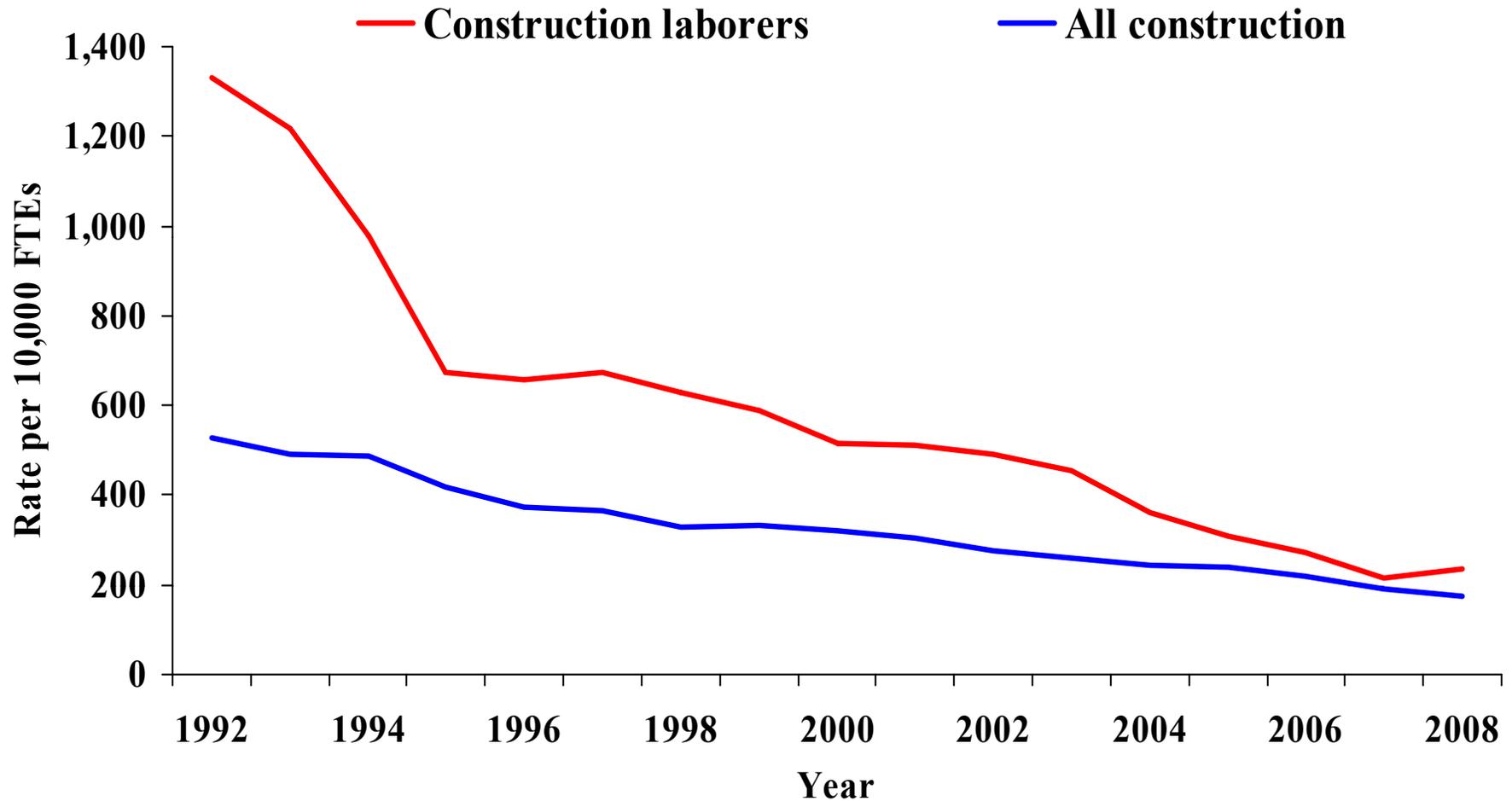


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Construction laborer data based on a total of 4,928 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

18b. Rate of nonfatal injuries and illnesses resulting in days away from work, construction laborers vs. all construction, 1992-2008

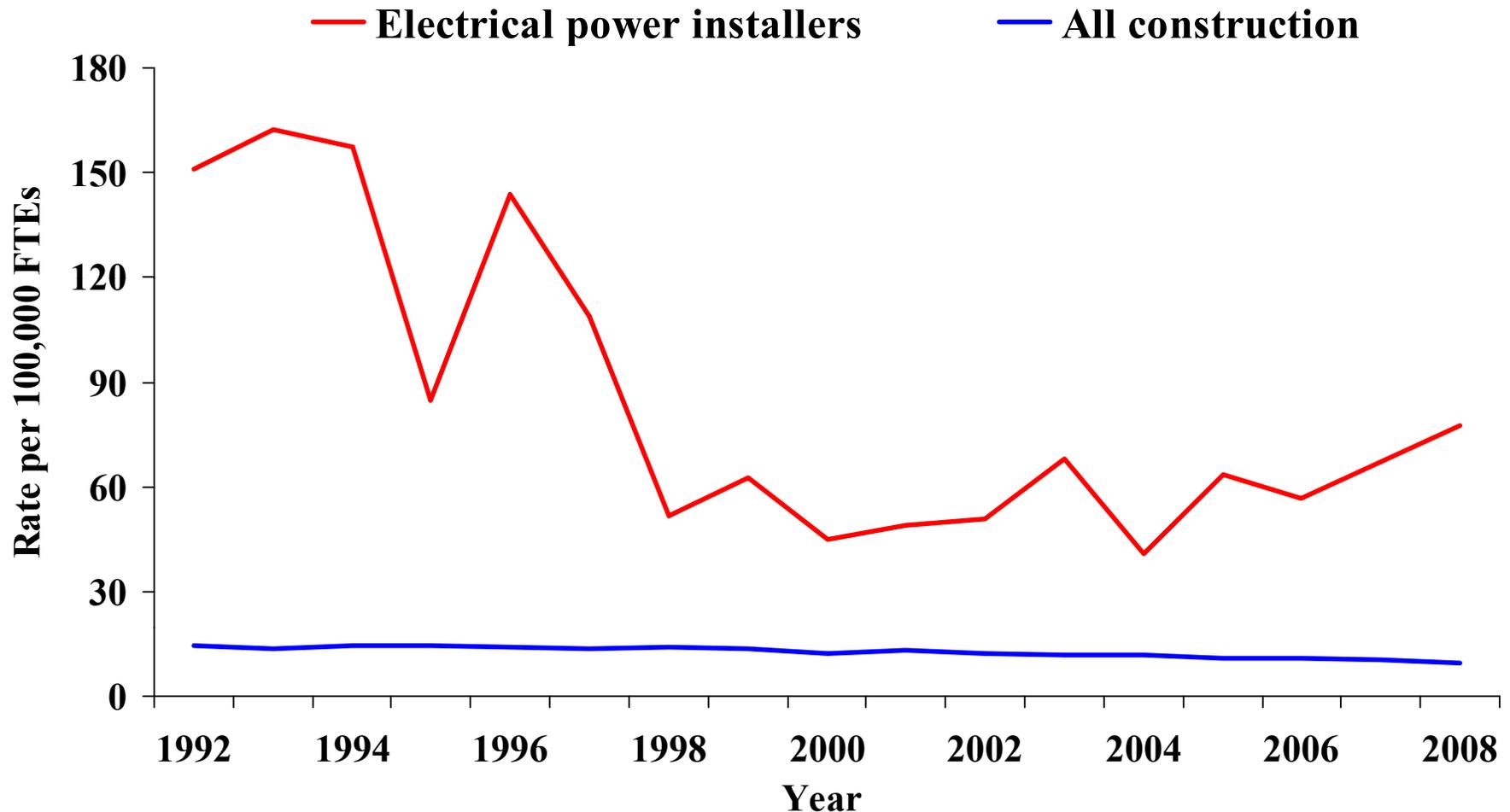


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

19a. Rate of work-related deaths from injuries, electrical power installers vs. all construction, 1992-2008

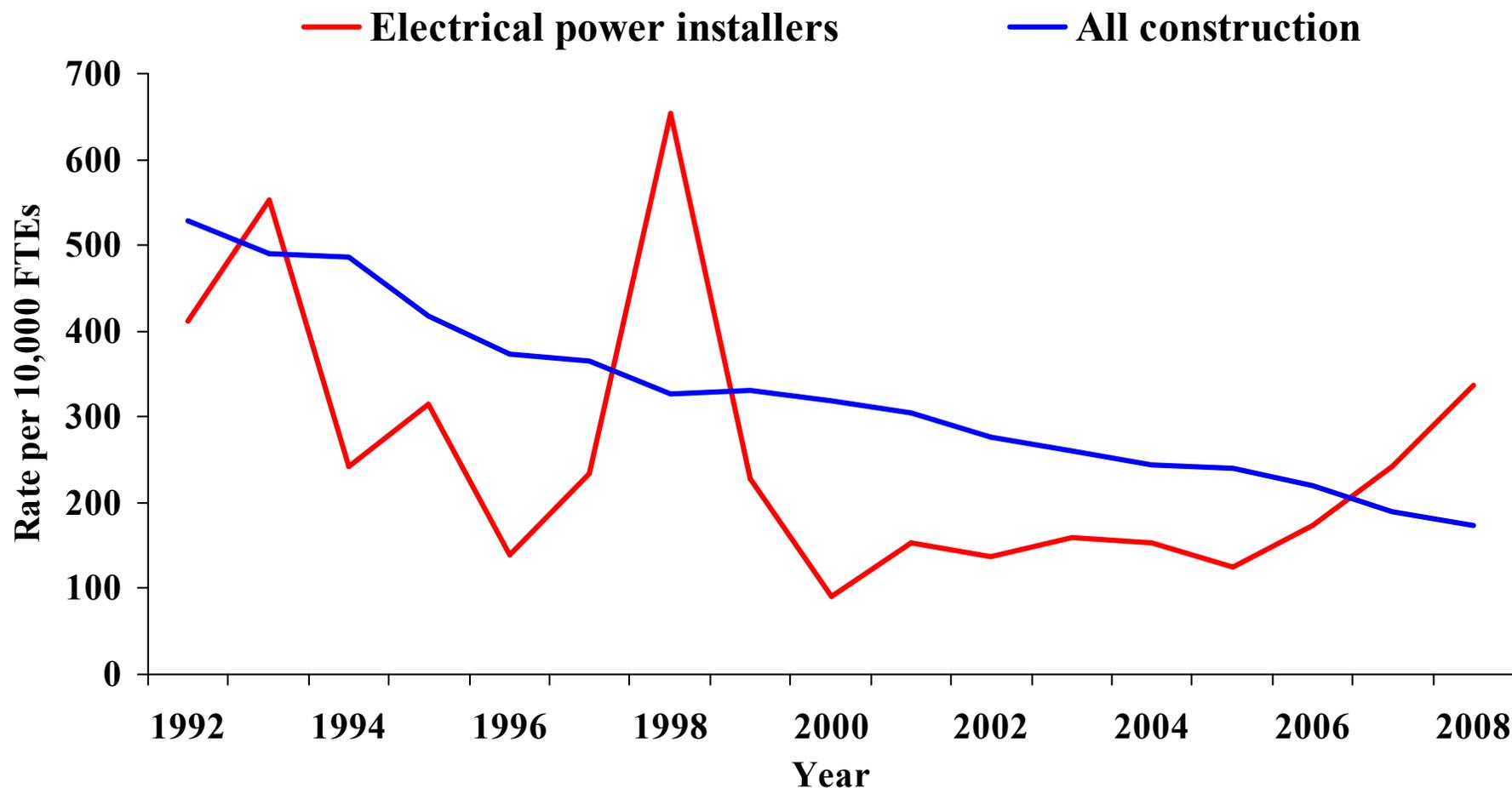


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Electrical power installer data based on a total of 260 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

