



Saving Construction Workers' Lives



Lawrence Technological University

2021 - 2022 Cycle

PPE Compliance Training

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Construction Safety Research Center

The construction industry struggles with safety performance. The CSRC helps industry leaders transfer their knowledge and extensive experience into products that save lives and improve overall industry performance.

- CSRC is a collaboration of industry leaders that reduces work-related fatalities and injuries by providing construction firms with innovative safety practices derived from groundbreaking research.



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Construction Safety Research Center

The CSRC aims to reduce fatal and non-fatal incidents and return construction workers safely back home to their families by:

- Conducting groundbreaking safety research
- Transforming research recommendations into best practices
- Converting best practices into effective training programs

Membership is available to industry leaders and safety influencers from the nation's construction industry, including companies, municipalities, associations, and agencies.



**2021-2022
CSRC Founding
Members**

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PPE Compliance Training

Purpose

Present and discuss the factors contributing to PPE non-compliance among construction workers and how to manage them.

Objectives

Upon completion of this module, safety and construction leaders will be able to:

- Explain the contributing factors to PPE non-compliance and their ranking
- Identify strategies and methods that enhance PPE compliance among construction workers

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Measuring Safety Performance

An acceptable safety performance could be defined as the performance of an organization's safety management system during a safe operation (Wu, 2001; Hsu et al., 2012). There are 3 types of safety performance measurements:

- Traditional measurements (i.e., lagging indicators), such as incident investigation, DART, and experience modification rate (EMR) (Al-Bayati et al., 2020)
 - Transfer measurements, such as safety target rate (Wei, 2008)
 - Predictive measurements (i.e., leading indicators), such as workers' involvement and subcontractors' safety pre-qualifications (Hinze et al., 2013; Costin et al., 2019)
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PPE Compliance Training

Although all types of safety performance measurements are important, some are more important than others. Traditional measurements are indirect measurements of safety performance because they measure the outcomes of the overall management system.

- To improve overall safety performance, safety management systems such as safety culture and climate, training programs, and enforcement policy should be the focus.



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Safety Management Techniques

There are two general directions for safety management techniques:

1. Manage safety by focusing on meeting OSHA's technical and training requirements to avoid penalties and enforcement actions
2. Manage safety by self-correcting, either by identifying and reporting hazards or by correcting unsafe behaviors and practices



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PPE Compliance Importance

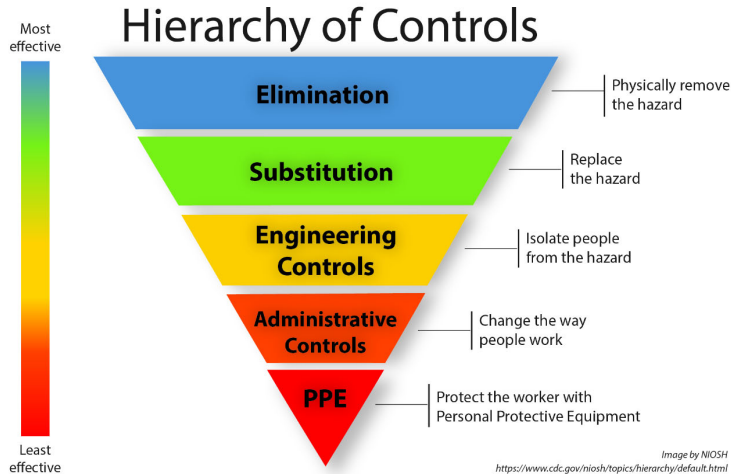
According to a 2022 CSRC study, US construction workers are 5.5 times more likely to be killed in workplaces than non-construction workers.

- Detecting hazards is the first step in controlling them. Control responses to recognized hazards include elimination and substitution, engineering controls, administrative controls, 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.

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Hierarchy of Controls



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PPE Compliance Importance

Elimination removes the hazard at the source. This could include changing the work process to stop using a toxic chemical, heavy object, or sharp tool. It is the preferred solution to protect workers because no exposure can occur.

Substitution is using a safer alternative to the source of the hazard. An example is using plant-based printing inks as a substitute for solvent-based inks.



