Highlighted Findings from a CPWR Survey on

Underlying Causes of Falls from Heights

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NIOSH LADDER SAFETY APP

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Introduction

Construction is one of the most dangerous industries in the United States,[1] due in part to the presence of major work-related hazards such as falls – the leading cause of death among construction workers. Despite ongoing efforts to improve awareness and use of fall protection and fall prevention solutions, 353 workers died from falls to a lower level in 2020 alone,[2] and fall protection in construction remained the most frequently cited OSHA standard for violations across all industries for the ninth consecutive fiscal year.[3]

To better understand why serious falls from heights continue to occur with such frequency despite being preventable, CPWR – The Center for Construction Research and Training (CPWR) conducted a survey of persons who experienced, witnessed, or investigated a workplace fall incident. The survey was developed and fielded with support from the American National Standards Institute (ANSI)/American Society of Safety Professionals (ASSP) Z359 National Work at Heights Task Force, the National Occupational Research Agenda (NORA) Construction Sector Council Falls Workgroup, and other organizers of the National Campaign to Prevent Falls in Construction (Falls Campaign) and the National Safety Stand-Down (Stand-Down).

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The survey's goal was to improve understanding of the underlying causes of falls in order to:

- Inform ANSI/ASSP voluntary standards;
- Create more relevant resources and materials in support of the Falls Campaign and Stand-Down;
- Improve CPWR outreach and education efforts;
- Influence future research on fall safety; and
- Share data with safety and health organizations, industry representatives, government officials, and other interested parties to improve collective fall prevention efforts.

This preliminary report provides an overview of highlighted findings from the survey. We plan to publish additional reports with more analyses in the future.

Key Findings

- **Respondents believe that lack of adequate planning is a key underlying cause of falls.** Insufficient or ineffective planning was the most selected primary cause for falls (27.4%).
- **Lack of planning is associated with a lower likelihood of using fall protection.** The odds of using fall protection were 71% lower for individuals whose employer or competent person did not do any planning compared to those whose employer or competent person did do planning or they were not sure.
- **Nearly half (48.8%) of respondents said that no fall protection was being used at the time of the fall.**
- **Employee beliefs about their company's fall protection policy are strongly associated with the use of fall protection.** Respondents who believed fall protection was required by their employer were 8 times more likely to use fall protection compared to those who did not believe fall protection was required.
- **Rescue training may help reduce fall-related deaths.** The odds of a fall being fatal were 76% lower for those who had self-rescue training compared to those who did not have this training.
- **Workers employed by subcontractors face an elevated risk of dying from falls.** Individuals who worked for a subcontractor at the time of the fall incident were 2.7 times more likely to die from the fall compared to those who worked for a general contractor.

Methods

This survey (see Appendix) was developed to gather information on falls from heights from a sample of individuals directly knowledgeable about construction workplaces, as well as workplaces in other industries where falls are common. The 32-question survey was created online in English and Spanish using Qualtrics. The survey asked respondents to describe a specific fall incident they had been involved in, witnessed, or investigated. Respondents who wanted to describe more than one fall incident could take the survey multiple times. If a respondent had never been involved in, witnessed, or investigated a fall incident, the survey immediately ended for them. The survey was approved by CPWR's Institutional Review Board and was completely voluntary and anonymous. Respondents had the option to provide their contact information in a separate link if they were interested in talking about their fall experiences in more depth, but their contact information was not connected to their survey response.

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The English version of the survey was distributed from February 12, 2021 to May 15, 2021. The Spanish version was distributed on April 16, 2021, upon requests from interested parties. It also closed on May 15, 2021. Participants were recruited through online channels. Recruitment notifications were sent via the CPWR, OSHA, and NIOSH Database and Outreach Resource (CONDOR) to a targeted list of construction contractors, safety and health professionals, government officials, trainers, insurance representatives, manufacturing representatives, and union staff. Members of the ANSI/ASSP Z359 National Work at Heights Task Force and the NORA Construction Sector Council Falls Workgroup also distributed recruitment information to their contacts. In addition, CPWR posted recruitment messages on its social media accounts, Stop Construction Falls website, and sent a recruitment notification to its email list. CPWR and partners also featured announcements about the survey in several falls-related webinars.

Qualitative analysis was performed by two coders using Excel and ATLAS.ti 6.2, and quantitative analysis was performed using Qualtrics and SAS 9.4. All the qualitative responses were coded with new or previously existing response categories. New response categories were differentiated from previously existing answer choices via the nomenclature: "Other: [new category name]." For more information, email Grace Barlet (gbarlet@cpwr.com).

Results

We received 658 responses to the English version of the survey and 13 responses to the Spanish version, for a total of 671 responses. Of these, 495 (73.8%) indicated they had been involved in, witnessed, or investigated a fall incident and continued with the survey. The survey ended for the other 176 (26.2%) respondents who had not been involved in, witnessed, or investigated a fall incident. Of the 495 respondents, 62.9% worked in construction. Excluding those who worked in insurance, equipment manufacturing, and equipment supply, about half of respondents (49.8%) were involved in the commercial sector, 42.1% in the industrial and/or specialty sectors, and 34.0% in the government/public sector. At the time of the fall incident, these respondents were largely contractor safety and health representatives (23.4%), safety and health trainers (16.9%), and safety and health staff/consultants (14.0%). Respondents (excluding those in insurance, equipment manufacturing, and equipment supply) worked in their respective industries for an average of 24.9 years.

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CHART 1. WAS THE FALL FATAL? (N=495)

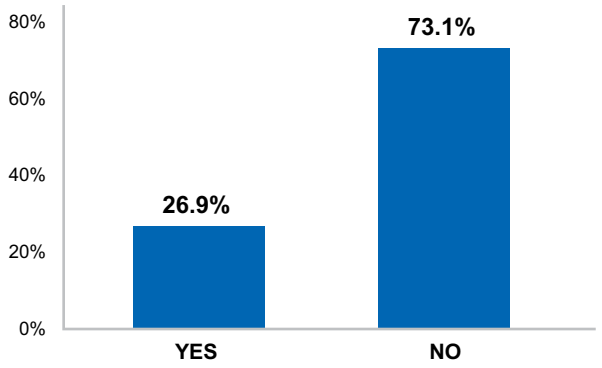
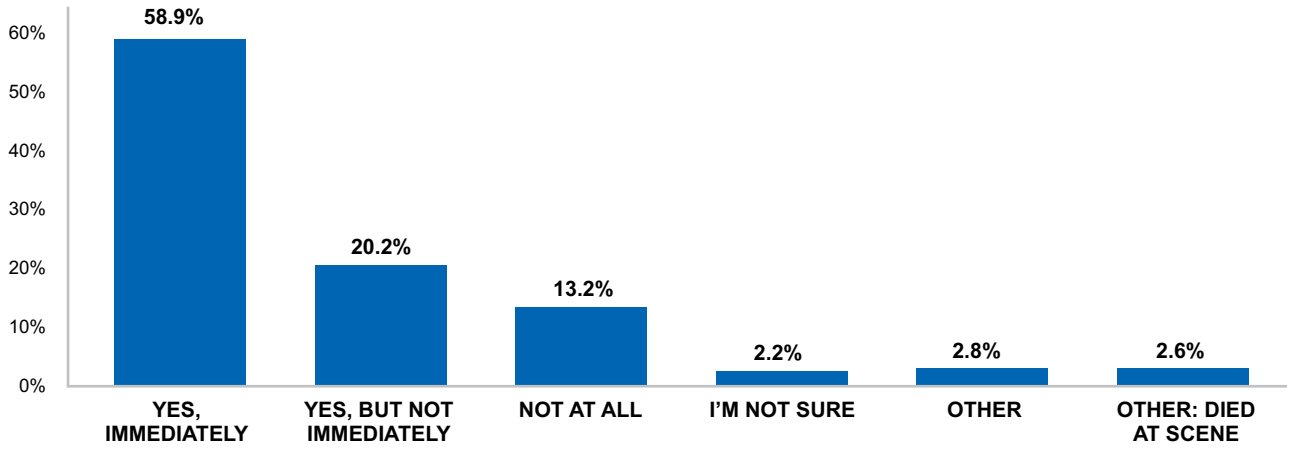


CHART 2. WAS MEDICAL CARE REQUIRED? (N=494)



Severity of Fall Incident

Respondents indicated that 26.9% of fall incidents they had been involved in, witnessed, or investigated were fatal [Chart 1]. Most (63.9%) said 911/emergency services were required at the time of the fall incident, and 34.9% said they were not required. In addition, medical care was required in 79.1% of fall incidents [Chart 2].