19b. Rate of nonfatal injuries and illnesses resulting in days away from work, electrical power installers vs. all construction, 1992-2008

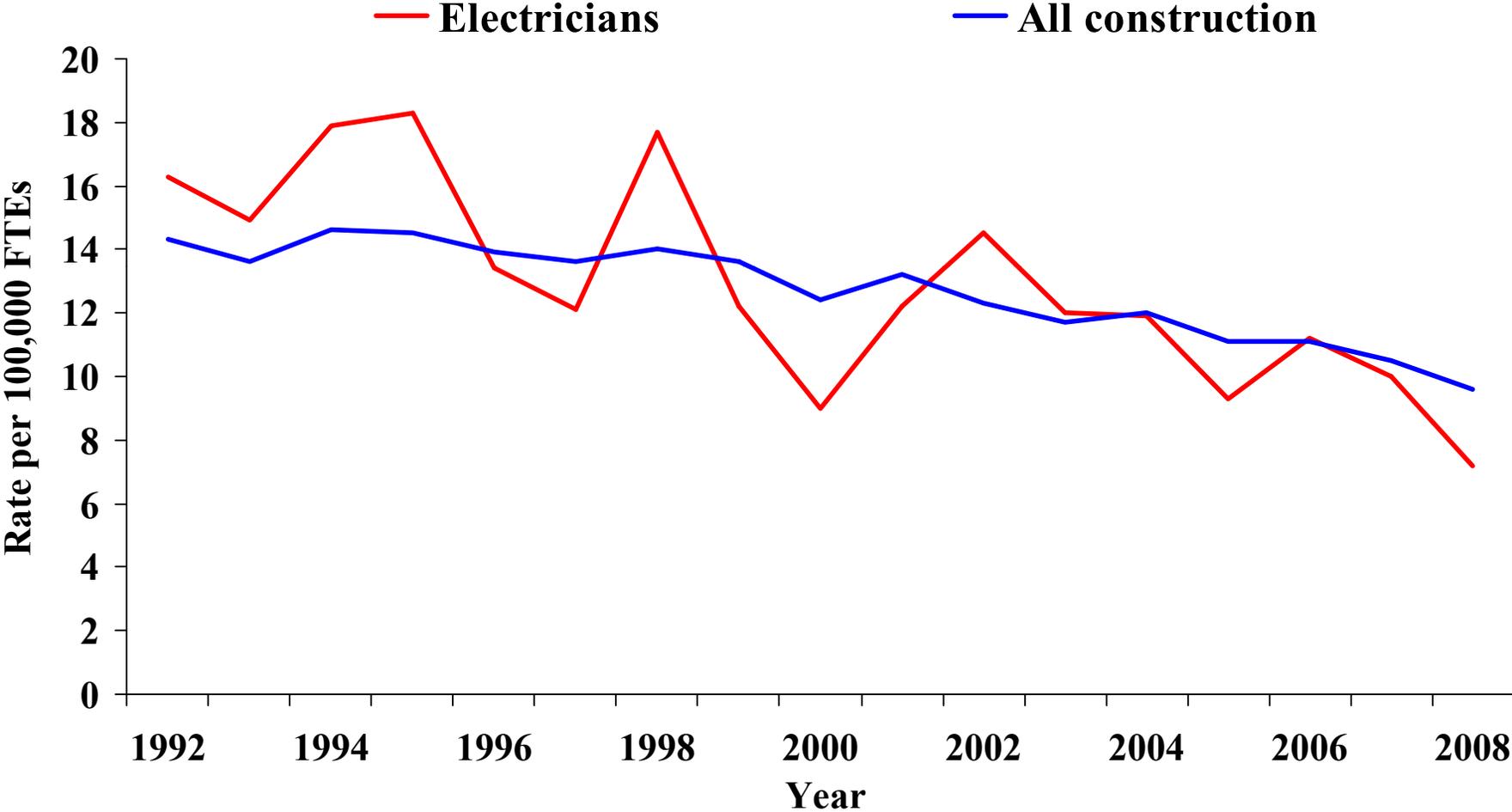


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

20a. Rate of work-related deaths from injuries, electricians vs. all construction, 1992-2008

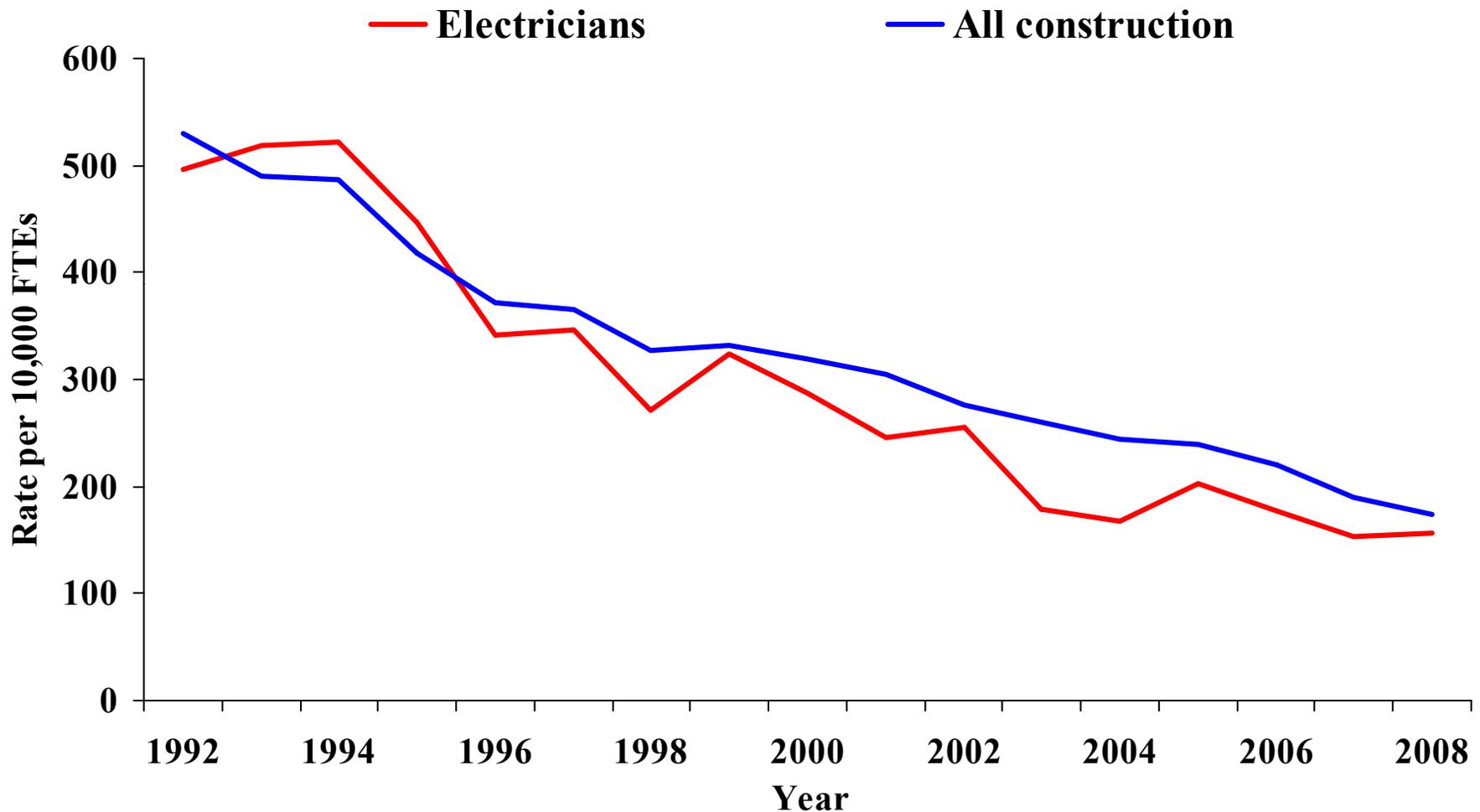


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Electrician data based on a total of 1,145 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

20b. Rate of nonfatal injuries and illnesses resulting in days away from work, electricians vs. all construction, 1992-2008