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PPE Compliance Importance

Engineering controls reduce or prevent hazards from meeting workers. Engineering controls can include modifying equipment or the workspace, using protective barriers, ventilation, and more.

Administrative Controls establish work practices that reduce the duration, frequency, or intensity of exposure to hazards. This may include work process training, job rotation, and limiting access to hazardous areas or machinery.



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PPE Compliance Importance

Engineering controls



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PPE Compliance Importance

PPE minimizes exposure to hazards. When employees use PPE, employers should implement a **PPE program**. While elements of the PPE program depend on the work process and the identified PPE, the program should address:

- Workplace hazards assessment
 - PPE selection and use
 - Inspection and replacement of damaged or worn-out PPE
 - Employee training
 - Program monitoring for continued effectiveness
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PPE Compliance Importance

Employers should not rely on PPE alone to control hazards when other effective control options are available. PPE can be effective, but only when workers use it correctly and consistently. PPE may seem less expensive than other controls but can be costly over time, especially when used daily.

When other control methods are unable to reduce the hazardous exposure to safe levels, employers must provide PPE when:

- Other controls are under development
 - Other controls cannot sufficiently reduce the hazardous exposure
 - PPE is the only control option available
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PPE Compliance Importance

The absence of and inappropriate use of PPE, 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 (2019) 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 3 times more likely to be injured than those who do

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OSHA's Construction Top 10 Violations

October 2021 through September 2022

1. Duty to have fall protection (PPE)
2. Ladders
3. General requirements
4. Training requirements (Related)
5. Eye and face protection (PPE)
6. Head protection (PPE)
7. General safety and health provisions
8. Aerial lifts
9. Specific Excavation Requirements
10. Hazard Communication (Related)



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PPE Compliance Importance

**Why is PPE non-compliance
a widespread issue among
construction workers?**

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PPE non-compliance Causes

Research carried out by the CSRC, and its members reveals 16 factors that contribute to PPE non-compliance.

- These factors can be grouped into 4 categories:
 - ❑ PPE Design Factors,
 - ❑ Safety Climate Factors,
 - ❑ Safety Culture Factors, and
 - ❑ Other Factors.
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Safety Culture Vs. Safety Climate

There are three dimensions of safety culture:

- **Corporate Safety Culture** consists of an organization's official policies, systems, procedures, and workflow.
- **Psychological Safety Culture** refers to thoughts and feelings about safety.
- **Behavioral Safety Culture** includes employee activities, behaviors, and actions related to workplace safety.



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Safety Culture Vs. Safety Climate

Construction safety culture represents policies and principles that guide safety decision-making (i.e., **Corporate Safety Culture**). For example, the following are good measures of construction safety culture (leading indicators)

- Safety training
- Management support
- Safety rules and policies
- Safety team competence



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Safety Culture Vs. Safety Climate

Construction safety climate represents the manifestation of construction safety culture (i.e., principals and policies) in construction workplaces (i.e., firm's project level). For example, the following are reasonable measures of construction safety climate (leading indicators)

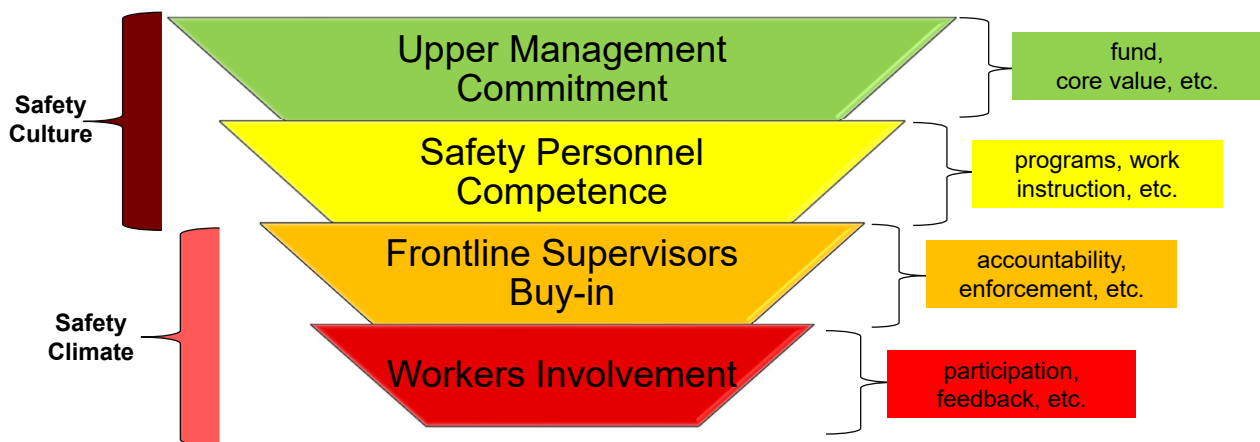
- Workers' beliefs and behavior
- Frontline supervisors' safety performance