TABLE 1. MULTIPLE LOGISTIC REGRESSION MODEL PREDICTING FATAL FALLS (N=381)

Variables	Adjusted* OR (95% CI)	p-value
Height of fall		
Less than 6 feet	1.00	---
6-10 feet	2.36 (0.60, 9.36)	0.22
11-20 feet	3.03 (0.84, 10.92)	0.09
21-30 feet	8.06 (2.11, 30.77)	0.002
31-40 feet	11.60 (2.71, 49.61)	0.001
More than 40 feet	28.73 (7.49, 110.25)	< 0.0001
Doing "other" task at time of fall		
No	1.00	---
Yes	2.55 (1.25, 5.24)	0.01
Employer provided incorrect fall protection for the situation		
No	1.00	---
Yes	4.06 (1.25, 13.19)	0.02
Personal fall arrest system failure		
No	1.00	---
Yes	8.92 (2.30, 34.66)	0.002
Self-rescue training		
No	1.00	---
Yes	0.24 (0.09, 0.68)	0.007
Worked for general contractor or subcontractor		
General contractor	1.00	---
Subcontractor	2.74 (1.41, 5.33)	0.003
Not applicable	0.60 (0.23, 1.61)	0.31
I'm not sure	2.23 (0.46, 10.77)	0.32

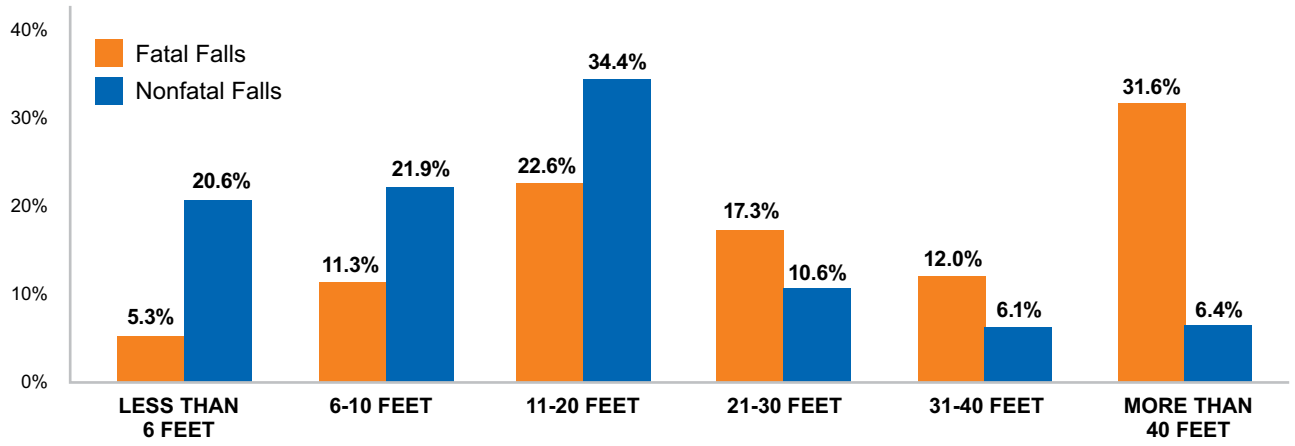
* Adjusted for slope of roof, access equipment being used (step ladder), access equipment being used (suspension system), fall protection being used (guardrails), no fall protection used, unsafe weather conditions, missed footing/slipped on ladder, Competent Person (EM 385) training, self-rescue training, vendor and/or manufacturer led training, native language (English), and native language (Spanish).

Several factors were found to be significantly associated with whether a fall was fatal [Table 1]. The higher the height of the fall, the greater the likelihood the fall would be fatal. Individuals who fell from a height of 21-30 feet were 8 times more likely to die from the fall compared to those who fell from a height of less than 6 feet ($p = 0.002$). Those who fell from a height of 31-40 feet were 11.6 times more likely to die from the fall compared to individuals who fell from less than 6 feet ($p = 0.001$). Moreover, individuals who fell from more than 40 feet were 28.7 times more likely to die from the fall compared to those who fell from a height of less than 6 feet ($p < 0.0001$). Employers who provided incorrect fall protection for the situation were 4 times more likely to cause a fatal fall than employers who provided the correct fall protection for the situation ($p = 0.02$). A personal fall arrest system (PFAS) failure was 8.9 times more likely to cause a fatal fall compared to PFASs that did not fail ($p = 0.002$), and the odds of a fall being fatal was 76% lower for those who had self-rescue training compared to those who did not have this training ($p = 0.007$). Finally, individuals who worked for a subcontractor at the time of the fall incident were 2.7 times more likely to die from the fall compared to those who worked for a general contractor ($p = 0.003$).

Height of Fall

Almost a third (31.2%) of falls occurred at a height of 11-20 feet, one-third (33.3%) occurred at a height above 20 feet, and 16.4% occurred at a height of less than 6 feet. Falls from a height above 20 feet were the

CHART 3. HEIGHT OF FALL X FATAL FALLS (N=493)

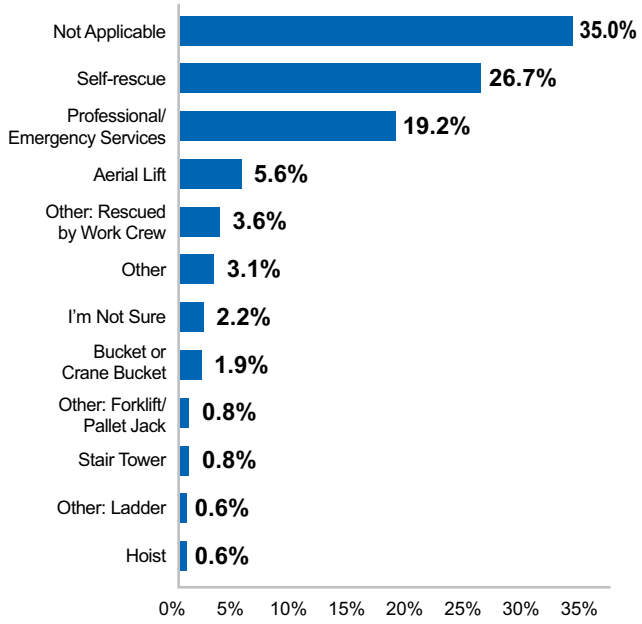


most likely to be fatal, accounting for 60.9% of fatalities. However, even falls from lower heights led to fatal injuries, with 5.3% of fatalities occurring from a height of less than 6 feet [Chart 3]. Of the falls that occurred from this height, 37.5% resulted in emergency services being called to the scene. In comparison, for all heights above 6 feet, emergency services were required for more than 50.0% of fall incidents.

Rescue

More than a quarter (26.7%) of individuals who had a nonfatal fall performed a self-rescue, and 19.2% were rescued by professional/emergency services.

CHART 4. HOW WAS THE INDIVIDUAL RESCUED? (N=360)



Others were rescued via aerial lift (5.6%), their work crew (3.6%), or by another means (3.1%) [Chart 4]. Self-rescue and professional/emergency services were the most common methods of rescue at each height interval, except for 21-30 feet when aerial lifts were commonly used, and above 40 feet, when being rescued by other crew members was necessary.

Activities at Time of Fall

Respondents were asked to describe the task the individual was doing at the time of the fall. Individuals were engaged in a wide range of tasks. Most said the individual who fell was working on a ladder, scaffold, or elevated platform (16.5%), doing another task (14.5%), or performing activities on a roof and/or roofing (14.0%). Other frequently mentioned tasks included operating and/or maintaining heavy equipment (5.0%), moving materials (5.0%), painting (4.3%), and framing (4.3%).