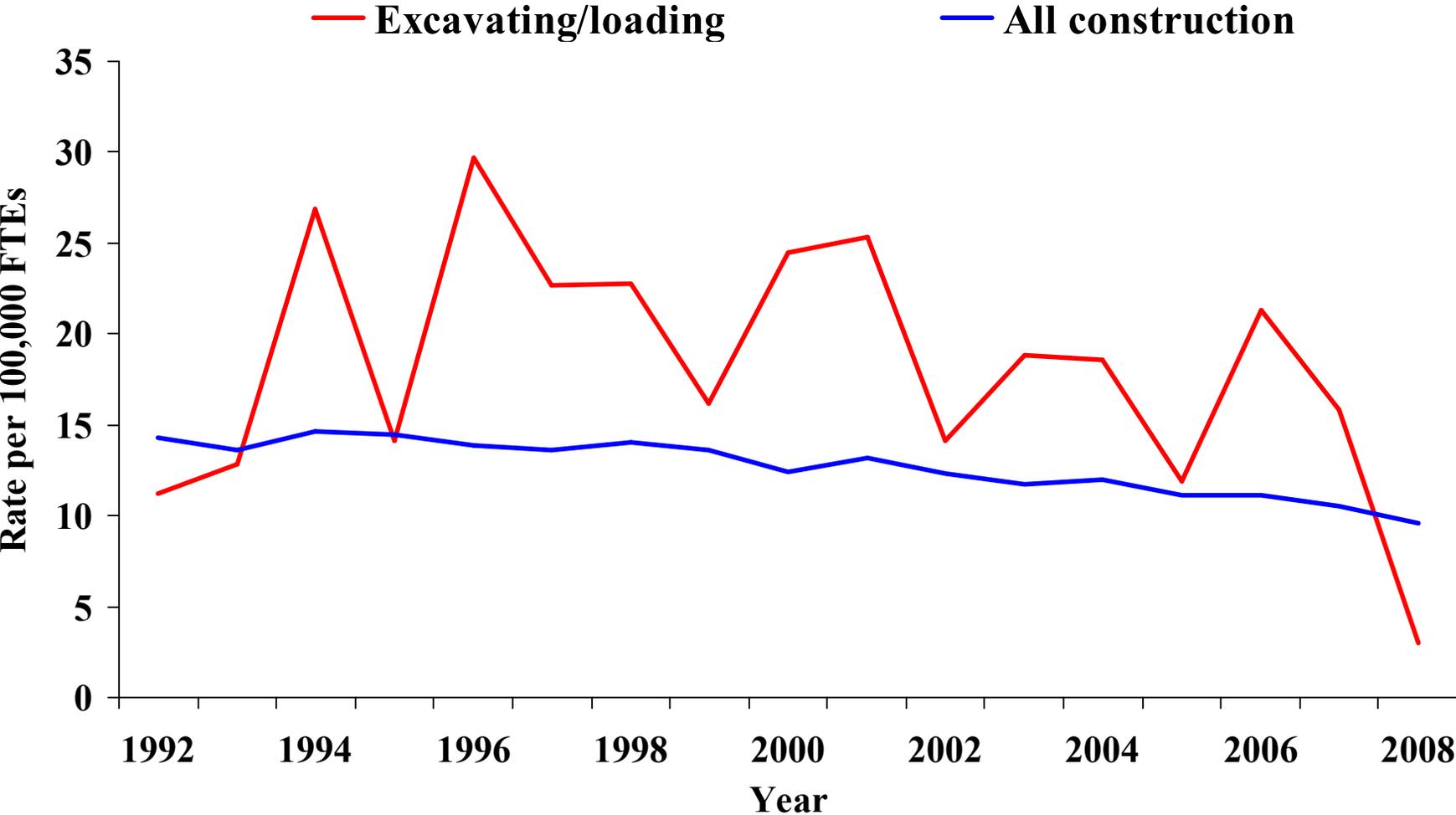


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

21a. Rate of work-related deaths from injuries, excavating/loading machine operators vs. all construction, 1992-2008

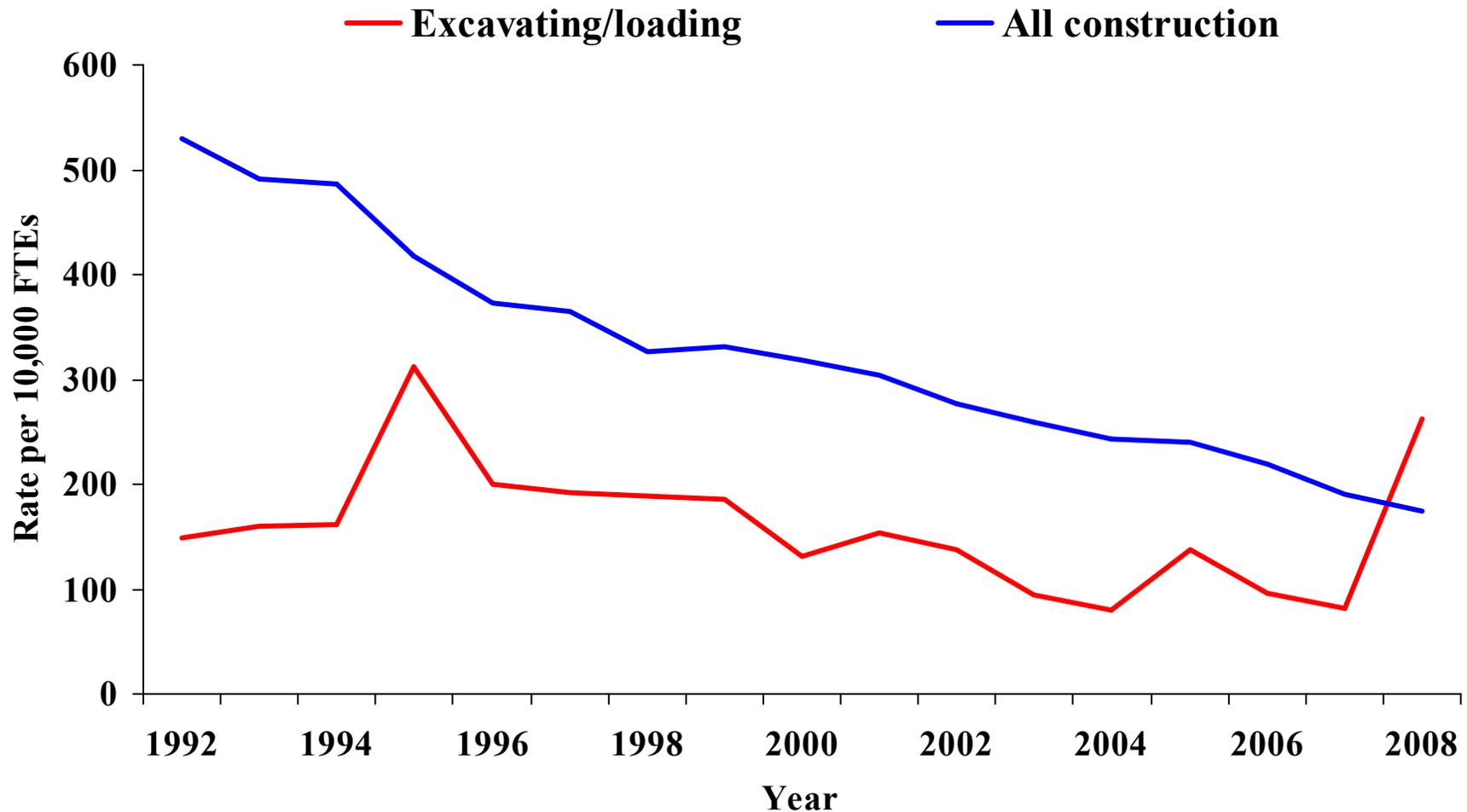


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Excavating/loading machine operator data based on a total of 204 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

21b. Rate of nonfatal injuries and illnesses resulting in days away from work, excavating/loading machine operators vs. all construction, 1992-2008

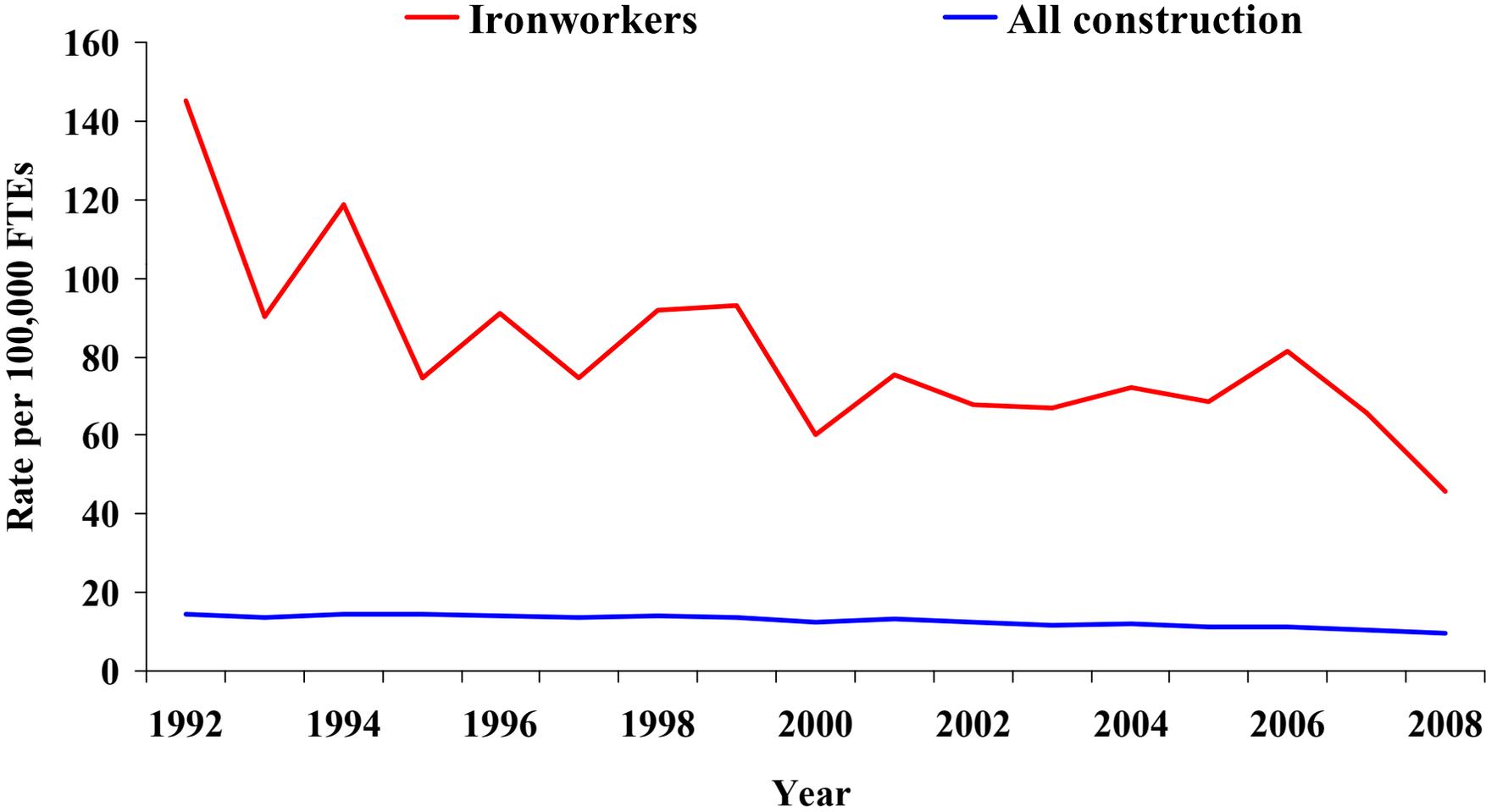


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

22a. Rate of work-related deaths from injuries, ironworkers vs. all construction, 1992-2008

