

THE CSRC'S PPE NON-COMPLIANCE STUDY

The Construction Safety Research Center (CSRC) at LTU has conducted a mixed methods study to identify factors that contribute to non-compliance with safety policies related to the use of personal protective equipment (PPE). This study was conducted with the support of the CSRC's founding members. The methodology and results of the study are outlined in this white paper.

PPE Research Findings

On average, **US construction workers are 5.5 times* more likely to be killed in workplaces than non-construction workers.** Detecting hazards is the first step in controlling them. Control responses to recognized hazards include elimination of hazards, engineering of management approaches to hazards, improvements to safety procedures, and the use of PPE. PPE is the last resort in the hierarchy of control because it depends on workers' risk tolerances, perceptions, and attitudes. The absence of and inappropriate use of PPE, hereafter referred to as PPE non-compliance, are major causes of fatal and non-fatal injuries at construction workplaces.

Kang et al. (2017) found that 70% of all fall incidents involved a lack of PPE. Similarly, Al-Bayati and York found that 85% of examined fatal fall incidents among Hispanic workers in the United States were associated with not using required PPE. Construction workers who do not use PPE are three times more likely to be injured than those who do.

*According to a 2022 CSRC study; 95% CI: 5.4-5.6

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Contributing Factors

Research carried out by the CSRC and its members reveals 14 factors that contribute to PPE non-compliance that can be grouped into the following four categories: PPE Design Factors, Construction Safety Climate Factors, Construction Safety Culture Factors, and Other Factors. An explanation of the factor categorization follows:

PPE Design Factors

This category centers on shortcomings in the design and fabrication of PPE wear. Factors include:

1. Poor quality and fit
2. Lack of climate adaptation (e.g., workers do not want to wear PPE such as helmets or gloves in hot climates)
3. Workers believe that PPE is cumbersome and a struggle to wear (even if PPE fits and is of good quality)



Construction Safety Climate Factors

This category includes factors related to the actions of workers and frontline supervisors (Al-Bayati et al. 2019).

There are four factors within this category:

1. Workers believe that PPE reduces the ability to meet performance deadlines due to the time required to properly don PPE
2. Inadequate safety supervision and enforcement of safe work practices can cause workers to display a negligent attitude toward PPE use and disregard safety rules (Martin et al. 2021)
3. Peer pressure among workers insinuating that wearing PPE denotes weakness in a worker
4. Poor worker perception of the risks they are exposed to when not wearing PPE (Wong et al. 2020)

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Contributing Factors

Construction Safety Culture Factors

This category includes factors related to the actions of upper management and safety personnel (Al Bayati et al. 2019).

There are four factors within this category:

1. Lack of safety training
2. Lack of management support
3. Lack of safety rules and policies
4. Lack of PPE availability and accessibility

Research reveals that non-compliance in all four of these categories is directly correlated to firm size, with non-compliance growing as firm size decreases.



Other Factors

There are three factors within this category:

1. Unstable employment status (e.g., temporary, undocumented, or seasonal employment): Some workers, particularly those of Hispanic descent, do not always receive the necessary PPE due to their undocumented or temporary employment status which forces them to value job security over speaking up about safety issues.
2. Somatic health effects: Some workers with health conditions cannot wear PPE due to physical and mental stress, especially in confined or poorly ventilated areas.
3. Cultural and language barriers: It has been suggested that cultural and language barriers contribute to higher fatality rates among ethnic minority construction workers (e.g., the Hispanic workforce in the US).

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Proactive Measures & Factor Rankings

A national survey and focus group sessions were conducted to rank the importance of the factors within each of the aforementioned four categories and suggest proactive measures to address them. The tables that follow show the resulting rankings and the suggested proactive measures.

PPE Design Factors

Factor	Proactive Measures	Importance
Lack of Climate Adaptation	<ul style="list-style-type: none"> • Improve PPE supply to accommodate different climates and provide specialized training and resources for wearing PPE in adverse weather conditions. • Provide cooling and heating stations for workers operating in intense weather conditions. 	High
Poor Quality and Fit	<ul style="list-style-type: none"> • Improve the supply of PPE (different styles and sizes should be available). • Improve worker training on how to adjust PPE for fit. • Gain worker input on fit and quality issues associated with PPE. 	Moderate to High
PPE Is Cumbersome and a Struggle	<ul style="list-style-type: none"> • Obtain employee feedback on PPE options that will not adversely affect work effort and encourage workers to suggest PPE alternatives. • Show documentation of the costs of accidents and injuries associated with failure to use PPE. • Gain worker input on cumbersome PPE features and conduct a study to determine how to address them. • Create PPE policies that can accommodate individual worker needs. 	Moderate to High

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Proactive Measures & Factor Rankings