Access Equipment

Thirty-one percent of respondents said that no access equipment was being used at the time of the fall, while 19.4% said an extension ladder was used, and 12.3% said a standard scaffold was used. Step ladders (8.0%), aerial lifts (7.8%), and fixed ladders (6.0%) were also commonly selected types of access equipment.

Use of Fall Protection

Almost half (48.8%) of respondents said that no fall protection was being used at the time of the fall. When

fall protection was being used, 31.3% used a personal fall arrest system (PFAS) and 16.1% used guardrails [Chart 5]. A significant association was found between fatal falls and use of guardrails ($p = 0.01$). When guardrails were used, 61.1% of falls were nonfatal. In addition, there was a significant association between fatal falls and not using fall protection or incorrect use of fall protection ($p = 0.01$). For fatal falls, 59.2% of individuals were using fall protection, while for nonfatal falls, 45.6% were using fall protection [Chart 6].

Using certain types of fall protection was significantly associated with the height of the fall, including PFASs ($p < 0.0001$) and safety nets ($p = 0.02$). Among those who used a PFAS, almost all (96.4%) used it at heights 6 feet or greater. Two-thirds (66.7%) of respondents who used safety nets did so at heights between 6 and 10 feet. Not using fall protection was also significantly associated with the height of the fall ($p < 0.0001$) and was more likely to occur at heights of 20 feet or less (80.3%).

Significant associations were found between the use of PFASs and the training an individual had at the time of the fall incident, including: OSHA 10 ($p = 0.02$); OSHA 30 ($p = 0.02$); Competent Person (EM 385) ($p = 0.003$); training for the inspection of the specific fall protection/arrest equipment being used at the time ($p < 0.0001$); training for the use of the specific fall protection/arrest equipment being used at the time ($p < 0.0001$); training on the proper use of access equipment ($p = 0.002$); self-rescue training ($p = 0.001$); training on how to complete an effective pre-task plan ($p = 0.04$); and having no training ($p = 0.002$). Among those who used a PFAS, only 5.9% had no training, and they were more likely to have received training for the inspection of the specific fall protection/arrest equipment being used at the time (54.4%) and for the specific fall protection/arrest equipment being used at the time (63.2%).

Significant associations were also found between not using fall protection and the training an individual had at the time of the fall incident, including: OSHA 10 ($p = 0.02$); OSHA 30 ($p = 0.03$); Competent Person (EM 385) ($p = 0.04$); training for the inspection of the specific fall protection/arrest equipment being used at the time ($p < 0.0001$); training for the use of the specific fall protection/arrest equipment being used at the time ($p < 0.0001$); self-rescue training ($p = 0.001$); training on

CHART 5. WHAT TYPE OF FALL PROTECTION, IF ANY, WAS BEING USED AT THE TIME OF THE FALL? (SELECT ALL THAT APPLY) (N=447)

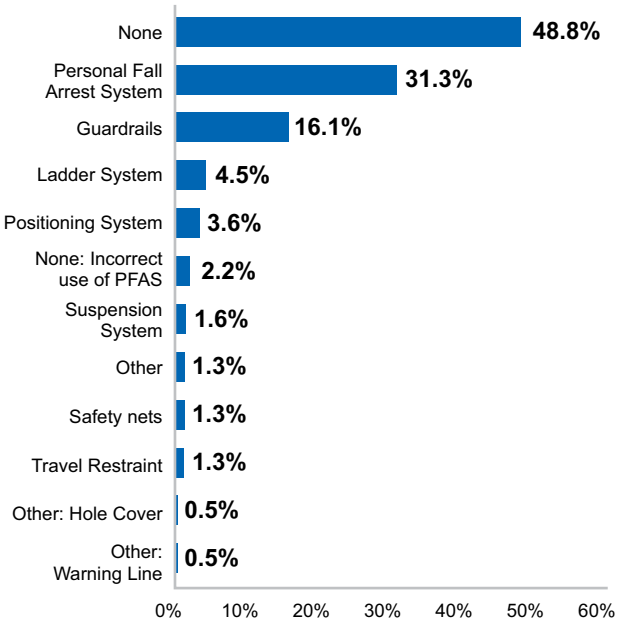
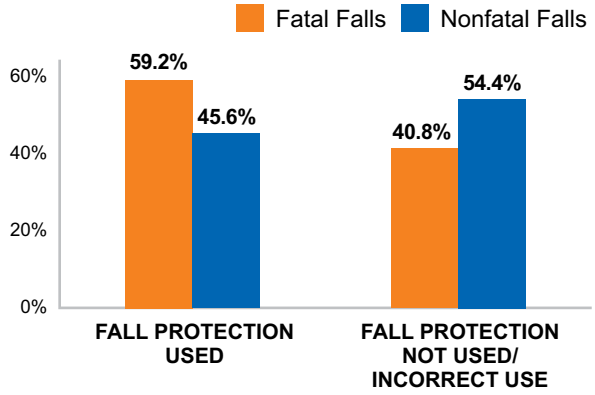


CHART 6. USE OF FALL PROTECTION X FATAL FALLS (N=447)



how to complete an effective pre-task plan ($p = 0.02$); and having no training ($p < 0.0001$). Individuals who did not use fall protection were less likely to have any of the training listed above. Among those who did not have training, 73.7% did not use fall protection.

Furthermore, significant associations were found between the use of fall protection and the level of planning by the employer and/or competent person. For example, there was a significant association between not using fall protection and pre-bid planning ($p = 0.007$); pre-job planning ($p < 0.0001$); Job Hazard Analysis (JHA)/Job Safety Analysis (JSA) was reviewed and

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CHART 7. DID THE INDIVIDUAL WHO FELL BELIEVE THAT FALL PROTECTION WAS REQUIRED BY COMPANY SAFETY POLICY FOR THE TASK THAT LED TO THE FALL? (N=430)

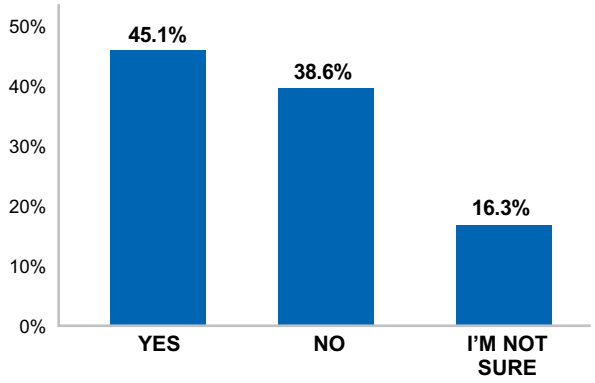
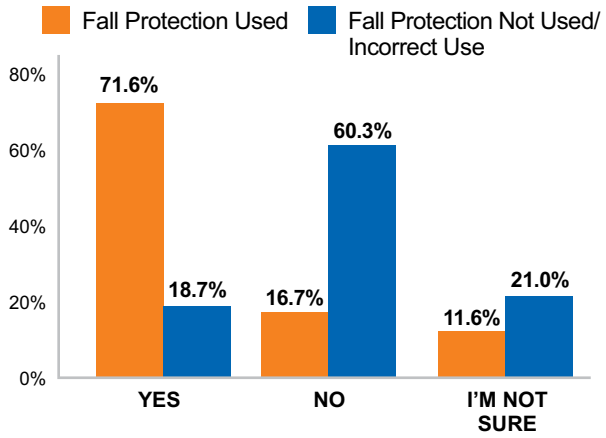


CHART 8. BELIEF THAT FALL PROTECTION WAS REQUIRED X FALL PROTECTION USE (N=429)



approved before work began ($p < 0.0001$); daily task assessments – where the work activity took place ($p = 0.02$); a full written fall protection plan ($p < 0.0001$); fall protection (or equipment) permit(s) ($p = 0.0003$); rescue planning ($p < 0.0001$); and doing no planning ($p < 0.0001$). Respondents who did not use fall protection were less likely to have employers and/or competent persons who did any of the planning listed above. Among those whose employer and/or competent person did not do any planning, 77.7% did not use fall protection.

When asked whether the individual who fell believed that fall protection was required by company safety policy for the task which led to the fall, 45.1% of respondents said yes [Chart 7]. Among those who used fall protection, 71.6% believed fall protection was required. In contrast, among those who did not use fall protection or used fall protection incorrectly, only 18.7% believed fall protection was required [Chart 8].