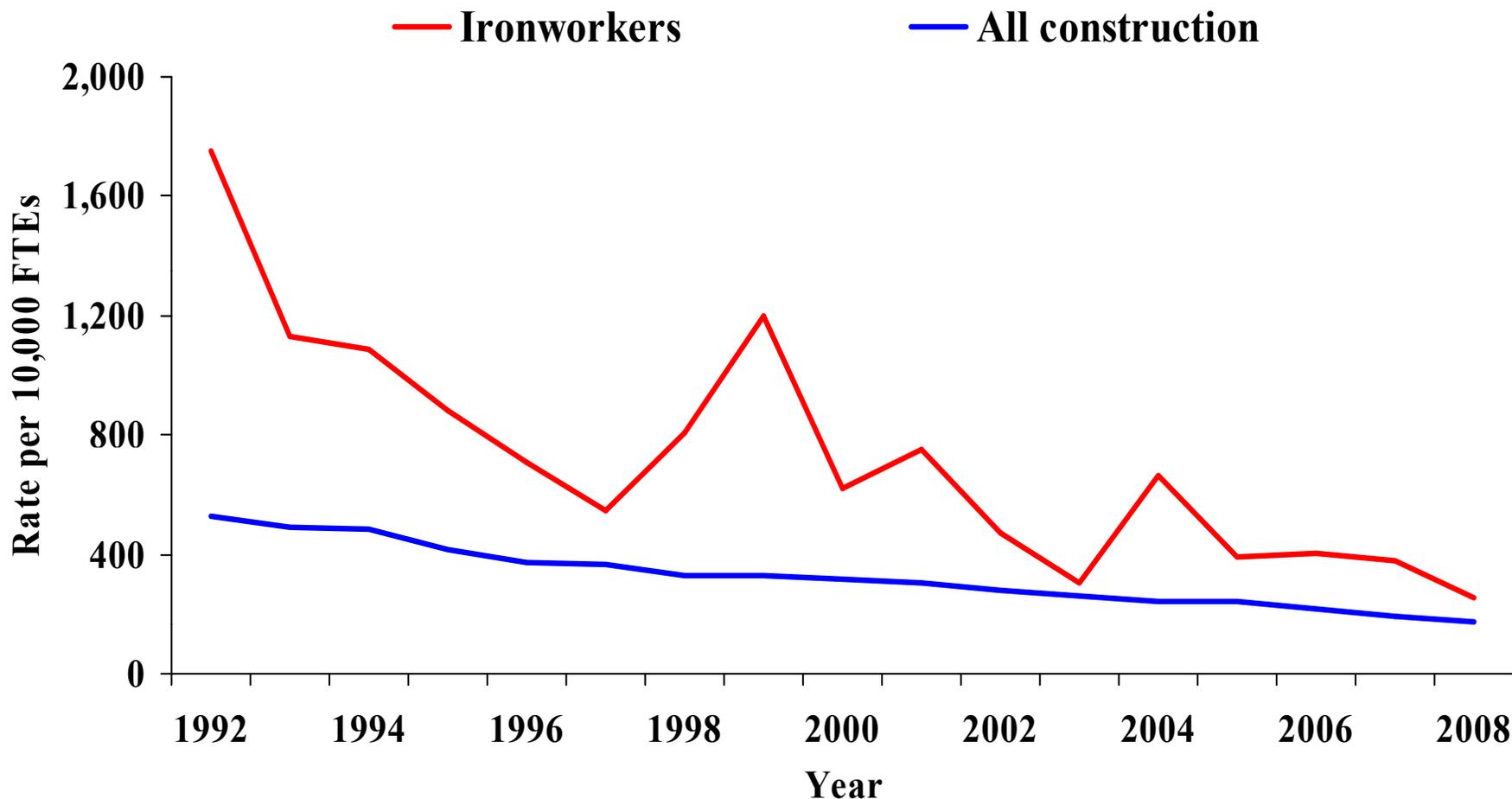


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Ironworker data based on a total of 666 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

22b. Rate of nonfatal injuries and illnesses resulting in days away from work, ironworkers vs. all construction, 1992-2008

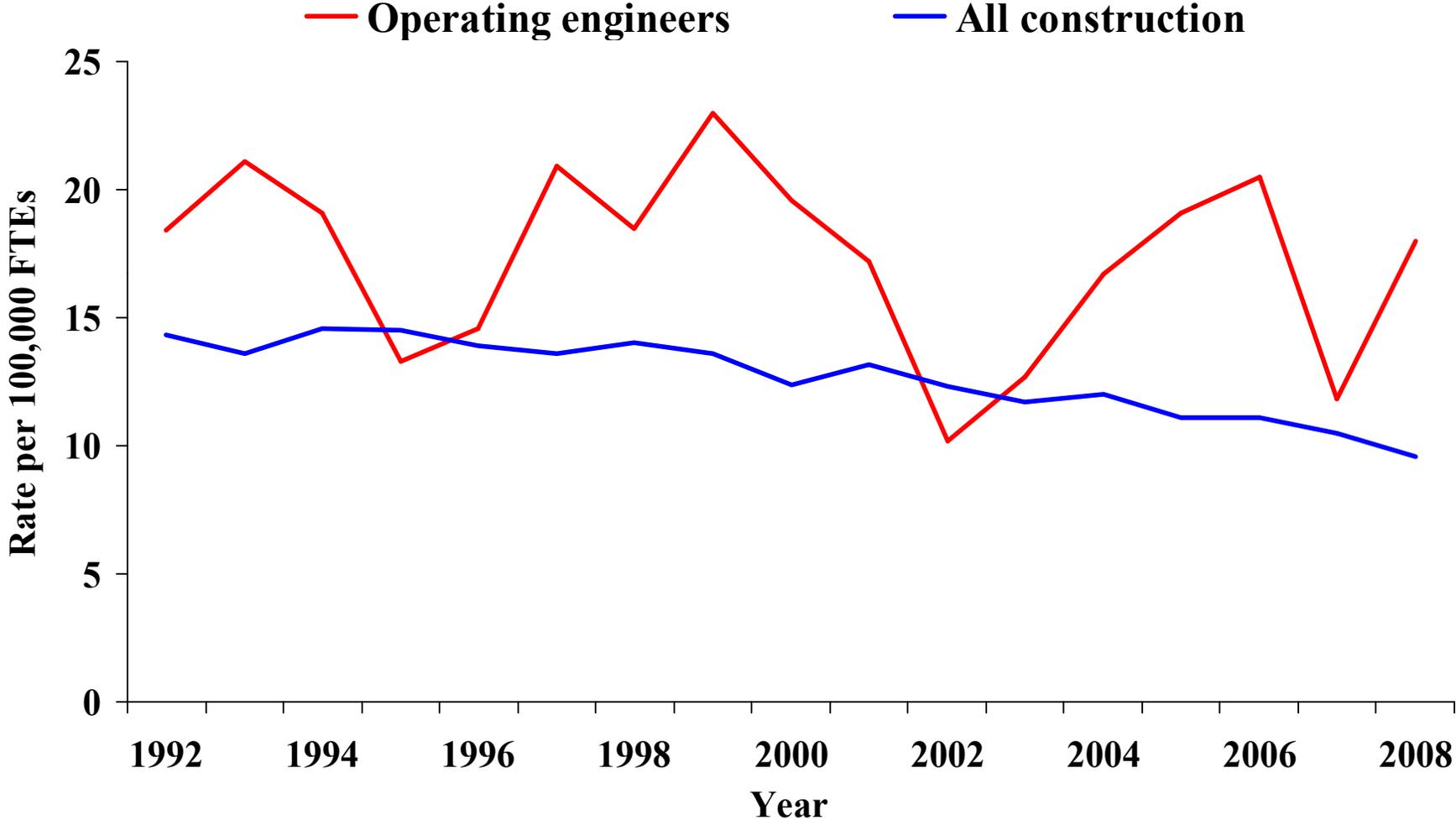


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

23a. Rate of work-related deaths from injuries, operating engineers vs. all construction, 1992-2008