Construction Safety Climate Factors

Factor	Proactive Measures	Importance
Inadequate Safety Supervision	<ul style="list-style-type: none"> • Perform a study centered on encouraging, measuring, and monitoring frontline supervisor accountability. • Provide safety resources (e.g., designated site safety representatives) and perform a study to determine how to foster clear and professional communication between frontline supervisors and workers. 	High
Poor Risk Perception	<ul style="list-style-type: none"> • Create training that emphasizes the stakes involved in non-compliance with PPE. • Enhance the critical thinking of workers through interactive risk perception training (dialoguing with workers about “what-if” and worst-case scenarios). 	High
PPE Reduces Ability to Meet Performance Deadlines	<ul style="list-style-type: none"> • Provide explanations and examples of the time costs of incidents and ensure adequate time for PPE use and installation. • Conduct studies on performance evaluation mechanisms that ensure safety is prioritized. • Emphasize the costs of safety incidents associated with PPE non-compliance (e.g., by creating handouts and videos and sharing articles that describe these costs). • Ensure that field leadership understands that safety cannot be sacrificed and provide rewards and incentives for good safety performance. 	Moderate
Peer Pressure	<ul style="list-style-type: none"> • Encourage and reward positive peer pressure around PPE use (e.g., through peer voting programs or incentive programs). • Discourage negative peer pressure through effective field monitoring and the development of training programs. 	Low

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Proactive Measures & Factor Rankings

Construction Safety Culture Factors

Factor	Proactive Measures	Importance
Lack of Safety Training	<ul style="list-style-type: none"> • Provide training at the same time that PPE is provided, to all new hires, and as a yearly refresher. • Provide educational and outreach programs (e.g., by paying workers to attend classes). 	High
Lack of Management Support	<ul style="list-style-type: none"> • Emphasize the reputational and financial costs of accidents due to PPE non-compliance (e.g., by providing management with data and concrete examples of these costs). • Increase leadership involvement, visibility, and accountability by bringing management into safety program meetings and the development of safety program procedures. 	High
Lack of Safety Rules and Policies	<ul style="list-style-type: none"> • Ensure safety programs are up to date, post safety programs at all job sites, and communicate OSHA PPE requirements during training. • Enforce PPE compliance by creating a sliding scale for safety performance penalties. 	Moderate to Low
Lack Of PPE Availability and Accessibility	<ul style="list-style-type: none"> • Improve PPE availability by introducing technologies, such as PPE vending machines and QR codes for PPE distribution tracking, to make PPE distribution more efficient. • Improve PPE funding by obtaining grants and allocating PPE funds within the contracts of smaller subcontractors. 	Moderate to Low

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Proactive Measures & Factor Rankings

Other Factors

Factor	Proactive Measures	Importance
Somatic Health Effects	<ul style="list-style-type: none"> • Explore PPE alternatives for individuals with health problems by conducting studies and soliciting worker feedback. • Create PPE policies that can accommodate individual worker needs. • Provide specialized training to increase worker awareness of the possible relationships between PPE use and certain health conditions. 	Moderate to High
Unstable Employment Status	<ul style="list-style-type: none"> • Ensure that temporary and seasonal workers receive the same training as permanent workers. • Develop a strong temporary worker program and partnership with a staffing agency that provides safety training. 	Moderate to Low
Cultural and Language Barriers	<ul style="list-style-type: none"> • Implement multilanguage literature and training (e.g., using images, videos, and pictures in the training). • Conduct studies on how to foster an inclusive workplace culture. 	Low

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Key Findings

- This study helps decision-makers prioritize resource allocation to the most critical safety issues.
- To prevent incidents, the primary root causes of PPE non-compliance—that is, lack of upper management support, inadequate safety supervision, lack of safety training, poor worker risk perception, and lack of PPE climate adaptation—must be addressed.
- The following proactive recommended measures revealed in this study address the aforementioned primary root causes, all of which are within the control of upper management and safety personnel:
 1. Convey to construction company leaders the importance of PPE compliance and their need to provide safety resources by training them on the reputational and financial costs of non-compliance.
 2. Improve leadership accountability by performing a study centered on improved front-line supervisor /worker communication as well as encouraging, incentivizing, measuring, monitoring, and rewarding the use of PPE.
 3. Solicit worker input to design and provide PPE that better fits, comes in different sizes/styles, is less cumbersome, and adapts to different climates.
 4. Improve front-line worker training by providing information on how to adjust PPE for better fit, how to use PPE in adverse weather, and the adverse risks of PPE non-compliance.
 5. Improve the timing of front-line worker training to ensure it is provided when PPE is supplied, before new hires start working, and as yearly refreshers.
 6. Explore how PPE can better meet the individual needs of workers with health issues by studying common issues, soliciting worker feedback, creating new policies, and providing specialized training.
 7. Develop front-line worker PPE training modules in multiple languages that are tailored to address cultural differences and challenges.
 8. Increase leadership participation, visibility, and accountability by bringing management into safety program meetings and the development of safety program procedures.
- This study illuminates the importance of addressing resource limitations, especially among residential construction firms. Project owners and general contractors should consider allocating funds specifically for safety programs when hiring smaller firms and only select contractors that agree to comply with a safety plan.

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CSRC meeting to discuss PPE compliance research results on LTU's campus



First focus group held on LTU's campus



Second focus group held on LTU's campus



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