Several factors were found to be significantly associated with whether an individual used fall protection [Table 2]. Individuals who fell from a height of 11-20 feet were 3.3 times more likely to use fall protection compared to those who fell from a height of less than 6 feet ($p = 0.005$). In addition, individuals who fell from a height of 21-30 feet were 4.7 times more likely to use fall protection compared to individuals who fell from less than 6 feet ($p = 0.002$), and those who fell from more than 40 feet were 7 times more likely to use fall protection compared to those who fell from a height of less than 6 feet ($p = 0.0002$). Individuals who believed fall protection was required by their company were 8 times more likely to use fall protection compared to those who did not believe fall protection was required ($p < 0.0001$). Finally, the odds of using fall protection were 71% lower for individuals whose employer or competent person did not do any planning compared to those whose employer or competent person did do planning or they weren't sure.

Perspectives on Underlying Causes

Respondents indicated that the top cause of falls was insufficient or ineffective planning (27.4%) and described a range of circumstances, such as "failure of construction manager to properly coordinate sequence of work of multiple trades working in the

TABLE 2. MULTIPLE LOGISTIC REGRESSION MODEL PREDICTING FALL PROTECTION USE (N=407)

Variables	Adjusted* OR (95% CI)	p-value
Height of fall		
Less than 6 feet	1.00	---
6-10 feet	1.72 (0.70, 4.23)	0.24
11-20 feet	3.30 (1.45, 7.52)	0.005
21-30 feet	4.72 (1.76, 12.69)	0.002
31-40 feet	2.92 (0.93, 9.17)	0.07
More than 40 feet	7.03 (2.51, 19.63)	0.0002
Believed fall protection was required by company		
No	1.00	---
Yes	8.02 (4.53, 14.20)	< 0.0001
I'm not sure	1.35 (0.67, 2.69)	0.40
No planning by employer and/or competent person		
Did plan/Not sure if they planned	1.00	---
Did not plan	0.29 (0.15, 0.55)	0.0002

* Adjusted for working on ladder, scaffold, or elevated platform, welding, pouring/forming concrete, working at heights (not otherwise described), OSHA 10 training, OSHA 30 training, Competent Person (EM 385) training, training for the inspection of the specific fall protection/arrest equipment being used at the time, training for the use of the specific fall protection/arrest equipment being used at the time, training on the proper use of the access equipment, self-rescue training, training on how to complete an effective pre-task plan, no training, pre-bid planning, pre-job planning, JHA/JSA was reviewed and approved before work began, daily task assessments - where the work activity took place, a full written fall protection plan, fall protection (or equipment) permit(s), and rescue planning.

same area" and "no pre-task planning." The second leading cause of falls indicated by respondents was fall protection being provided but not used (21.7%), followed by improper use of fall protection (e.g., wrong length lanyard, failure to tie off) (17.1%). For example, an "employee opted to not attach to the anchorage point on the last phase of the task." Additional causes included lack of relevant training (14.8%), improper use of access equipment (13.1%), and failure of a walking/working surface (12.4%) [Chart 9].

Training

There were significant associations between whether a fall was fatal and the type of training the individual had at the time of the fall incident, including Competent Person (EM 385) ($p = 0.01$), self-rescue training ($p = 0.01$), and vendor and/or manufacturer led training ($p = 0.03$). Individuals who had a fatal fall were less likely to have these types of training [Chart 10].

New to Workforce

The majority (81.5%) of individuals who fell were not new to the workforce when the fall occurred, while 12.4% were new. There was no significant association between fatal falls and whether the individual was new to the workforce ($p = 0.41$). The percentage of individuals who were new to the workforce was around the same for both fatal and nonfatal falls (9.8% and 13.3%, respectively).

Language

Most individuals' (79.3%) native language was English, followed by Spanish (17.5%). A minority spoke Hindi, Portuguese, Korean, Arabic, Russian, or another language. There was a significant association between fatal falls and whether an individual's native language was English ($p = 0.003$) or Spanish ($p = 0.01$). Although this finding was no longer significant when adjusted for other variables, the odds of a fall being fatal was 53% lower for native English speakers compared to native Spanish speakers or those who spoke another language (unadjusted OR = 0.47; $p = 0.003$) and native Spanish speakers were 95% more likely to have a fatal fall compared to native English speakers or those who spoke another language (unadjusted OR = 1.95; $p = 0.01$). Among those who experienced a fatal fall,

CHART 9. WHAT WERE THE PRIMARY CAUSES OF THE FALL? (SELECT UP TO 3) (N=434)

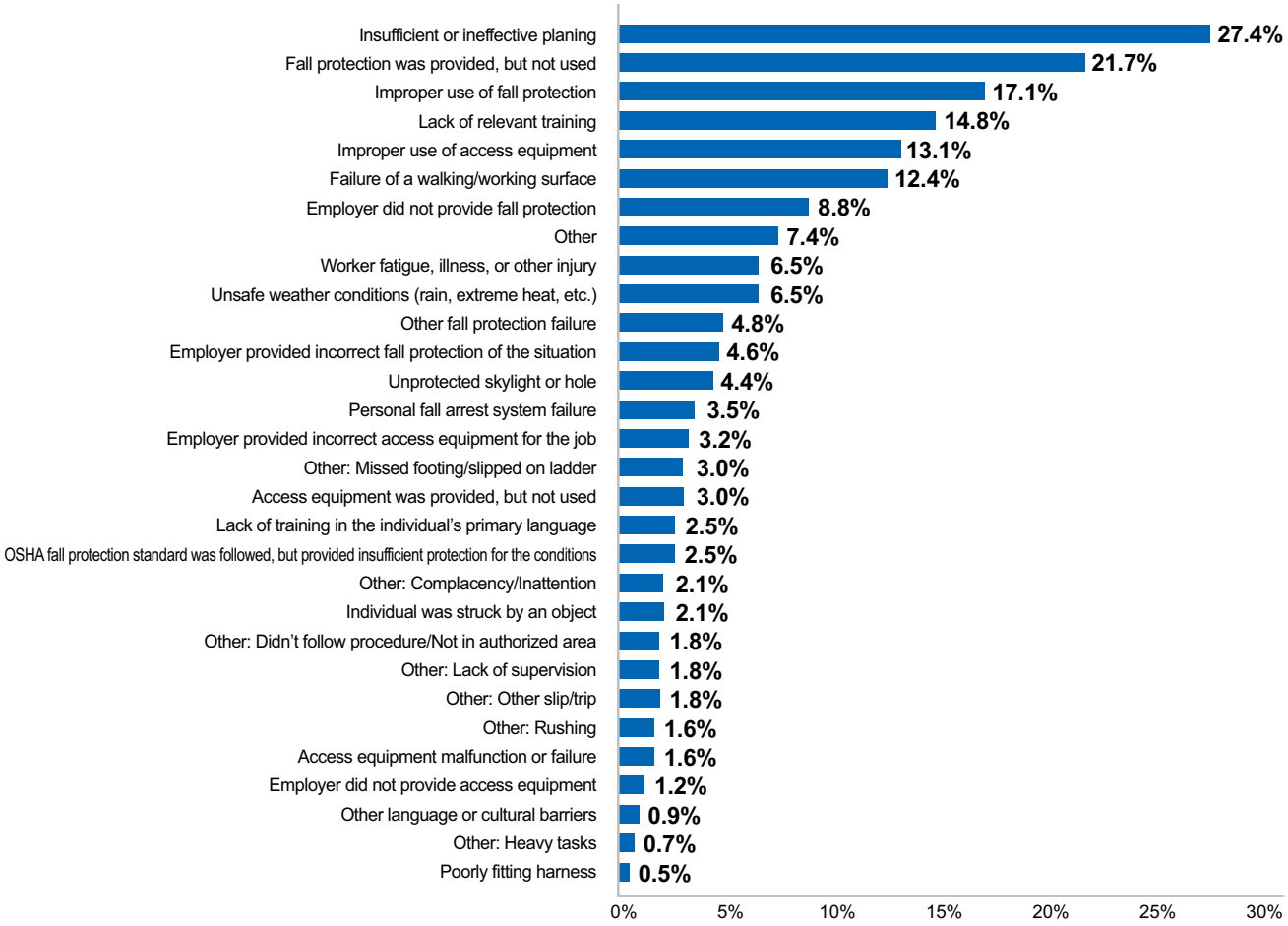
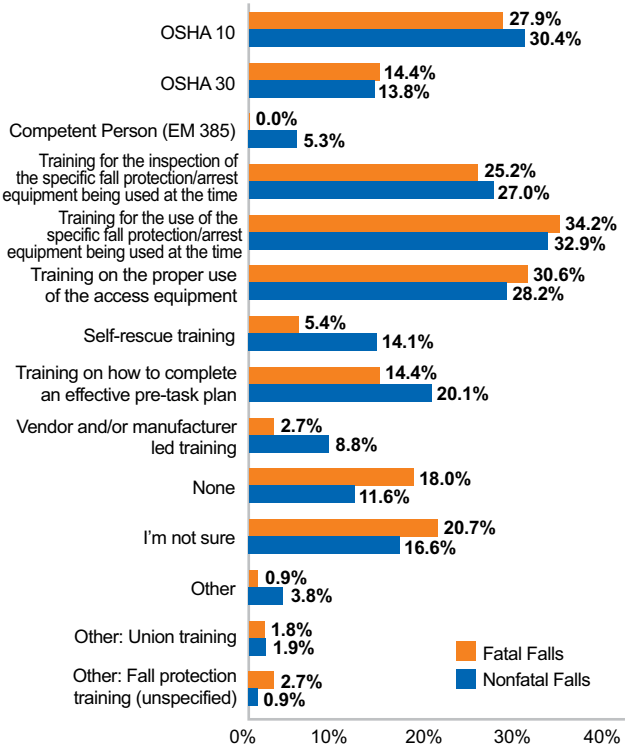