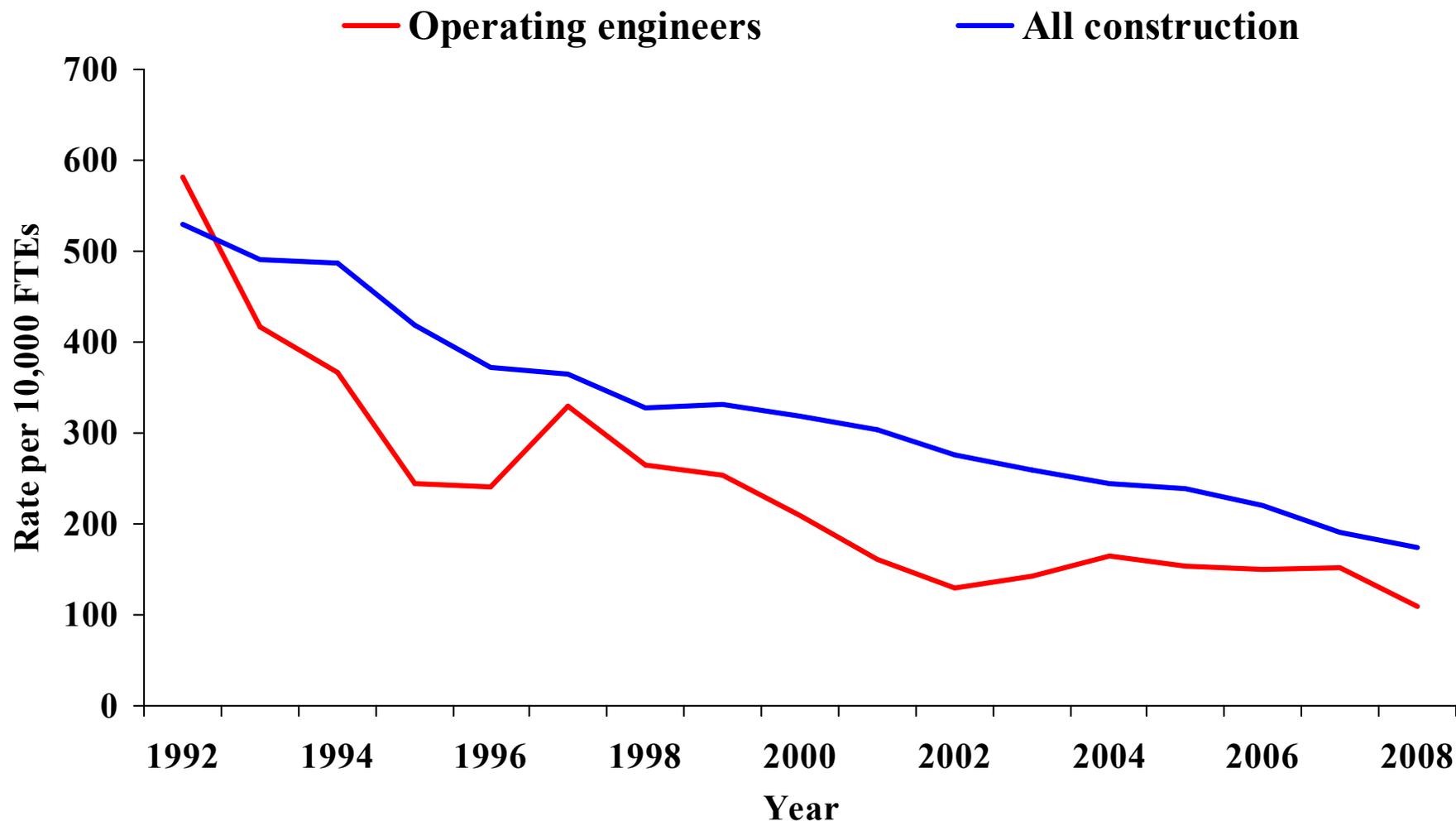


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Operating engineer data based on a total of 684 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

23b. Rate of nonfatal injuries and illnesses resulting in days away from work, operating engineers vs. all construction, 1992-2008

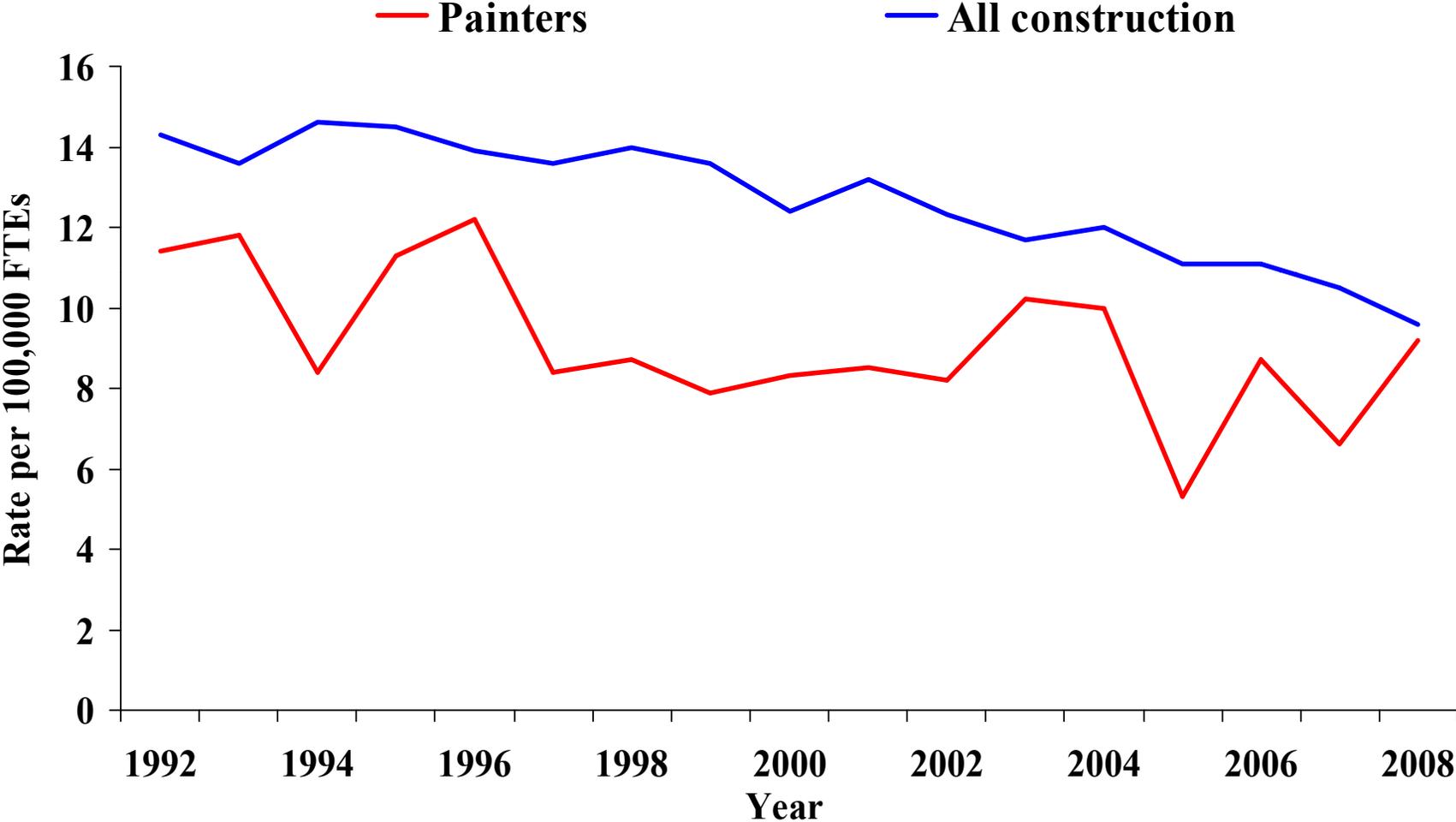


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

24a. Rate of work-related deaths from injuries, painters vs. all construction, 1992-2008

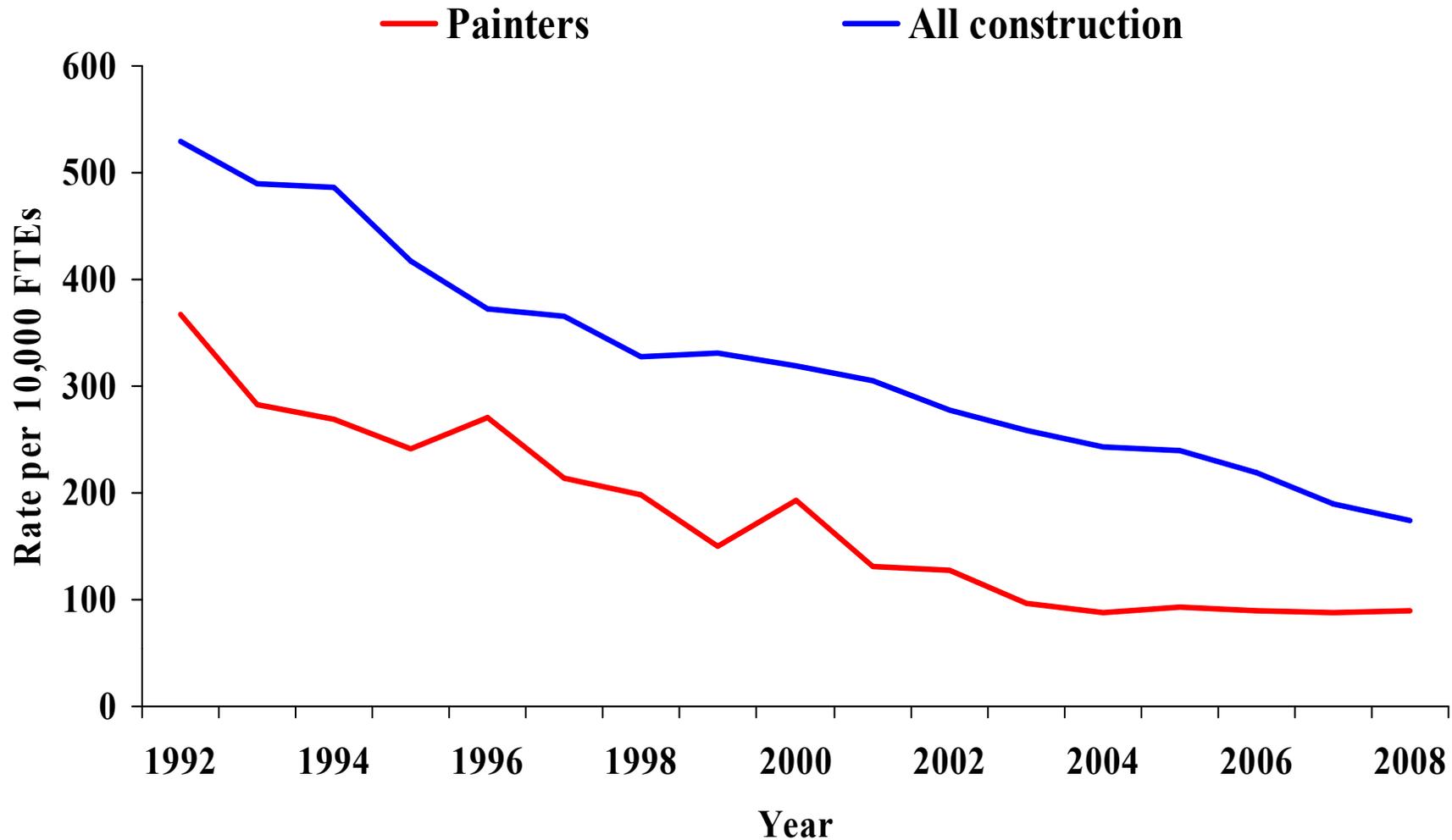


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Painter data based on a total of 703 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

24b. Rate of nonfatal injuries and illnesses resulting in days away from work, painters vs. all construction, 1992-2008