More info about safety culture and climate:

<https://www.ltu.edu/engineering/csrc/projects.asp>



Safety Culture Vs. Safety Climate



More info about safety culture and climate: <https://www.ltu.edu/engineering/csrc/projects.asp>

For more information contact Dr. Ahmed Al-Bayati, the CSRC founding director, at aalbayati@ltu.edu

PPE Design Factors

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

- Poor quality, fit, and comfort
- Lack of climate adaptation (e.g., workers do not want to wear PPE such as helmets or gloves in hot climates)



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Construction Safety Climate Factors

This category includes factors related to the actions of workers and frontline supervisors.

- Workers believe that PPE reduces the ability to meet performance deadlines, increases work effort, and increases restrictions
- Inadequate safety supervision and enforcement of safe work practices can cause workers to display a negligent attitude toward PPE use and disregard safety rules
- Peer pressure among workers insinuating that wearing PPE denotes weakness in a worker
- Poor worker perception of the risks they are exposed to when not wearing PPE

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Construction Safety Culture Factors

This category includes factors related to the actions of upper management and safety personnel.

- Lack of safety training
- Lack of management support
- Lack of safety rules and policies
- Lack of PPE availability and accessibility



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Other Factors

- **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.
- **Somatic health effects**: some workers with health conditions cannot wear PPE due to physical and mental stress, especially in confined or poorly ventilated areas.
- **Cultural and language barriers**: these barriers contribute to higher fatality rates among ethnic minority construction workers (e.g., the Hispanic workforce in the US).

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Factor Ranking

A national survey was conducted by the CSRC to rank the importance of the factors within each of the aforementioned 4 categories.

- High Importance Factors
 1. Inadequate Safety Supervision
 2. Poor Risk Perception
 3. Lack of Climate Adaptation
 4. Lack of Safety Training
 5. Lack of Management Support

**High
Importance
5**

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Factor Ranking

- Moderate to High Factors
 1. Poor Quality, Fit, and Comfort
 2. PPE Increases Restrictions
 3. Somatic Health Effects
 4. PPE Increases Work Effort

**Moderate to High
Importance
4**

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Factor Ranking

- Moderate Factors
 1. PPE Increases Work Time
 2. Performance Pressure
- Moderate to Low Factors
 1. Unstable Employment Status
 2. Lack of PPE Availability and Accessibility
 3. Lack of Safety Rules and Regulations
- Low Importance Factors
 1. Cultural and Language Barriers & Peer Pressure

Moderate Importance
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Moderate to Low Importance
3

Low Importance
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PPE Compliance Importance

Proactive Measures?

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Proactive Measures

Focus groups were conducted to suggest proactive measures that can address the factors.