CHART 10. TRAINING X FATAL FALLS (N=430)



69.4% were native English speakers and 25.2% were native Spanish speakers [Chart 11].

General Contractor/Subcontractor Role

Almost half (49.3%) of respondents said that at the time of the fall, the individual who fell was working for a subcontractor, and 28.2% were working for a general contractor. There was a significant association between fatal falls and working for a subcontractor or general contractor ($p = 0.001$). Among the individuals who had a fatal fall, 63.7% worked for a subcontractor; among those who had a nonfatal fall, 44.2% worked for a subcontractor [Chart 12].

Consequences for Employer

The most common consequences an employer experienced because of the fall incident were no consequences (31.7%), an OSHA citation/penalty (25.5%), and higher insurance premiums (19.5%).

CHART 11. NATIVE LANGUAGE X FATAL FALLS (N=429)

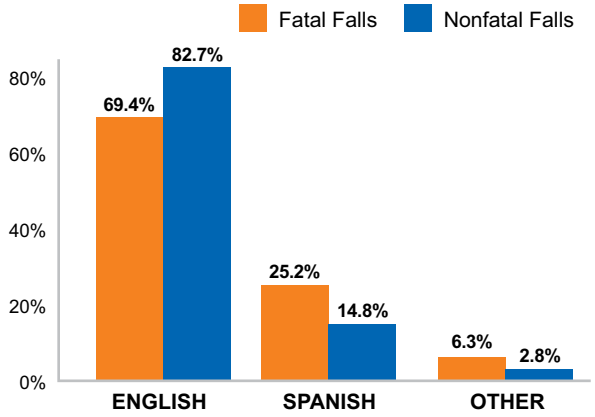
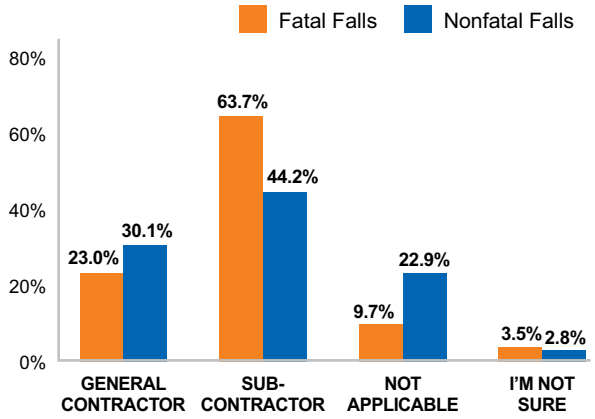


CHART 12. TYPE OF CONTRACTOR X FATAL FALLS (N=432)

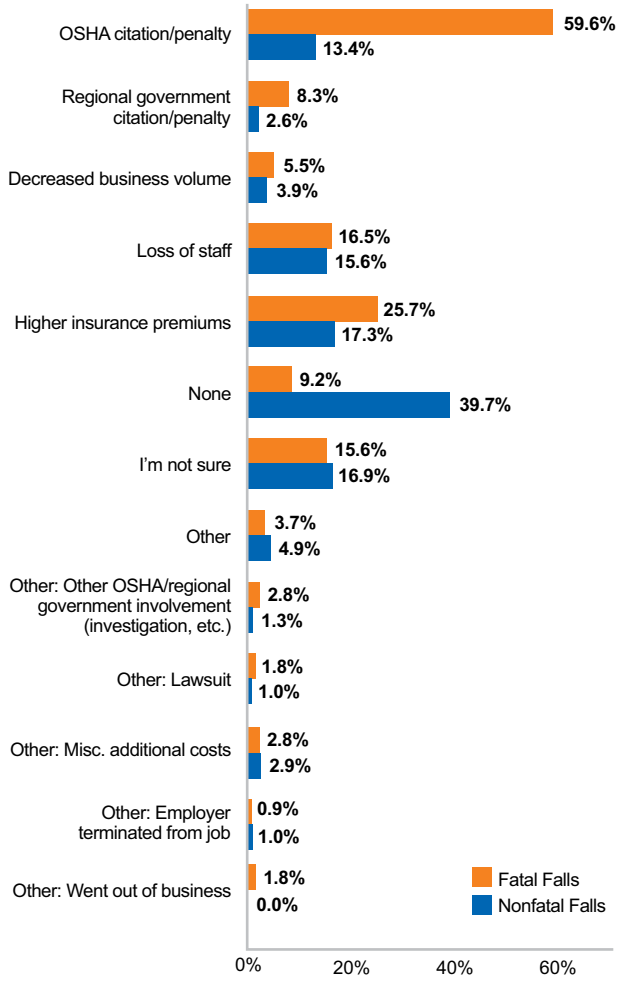


In addition, there were several differences between the consequences for employers who had nonfatal falls and those who had fatal falls. Among individuals who had a nonfatal fall, 39.7% had employers who did not experience any consequences. In contrast, among those who had a fatal fall, 9.2% had employers who did not experience any consequences. When looking at specific types of penalties, individuals who had a fatal fall were more likely to have employers who received an OSHA citation/penalty, followed by consequences such as higher insurance premiums, regional government citation/penalty, going out of business, and decreased business volume [Chart 13].

Employer-Implemented Changes Post Fall Event

Respondents were asked whether the employer instituted any significant or sustained changes to their ways of working because of the fall event.

CHART 13. CONSEQUENCES TO EMPLOYER X FATAL FALLS (N=416)



Changes were made by 45.8% of employers, whereas 35.9% made no changes. Employers who had a fatal fall on their job site were more likely to institute changes, with 53.7% of respondents indicating changes were made compared to 16.7% who indicated no changes were made [Chart 14].

Respondents who reported the employer did institute significant or sustained changes to their ways of working were asked to describe these changes. The most common responses described changes in training (44.4%); policy, procedure, and planning (39.2%); equipment and physical environment (29.8%); and/or compliance and management (15.8%). Less common responses included changes in personnel (5.9%), an investigation (4.7%), and/or other (4.7%).

Respondents described a wide scope of employer-implemented changes. While some employers

implemented narrow changes specific to the task the individual was performing when they fell, others engaged in a broader restructuring of their fall protection approaches, or they did both [Figure 1].

Some respondents said employers implemented changes to specific tasks based on the circumstances of the fall event. For example, after a fall incident in which an individual was riding a construction dumbwaiter, the employer "posted signs that people were not allowed in [the] dumbwaiter." These employers tried to address hazards for the specific task the individual was performing at the time of the fall. In contrast, some respondents said employers completely restructured their approaches. Instead of focusing on a specific task, these employers "[evaluated] all fall hazards" and "[reviewed] any elevated work task." These employers overhauled their fall protection programs beyond the specific task the individual was performing when they fell.