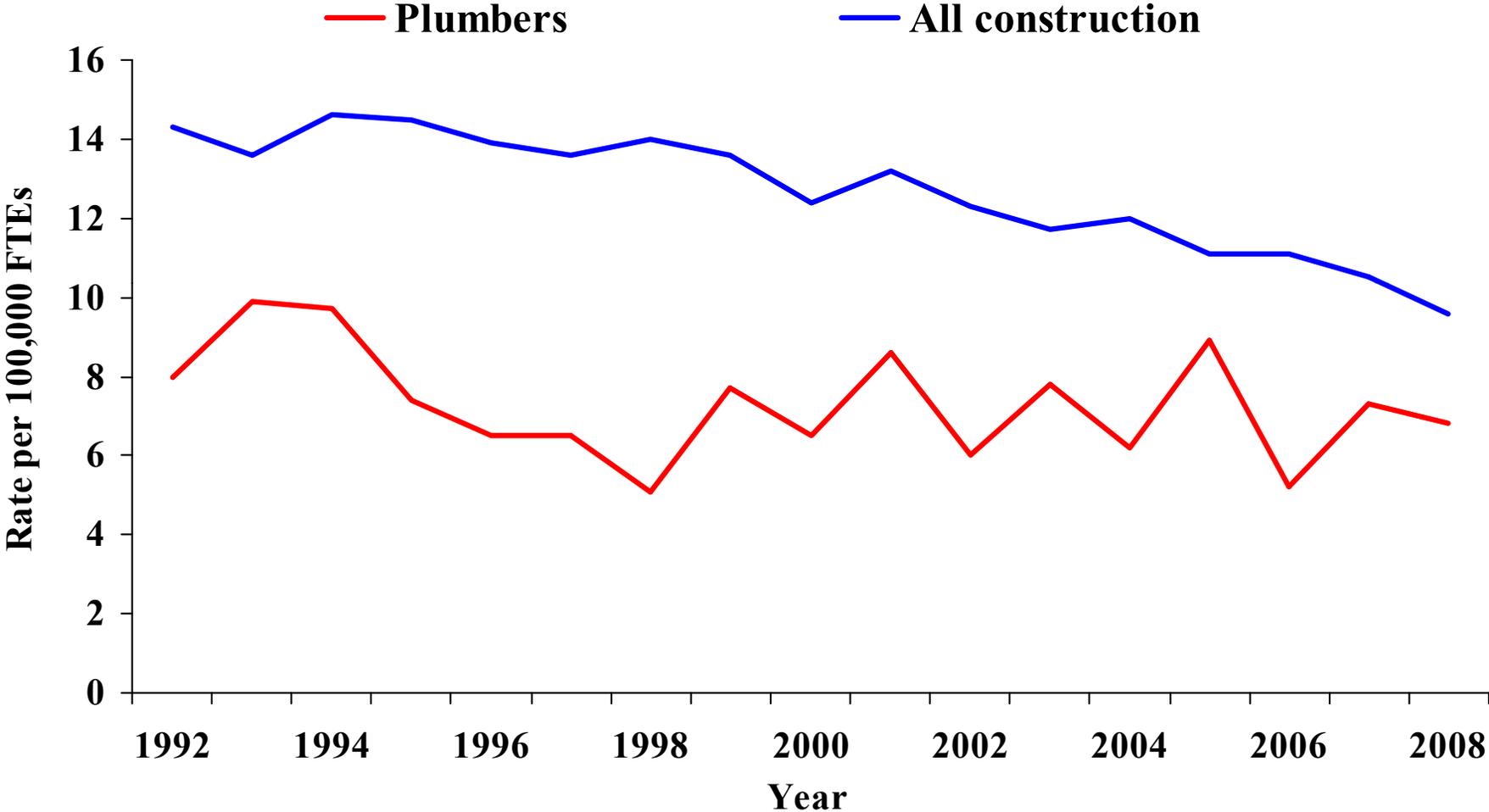


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

25a. Rate of work-related deaths from injuries, plumbers vs. all construction, 1992-2008

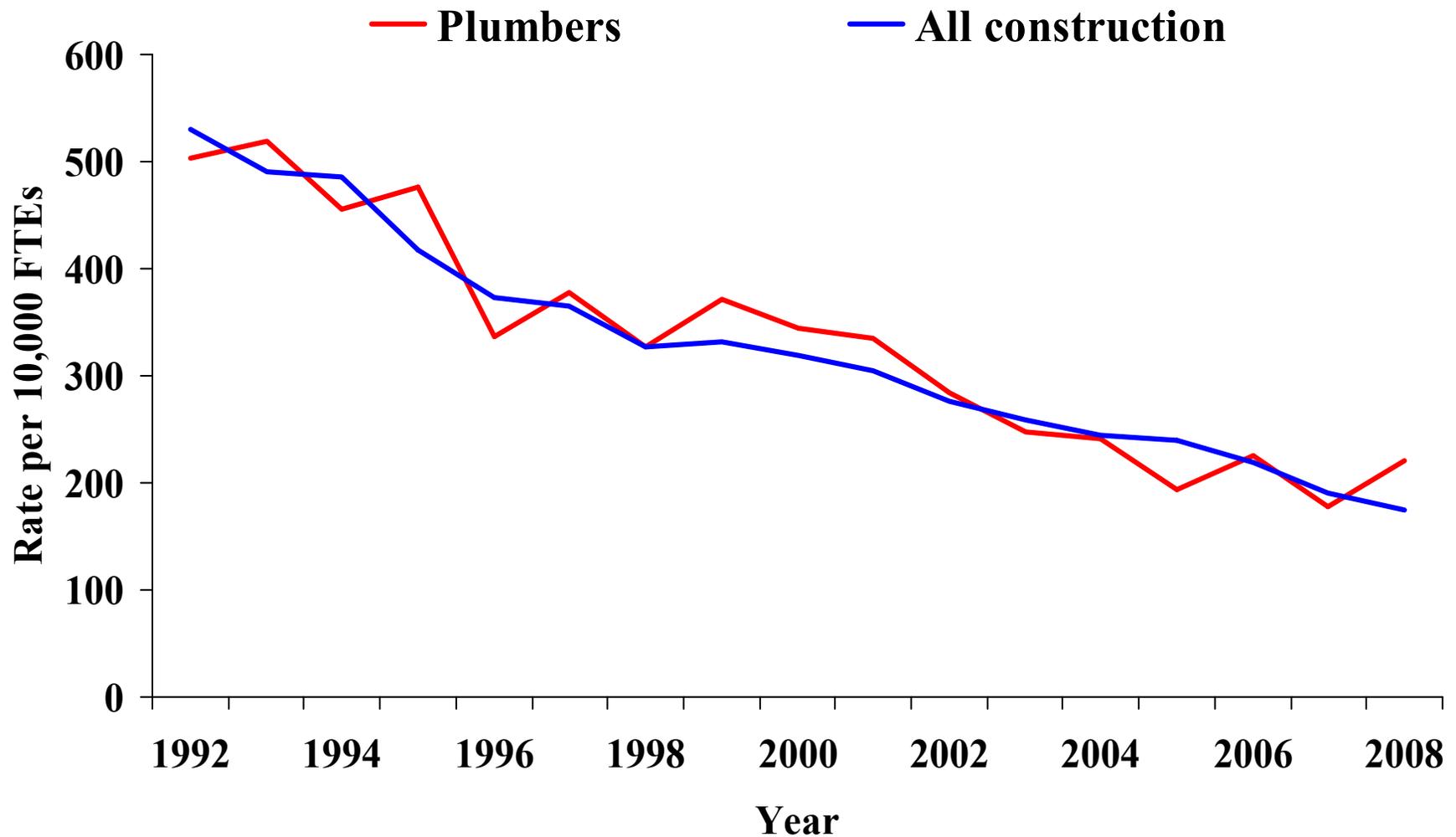


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Plumber data based on a total of 520 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

25b. Rate of nonfatal injuries and illnesses resulting in days away from work, plumbers vs. all construction, 1992-2008

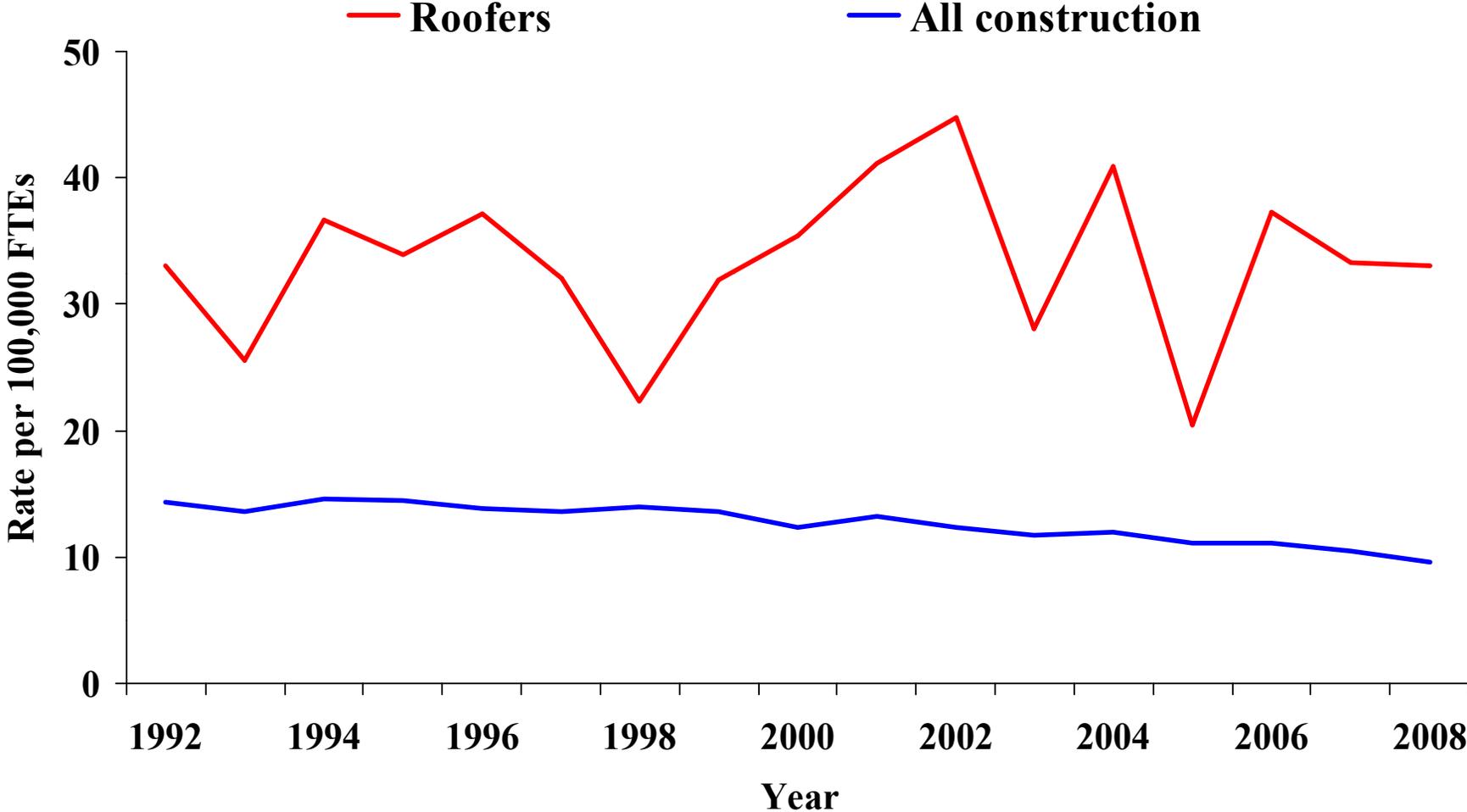


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

26a. Rate of work-related deaths from injuries, roofers vs. all construction, 1992-2008