- Inadequate Safety Supervision (**High Importance**)
 - Encouraging, measuring, and monitoring frontline supervisor accountability
 - Providing safety resources (e.g., designated site safety representatives) and fostering clear and professional communication between frontline supervisors and workers



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Proactive Measures

- Poor Risk Perception (**High Importance**): poor assessments of the risks that workers are exposed to. For example, some experienced workers rely on their experience, believing that they don't need PPE; some young workers often see work as an adventure and are overconfident.
 - Emphasizing the stakes involved in non-compliance with PPE
 - Enhancing the critical thinking of workers through interactive risk perception training (dialoguing with workers about “what-if” and worst-case scenarios)

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Proactive Measures

- Lack of Climate Adaptation (**High Importance**)
 - Improving PPE supply and providing specialized training and resources for wearing PPE in adverse weather conditions
 - Providing cooling and heating stations for workers operating in intense weather conditions
 - Lack of Safety Training (**High Importance**)
 - Providing training at the same time that PPE is provided, to all new hires, and as a yearly refresher
 - Improving management support for educational and outreach programs
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Proactive Measures

- Lack of Management Support (**High Importance**)
 - Emphasizing the reputational and financial costs of accidents due to PPE non-compliance
 - Increasing leadership involvement, visibility (e.g., bringing management into the safety program to demonstrate PPE use), and accountability



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Proactive Measures

- Poor Quality, Fit, and Comfort (**Moderate to High**)
 - Improving the supply of PPE (different styles and sizes)
 - Improving PPE training and gaining worker input on PPE fit and comfort
 - PPE Increases Restrictions (**Moderate to High**)
 - Gaining worker input on potential restrictions and addressing them
 - Conducting case-by-case evaluations to reach a resolution
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Proactive Measures

- Somatic Health Effects (**Moderate to High**)
 - Exploring PPE alternatives for individuals with health problems and employing case-by-case decision-making
 - Raising worker awareness of the possible relationships between PPE use and certain health conditions
 - PPE Increases Work Effort (**Moderate to High**)
 - Collecting employee feedback on PPE options that will not adversely affect effort and encouraging workers to suggest PPE alternatives
 - Showing the costs of accidents associated with failure to use PPE
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Proactive Measures

- PPE Increases Work Time (**Moderate**)
 - Providing explanations and examples of the time-costs of incidents and ensuring adequate time for PPE use and installation
 - Letting workers know they will be evaluated more favorably if they work safely than if they work quickly but unsafely
 - Performance Pressure (**Moderate**)
 - Emphasizing the costs of safety incidents associated with PPE non-compliance
 - Ensuring that field leadership understands that safety cannot be sacrificed and providing rewards and incentives for good safety performance
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Proactive Measures

- Unstable Employment Status (**Moderate to Low**)
 - Ensuring that all employees are trained to the same standard
 - Developing a temporary worker program and partnership with staffing agencies
 - Lack of PPE Availability and Accessibility (**Moderate to Low**)
 - Improve PPE availability by introducing technologies such as PPE vending machines and QR codes to make PPE distribution more efficient
 - Improve PPE funding by obtaining available grants and allocating PPE pay items within the contracts of smaller subcontractors
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Proactive Measures

- Lack of Safety Rules and Regulations (**Moderate to Low**)
 - Ensuring safety programs are up to date, posting safety programs at all job sites, and communicating OSHA PPE requirements
 - Enforcing PPE compliance and creating a sliding scale for safety performance penalties
 - Cultural and Language Barriers (**Low**)
 - Implementing multi-language literature and training (e.g., using images and pictures in training)
 - Fostering an inclusive workplace culture
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Proactive Measures

- Peer Pressure (**Low**)
 - Encouraging and rewarding positive peer pressure around PPE use
 - Discouraging negative peer pressure via effective field monitoring and education



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Key Findings

This study helps decision-makers prioritize resource allocation to the most critical PPE non-compliance factors.

- The primary root causes of PPE non-compliance are inadequate safety supervision, poor worker risk perception, lack of PPE climate adaptation, lack of upper management support, and lack of safety training.



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Key Findings

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.

- Convey to construction company leaders the importance of PPE compliance and the reputational and financial costs of non-compliance
- Improve leadership accountability, focus on front-line supervisors
- Encourage, incentivize, measure, monitor, and reward the use of PPE
- Solicit worker input to provide PPE that better fits and adapts to different climates

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Acknowledgment

The CSRC exists because of the outstanding safety commitment, extensive experience, and generous support of the Center's founding members.



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



Questions?

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