Other Experiences and Observations

Respondents were asked to characterize their observations based on all their experience over the years (as opposed to the single fall incident they were reporting on thus far). More than half indicated they always or frequently witnessed sufficient pre-planning for fall prevention and protection (57.3%); regular employer-mandated inspections of fall protection and/or access equipment (54.2%); fall protection and/or access equipment that is properly set up and maintained (62.6%); new workers that are properly trained before being exposed to fall hazards (53.0%); proper PPE that is provided by employers (77.3%); PPE that is checked for fit, and fits all workers properly (57.9%); and supervisors

CHART 14. CHANGES TO WAYS OF WORKING X FATAL FALLS (N=415)

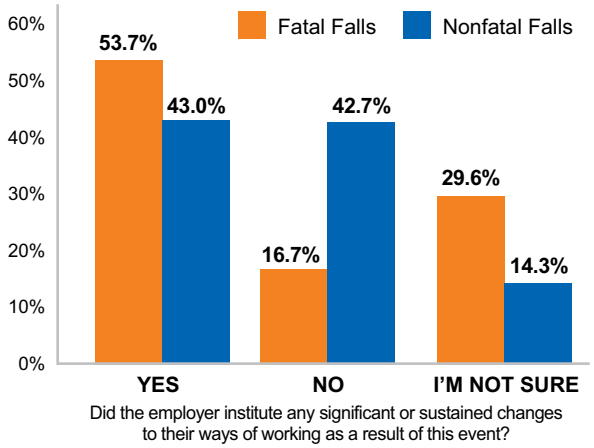


FIGURE 1. VISUALIZATION OF EXAMPLES OF SCOPE OF EMPLOYER-IMPLEMENTED CHANGE

Specific Fall Event-Related Task Changes

"Pre-job JSAs specific to the task and all employees made aware."

"They posted signs that people were not allowed in dumbwaiter."

"They started painting the temporary standards for suspended work platforms a different color so that they were clearly identifiable."

"Installed fall protection in location of accident and in many other parts of facility."

"We provided full time safety observer for the task, conducted site-wide safety stand down, and retrained the crews conducting the work and similar job tasks on the proper use of fall protection equipment."

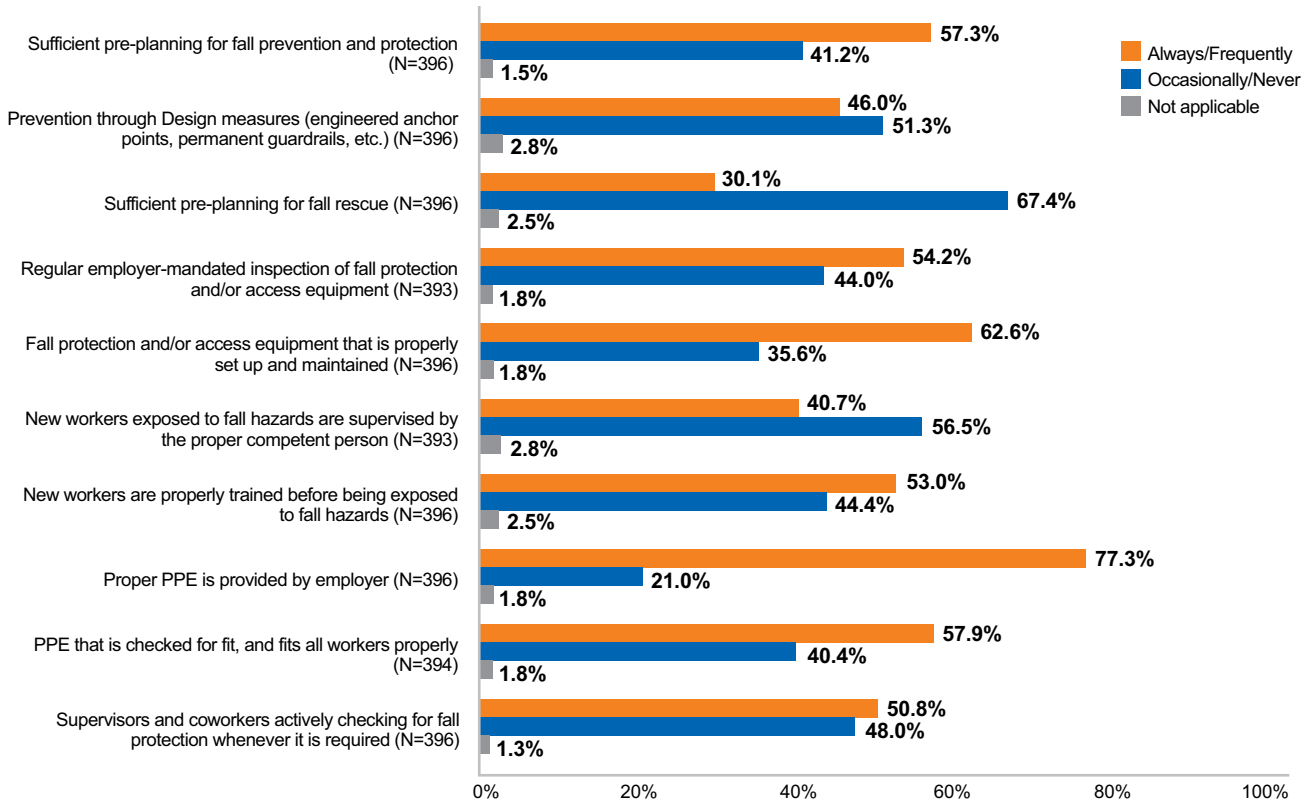
Fall Protection Restructuring

"Complete restructuring of contractor safety program."

"Evaluating all fall hazards and engineering out where possible. Reviewing any elevated work task and implementing the best tool for the job. This will be revisited in the JHA's."

"Implemented much safer job preparation, invested in better equipment and SLOWED DOWN!"

CHART 15. HOW OFTEN HAVE YOU WITNESSED THE FOLLOWING ON A JOBSITE?



and coworkers actively checking for fall protection whenever it is required (50.8%). However, more than half of respondents also indicated they occasionally or never witnessed Prevention through Design measures (51.3%); sufficient pre-planning for fall rescue (67.4%); and new workers exposed to fall hazards being supervised by the proper competent person (56.5%) [Chart 15].

Strengths and Limitations

This was a novel cross-sectional survey that gathered information from individuals directly involved with construction and other workplace fall incidents. Improving understanding of root causes of falls is key to developing standards, resources, research, and data to prevent future morbidity and mortality. The findings will be used to target priority areas in fall prevention, which will inform ANSI/ASSP voluntary standards, improve CPWR outreach and education efforts, allow for the creation of more relevant resources and materials in support of the Falls Campaign and Stand-Down, inform future research on fall safety, and ultimately, enhance fall prevention efforts among government, industry, labor, and other interested parties.

However, the study had several limitations. First, elements of the survey structure and recruitment may have limited the diversity of participants. Language accessibility may have created a barrier for non-English speaking participants. A Spanish-language survey was made available but was open for the final month of recruitment instead of the three-month duration of the study, and monolingual Spanish-language recruitment was limited. Moreover, the length of the survey and technical language used in it may have also presented challenges for lower-literacy participants.

Second, it was not possible to calculate a response rate because we could not determine the exact number of people reached, and despite recruitment efforts, the sample size was small, which may have reduced the power to detect associations between variables. Third, to protect participant anonymity, participants were not asked to differentiate whether the fall they described in the survey was one they witnessed, investigated, or experienced. As such, analysis could not compare whether individuals who were reporting on their own fall experience had different perspectives about falls than individuals

who answered the survey based on their perceptions of another person's fall experience. Furthermore, the findings reflect the experiences and practices of the participants and may not be generalizable to all workers and workplaces. Since demographic information was not collected, we cannot compare respondents to non-respondents. Finally, responses were self-reported, and participants were not asked when the fall they described in the survey took place. Therefore, the study may have been subject to recall bias since some participants described fall incidents that could have occurred years ago.