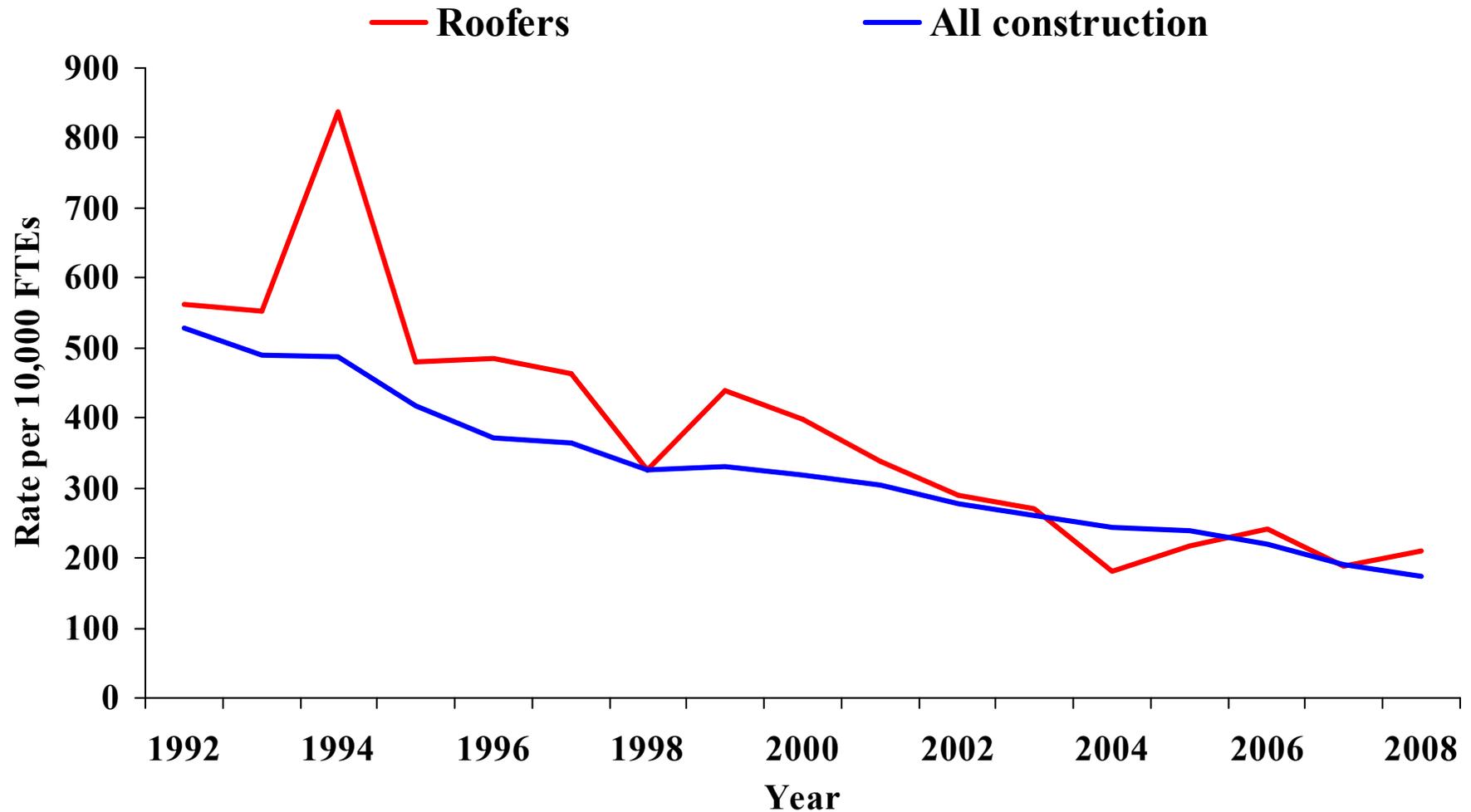


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Roofer data based on a total of 1,075 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

26b. Rate of nonfatal injuries and illnesses resulting in days away from work, roofers vs. all construction, 1992-2008

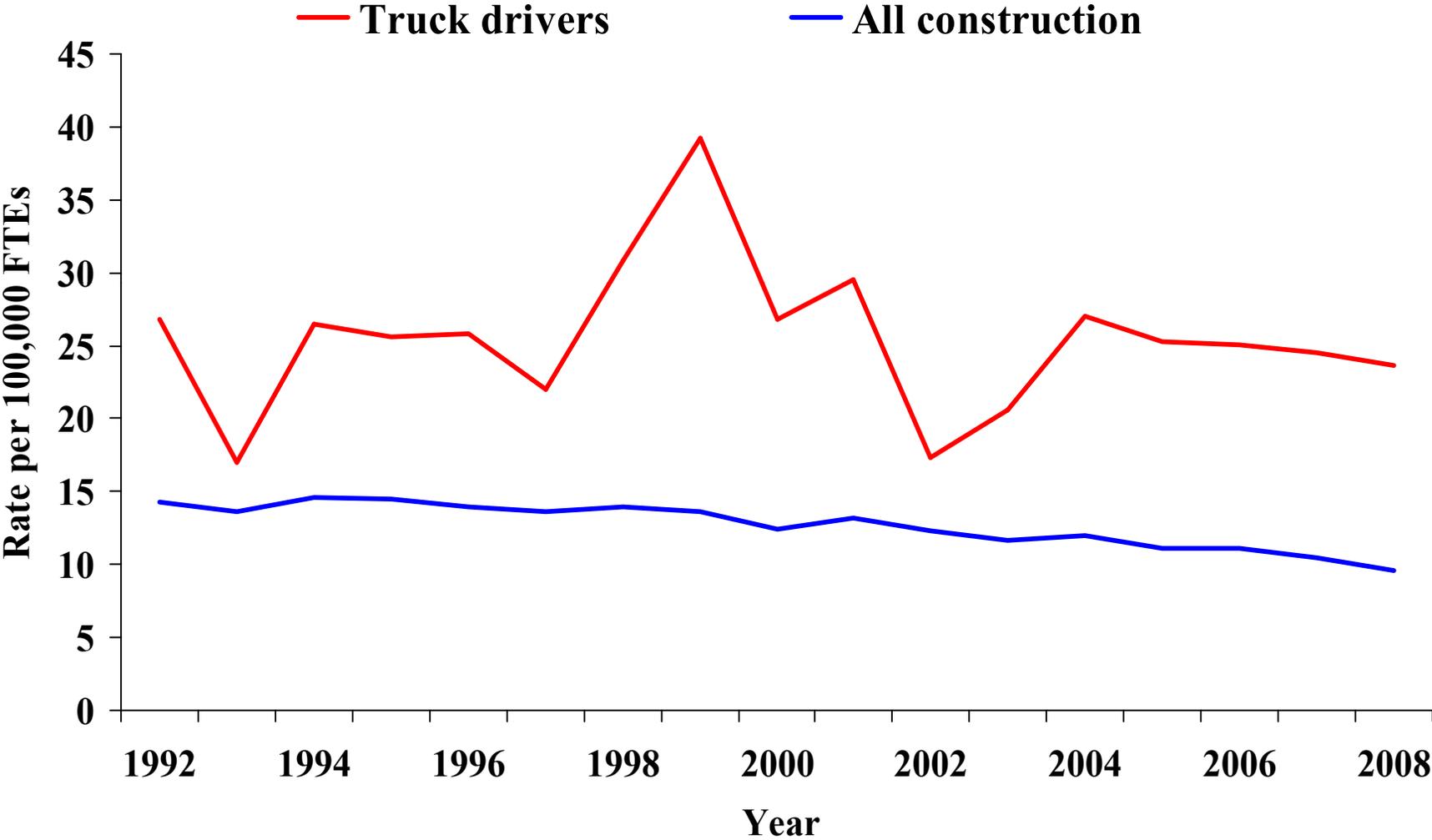


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

27a. Rate of work-related deaths from injuries, truck drivers vs. all construction, 1992-2008