Conclusion and Suggestions for Future Research

This study explored root causes of falls in construction. Participants believed that a lack of adequate fall protection planning was a key underlying cause of falls. Results also found that a lack of planning was associated with a lower likelihood of using fall protection. Moreover, in nearly half of all falls, no fall protection was being used. Employee beliefs about whether their company mandated fall protection were strongly associated with the use of fall protection. Finally, rescue training may reduce the risk of fatal falls.

Future research is needed to better understand how to encourage and support fall protection planning. Participants identified inadequate planning as the leading underlying cause of falls. By engaging in fall protection planning, employers can target the most effective levels of the hierarchy of controls and use methods such as Prevention Through Design (PtD) to design buildings, job sites, and workflow for safety. An analysis of PtD and planning measures successfully implemented in the United Kingdom would be beneficial along with research on the factors that promote or hinder fall prevention planning. Moreover, research on how to get more employers to provide and use fall protection, particularly smaller companies, is needed. Exploring how to support fall protection planning among small employers and subcontractors with fewer resources could help to lessen the gap between employer groups in fall outcomes.

More research is also needed on health disparities in falls associated with race, ethnicity, immigration, and income. Including additional demographic questions in subsequent studies would deepen future analyses of health disparities. In addition, including questions about workplace racism, discrimination, and nativism would provide additional avenues for exploring equity-related associations between worksite conditions and falls.

Falls are the leading cause of death in construction, and they are preventable. This study provides actionable findings about leading root causes of falls and identifies opportunities for future research to better understand this urgent occupational safety issue and effectively address it.

For more information on planning, training, and otherwise preventing construction falls, visit stopconstructionfalls.com.

Endnotes

[1] The fatal work injury rate for the private construction industry was 10.2 per 100,000 full-time equivalent (FTE) workers in 2020. The fatal work injury rate in all private industries was 3.7 per 100,000 FTEs in 2020.

[2] CPWR – The Center for Construction Research and Training. (2022). Construction Focus Four Dashboard. https://www.cpwr.com/research/data-center/data-dashboards/construction-focus-four-dashboard/.

[3] Occupational Safety and Health Administration. (2021). Top 10 Most Frequently City Standards for Fiscal Year 2020. https://www.osha.gov/top10citedstandards.

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Appendix

Fall Experience Survey

Thank you for taking the time to participate in this 10 - 15 minute survey exploring the root causes of falls from heights. While there is annual data available on the types and rates of fatal and non-fatal falls, good qualitative information on the causes of those falls is lacking. In an effort to learn more, CPWR – The Center for Construction Research and Training is conducting this survey. The results will be used to inform our safety and health efforts in the construction industry as well as the efforts of others working to improve fall safety for workers across all industries.

As part of the survey, you will be asked to provide information about a fall incident you experienced, witnessed, or investigated. If you would like to tell us about more than one incident, you may re-take the survey as many times as needed.

Your participation in this survey is completely voluntary and your responses are collected anonymously. At the end of the survey you will be given the option to provide your name and contact information in a completely separate secondary survey. No identifying information will be linked to your original fall experience survey response.

If you have any questions about this survey, feel free to contact [contact name and information provided].

1. What type of work do you do?

- ○ Construction
- ○ Energy
- ○ Equipment Manufacturing
- ○ Equipment Supply
- ○ General Industry
- ○ Insurance
- ○ Maritime
- ○ Mining
- ○ Transportation, Utility, Warehouse
- ○ Other (please specify): _____

Display This Question:

- *If What type of work do you do? = Construction*
- *Or What type of work do you do? = General Industry*
- *Or What type of work do you do? = Maritime*
- *Or What type of work do you do? = Mining*
- *Or What type of work do you do? = Energy*
- *Or What type of work do you do? = Transportation, Utility, Warehouse*
- *Or What type of work do you do? = Other (please specify): _____*

2. What type of industry segment are you currently involved with? (Select all that apply)

- ☐ Commercial
- ☐ Government/Public Sector
- ☐ Heavy & Highway
- ☐ Industrial and/or Specialty
- ☐ Residential (high rise buildings)
- ☐ Residential (single home dwellings, low rise buildings)
- ☐ Not applicable
- ☐ Other (please specify): _____

3. Have you ever been involved in, witnessed, or investigated a fall incident?

- ○ Yes
- ○ No

Skip To: End of Survey If Have you ever been involved in, witnessed, or investigated a fall incident? = No

For the next series of questions, please tell us about the most serious fall incident you were involved in, witnessed, or investigated and/or the one you remember the best.

4. Was the fall fatal?

- ○ Yes
- ○ No

5. **What height did the fall occur at?**

- ○ Less than 6 feet
- ○ 6-10 feet
- ○ 11-20 feet
- ○ 21-30 feet
- ○ 31-40 feet
- ○ More than 40 feet

6. **Were 911/Emergency services required?**

- ○ Yes
- ○ No
- ○ I'm not sure

7. **Was medical care required?**

- ○ Yes, immediately
- ○ Yes, but not immediately
- ○ Not at all
- ○ I'm not sure
- ○ Other (please specify): _____

Display This Question:

– *If Was the fall fatal? = No*

8. **How was the individual rescued?**

- ○ Self-rescue
- ○ Aerial lift
- ○ Bucket or crane basket
- ○ Hoist
- ○ Stair tower
- ○ Professional/emergency services
- ○ Not applicable
- ○ I'm not sure
- ○ Other (please specify): _____

9. **What task was the individual doing at the time of the fall?**

_____

10. **If the individual fell from a roof, was it a low or steep slope?**

- ○ Low (4:12 inches or less)
- ○ Steep (greater than 4:12 inches)
- ○ I'm not sure
- ○ Not applicable

11. **What type of access equipment, if any, was being used at the time of the fall?**

- ○ Aerial lift
- ○ Bucket truck
- ○ Crane basket
- ○ Extension ladder
- ○ Fixed ladder
- ○ Mast climbing scaffold
- ○ Stair tower
- ○ Standard scaffold
- ○ Step ladder
- ○ Suspension system
- ○ Swing scaffold
- ○ None
- ○ Other (please specify): _____

12. **What type of fall protection, if any, was being used at the time of the fall? (Select all that apply)**

- ☐ Guardrails
- ☐ Ladder system
- ☐ Personal Fall Arrest System (harness, lanyard, anchorage)
- ☐ Positioning system
- ☐ Safety nets
- ☐ Suspension system
- ☐ Travel restraint
- ☐ None
- ☐ Other (please specify): _____

13. **Did the individual who fell believe that fall protection was required by company safety policy for the task that led to the fall?**

- ○ Yes
- ○ No
- ○ I'm not sure

14. What were the primary causes of the fall? (Select up to 3)

- ☐ Employer did not provide fall protection
- ☐ Employer provided incorrect fall protection for the situation
- ☐ Fall protection was provided, but not used
- ☐ Improper use of fall protection (e.g., wrong length lanyard, failure to tie off)
- ☐ Insufficient or ineffective planning – i.e. no competent person, fall hazards were not identified or changed
- ☐ Employer provided incorrect access equipment for the job (e.g., wrong ladder, or a ladder when scaffolding would be safer)
- ☐ Employer did not provide access equipment (e.g., used a chair because no ladder was available)
- ☐ Access equipment was provided, but not used
- ☐ Improper use of access equipment (e.g., climbing the sides of a scaffold, using the wrong length ladder)
- ☐ Personal fall arrest system failure
- ☐ Poorly fitting harness
- ☐ Other fall protection failure
- ☐ Access equipment malfunction or failure (e.g., faulty ladder or lift)
- ☐ Failure of a walking/working surface
- ☐ Individual was struck by an object
- ☐ Unsafe weather conditions (rain, extreme heat, etc.)
- ☐ Unprotected skylight or hole
- ☐ OSHA fall protection standard was followed, but provided insufficient protection for the conditions
- ☐ Lack of relevant training
- ☐ Lack of training in the individual's primary language
- ☐ Other language or cultural barriers
- ☐ Worker fatigue, illness, or other injury
- ☐ Other (please specify): _____

15. What type of training did the individual who fell have at the time of the incident? (Select all that apply)

- ☐ OSHA 10
- ☐ OSHA 30
- ☐ Competent Person (EM 385)
- ☐ Training for the inspection of the specific fall protection/arrest equipment being used at the time
- ☐ Training for the use of the specific fall protection/arrest equipment being used at the time
- ☐ Training on the proper use of the access equipment
- ☐ Self-rescue training
- ☐ Training on how to complete an effective pre-task plan
- ☐ Vendor and/or manufacturer led training
- ☐ None
- ☐ I'm not sure
- ☐ Other (please specify): _____

16. Was the individual new to the workforce when the fall occurred?

- ○ Yes
- ○ No
- ○ I'm not sure

17. What is the individual's native language?

- ○ English
- ○ Spanish
- ○ Other (please specify): _____

18. At the time of the fall, was the individual who fell working for the general contractor or a subcontractor?

- ○ General Contractor
- ○ Subcontractor
- ○ Not applicable
- ○ I'm not sure

19. What level of planning was done by the employer and/or a competent person? (Select all that apply)

- ☐ Pre-bid planning
- ☐ Pre-Job planning
- ☐ JHA/JSA was reviewed and approved before work began
- ☐ Daily task assessments – at a location other than where the work occurred
- ☐ Daily task assessments – where the work activity took place
- ☐ Mid shift task assessment review
- ☐ A full written fall protection plan
- ☐ Fall protection (or equipment) permit(s)
- ☐ Rescue planning
- ☐ None
- ☐ I'm not sure
- ☐ Other (please specify): _____

20. What, if any, consequences did the employer experience as a result of the fall incident? (Select all that apply)

- ☐ OSHA citation/penalty
- ☐ Regional government citation/penalty
- ☐ Decreased business volume
- ☐ Loss of staff
- ☐ Higher insurance premiums
- ☐ None
- ☐ I'm not sure
- ☐ Other (please specify): _____

21. Did the employer institute any significant or sustained changes to their ways of working as a result of this event?

- ○ Yes
- ○ No
- ○ I'm not sure

Display This Question:

– *If Did the employer institute any significant or sustained changes to their ways of working as a res... = Yes*

22. Please describe those changes:

_____

23. Taking into consideration not just this experience, but any and all fall incidents you have been involved in, witnessed, or inspected, what do you believe are the biggest contributors to falls from heights? (Select up to 3)

- ☐ Cost/tight budgets
- ☐ Equipment failure
- ☐ Indifference of contractors or supervisors
- ☐ Indifference of workers
- ☐ Insufficient planning for fall safety
- ☐ Lack of knowledge of OSHA 1926 Subpart M (fall protection standard)
- ☐ Lack of training on fall safety
- ☐ Lack of work experience
- ☐ Language or cultural barriers
- ☐ Productivity/trying to stay on schedule
- ☐ Working in poor conditions
- ☐ Other (please specify): _____

24. How often have you witnessed the following on a jobsite?

	Always	Frequently	Occasionally	Never	Not Applicable
Sufficient pre-planning for fall prevention and protection	○	○	○	○	○
Prevention through Design measures (engineered anchor points, permanent guardrails, etc.)	○	○	○	○	○
Sufficient pre-planning for fall rescue	○	○	○	○	○
Regular employer-mandated inspections of fall protection and/or access equipment	○	○	○	○	○
Fall protection and/or access equipment that is properly set up and maintained	○	○	○	○	○
New workers exposed to fall hazards are supervised by the proper competent person	○	○	○	○	○
New workers are properly trained before being exposed to fall hazards	○	○	○	○	○
Proper PPE is provided by employer	○	○	○	○	○
PPE that is checked for fit, and fits all workers properly	○	○	○	○	○
Supervisors and coworkers actively checking for fall protection whenever it is required	○	○	○	○	○

Display This Question:

- *If What type of work do you do? = Construction*
- *Or What type of work do you do? = General Industry*
- *Or What type of work do you do? = Maritime*
- *Or What type of work do you do? = Mining*
- *Or What type of work do you do? = Energy*
- *Or What type of work do you do? = Transportation, Utility, Warehouse*
- *Or What type of work do you do? = Other (please specify): _____*

25. How many years have you worked in the industry?

_____

Display This Question:

- *If What type of work do you do? = Construction*
- *Or What type of work do you do? = General Industry*
- *Or What type of work do you do? = Maritime*
- *Or What type of work do you do? = Mining*
- *Or What type of work do you do? = Energy*
- *Or What type of work do you do? = Transportation, Utility, Warehouse*
- *Or What type of work do you do? = Other (please specify): _____*

26. What is your trade?

- ○ Carpentry
- ○ Electrical Work
- ○ Insulating
- ○ Iron Work
- ○ Laborer
- ○ Masonry – Brick & Block
- ○ Mechanic
- ○ Operating Engineer
- ○ Painting
- ○ Plaster & Cement Masonry
- ○ Plumbing/Pipefitting
- ○ Waterproofing
- ○ Rigging
- ○ Roofing
- ○ Sheetmetal Work
- ○ Not Applicable
- ○ Other (please specify): _____

Display This Question:

- *If What type of work do you do? = Construction*
- *Or What type of work do you do? = General Industry*
- *Or What type of work do you do? = Maritime*
- *Or What type of work do you do? = Mining*
- *Or What type of work do you do? = Energy*
- *Or What type of work do you do? = Transportation, Utility, Warehouse*
- *Or What type of work do you do? = Other (please specify): _____*

27. At the time of the fall incident you told us about in this survey, what was your role or position?

- ○ Contractor/Business Owner
- ○ Tradesman/Construction Worker
- ○ Contractor Safety & Health Rep
- ○ Union Safety & Health Rep
- ○ Other Union or Labor Role
- ○ Foreman/Supervisor
- ○ Safety & Health Trainer
- ○ Other (please specify): _____

Display This Question:

- *If What type of work do you do? = Equipment Manufacturing*
- *Or What type of work do you do? = Equipment Supply*

28. What type of equipment do you produce or provide?

- ○ Access equipment (aerial lifts, scaffolds, etc.)
- ○ Fall prevention equipment (guardrails, restraint lines, etc.)
- ○ Fall protection equipment (personal fall arrest systems, other PPE)

Display This Question:

- *If What type of work do you do? = Equipment Manufacturing*
- *Or What type of work do you do? = Equipment Supply*

29. At the time of the fall incident you told us about in this survey, what was your position?

- ○ Company Owner
- ○ Supervisor
- ○ Safety & Health Representative
- ○ Other (please specify): _____

Display This Question:

- *If What type of work do you do? = Insurance*

30. At the time of the fall incident you told us about in this survey, what was your position?

- ○ Insurance Broker/Agent
- ○ Executive
- ○ Loss Control
- ○ Claim Investigator
- ○ Risk Manager
- ○ Safety Professional
- ○ Underwriter
- ○ Other (please specify): _____

Display This Question:

- *If What type of work do you do? = Construction*
- *Or What type of work do you do? = Energy*
- *Or What type of work do you do? = General Industry*
- *Or What type of work do you do? = Maritime*
- *Or What type of work do you do? = Mining*
- *Or What type of work do you do? = Transportation, Utility, Warehouse*
- *Or What type of work do you do? = Other (please specify): _____*

31. At the time of the fall incident, what was the size of your employer/company?

- ○ Less than 10 employees
- ○ 10-24 employees
- ○ 25-99 employees
- ○ 100-499 employees
- ○ 500-999 employees
- ○ Over 1,000 employees

Display This Question:

- *If At the time of the fall incident, what was the size of your employer/company? = 100-499 employees*
- *Or At the time of the fall incident, what was the size of your employer/company? = 500-999 employees*
- *Or At the time of the fall incident, what was the size of your employer/company? = Over 1,000 employees*

32. If you were part of a larger company, how many employees on average were at your jobsite/ office/location?

- ○ Less than 10 employees
- ○ 10-24 employees
- ○ 25-99 employees
- ○ 100-499 employees
- ○ 500-999 employees
- ○ Over 1,000 employees

If you are interested in talking about your experience or experiences in more depth, please consider providing your contact information at this separate and confidential link. CPWR will not share your information, and we will not link it to any of the responses in this survey unless you give express permission for us to do so when contacted.