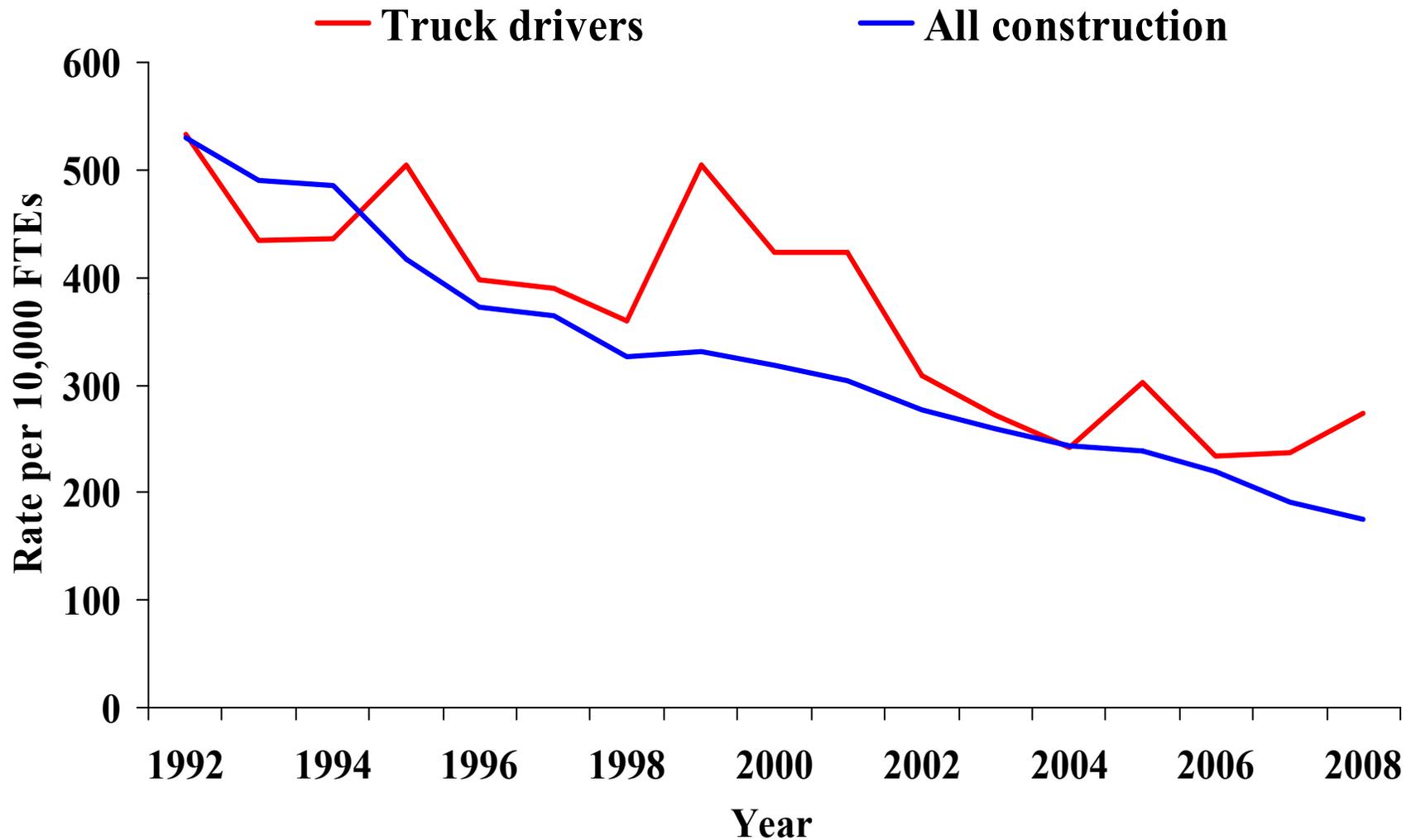


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Truck driver data based on a total of 796 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

27b. Rate of nonfatal injuries and illnesses resulting in days away from work, truck drivers vs. all construction, 1992-2008

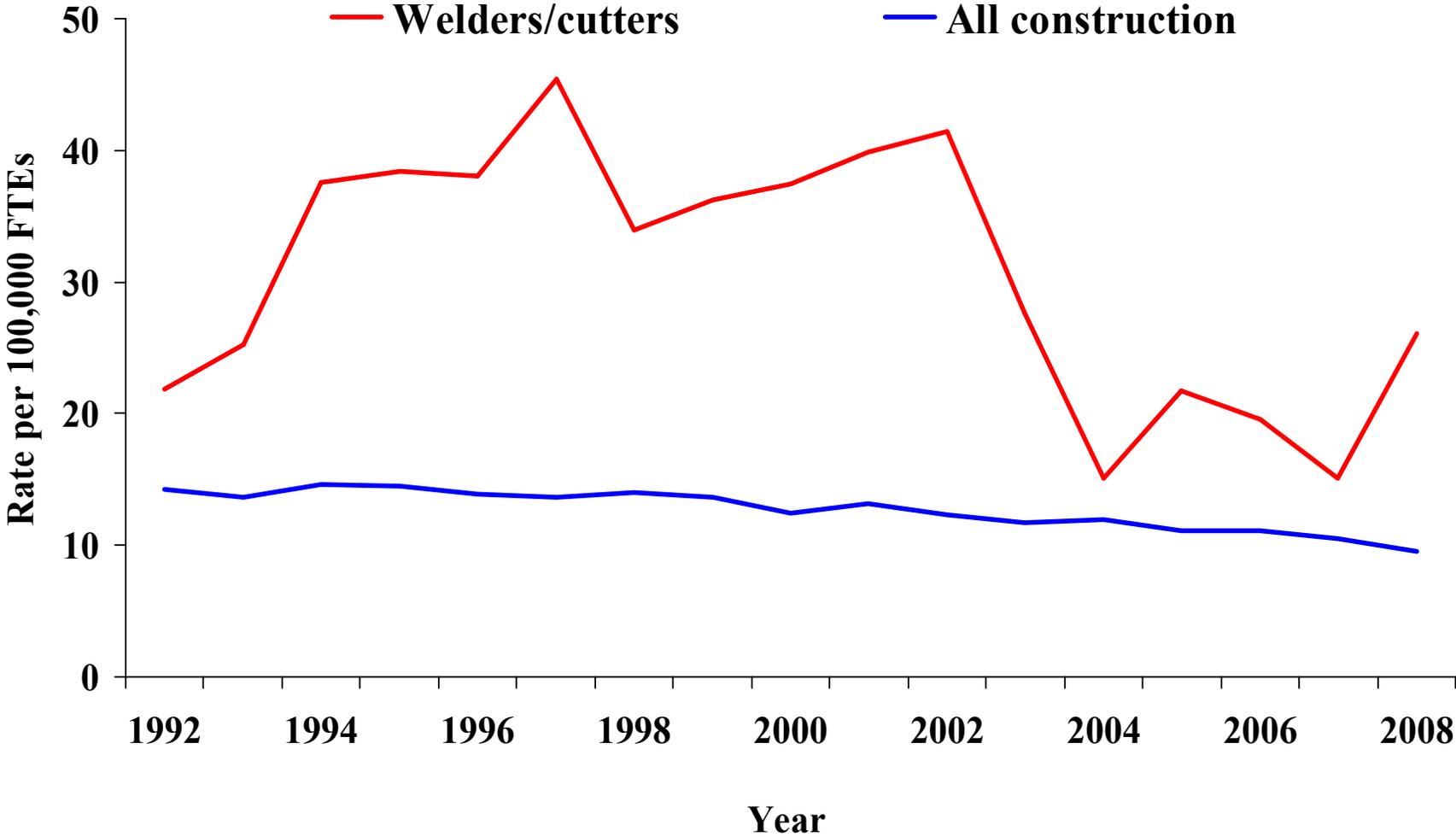


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

28a. Rate of work-related deaths from injuries, welders/cutters vs. all construction, 1992-2008

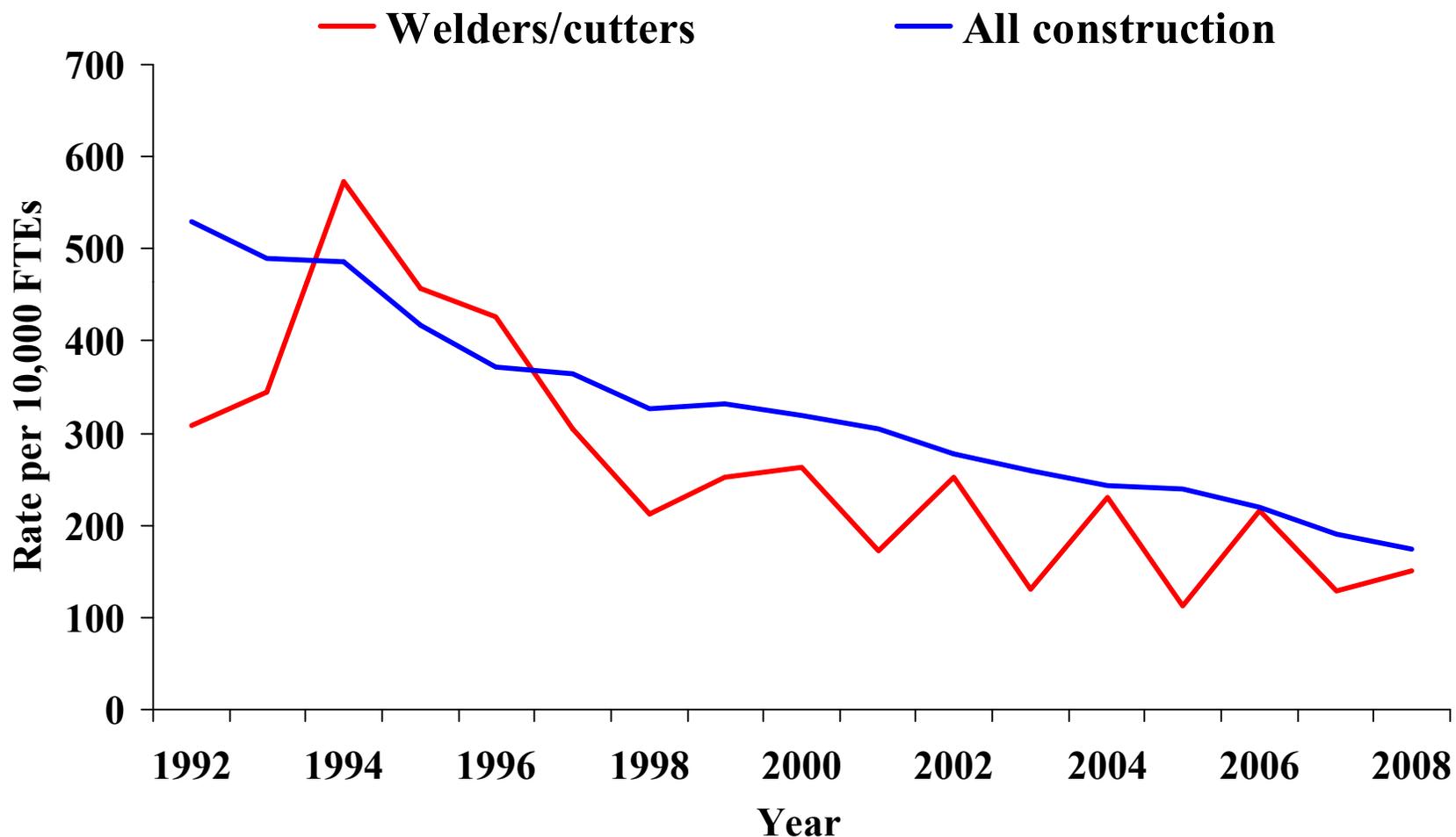


FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Welder/cutter data based on a total of 403 deaths

Source: U.S. Bureau of Labor Statistics, 1992-2008 Census of Fatal Occupational Injuries and Current Population Survey

28b. Rate of nonfatal injuries and illnesses resulting in days away from work, welders/cutters vs. all construction, 1992-2008



FTE = Full-time equivalent, defined as 2,000 hours worked per year

Note: Data cover the private sector only and excludes self-employed workers

Source: U.S. Bureau of Labor Statistics, 1992-2008 Survey of Occupational Injuries and Illnesses and Current Population Survey

