

Hard Hat Safety by California Contractors

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The hard hat is the quintessential item of PPE, and yet it often gets overlooked when ensuring safety standards are being met. We all expect our hard hat to protect us, but many never inspect it to ensure that it is properly fulfilling its purpose. This disregard to inspection and maintenance can lead to serious injury or death in the event of an accident. While organizations such as OSHA and the hard hat manufacturers themselves post information on this topic, it is unclear if this information is actually being received by the people involved in a construction project. This research is intended to discover which methods are currently being used by contractors in California to train their employees on the importance of using a properly maintained hard hat. An online survey was used to discover the qualities of hard hat safety by contractors throughout California. In addition, a survey was performed on-site to discover workers' knowledge on hard hat usage and safety. The expectation is that all workers on a site should understand the basic importance of wearing a hard hat that is free from damage and defects.

Keywords: Construction, Safety, Training, Hard Hat, Protective Equipment, California

Introduction

The hard hat is the quintessential representation of Personal Protective Equipment (PPE) and a symbol of the construction industry. When a person thinks of construction or of a construction worker, they imagine a person on a jobsite wearing a hard hat and wielding some tools. According to the Occupational Health and Safety Administration (OSHA), *[1926.100(a)] - employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall be protected by protective helmets* (OSHA). However, even as an established safety standard, many fail to recognize the importance of proper head protection. While it is perceived as a low-tech item, it is a crucial element of ensuring proper safety on a jobsite.

A hard hat consists of a rigid plastic shell that is meant to resist and deflect blows to the head, while the suspension system is located below and inside the shell and is meant to act as a shock absorber and provides space for the shell to move without damaging the wearer's head (See Figure 1 below). The suspension is attached to the shell through the use of four or six connections (usually referred to as slots, pins, or tabs) and must be tightly secured to act in weight distribution (See Figure 2 below). In addition, some hard hats act as an insulator against electrical shocks. (All About Head Protection). The shell and suspension work together and must both be in proper working condition to ensure proper protection.

While hard hats are available in various styles and multiple colors and patterns, those that are "OSHA approved" meet the minimum requirements established by the American National Standards Institute (ANSI) and the International Safety Equipment Association (ISEA). ANSI then further divides them into different types and classes. A hard hat type describes the level of impact protection. Type I hard hats are designed to reduce the force

of impact from a blow to the top of the head only. Type II hard hats are designed to reduce the force of lateral impact from a blow which can be received off-center, from the top, or to the side of the head. Hard hat classes, however, describes the degree of the hat's electrical performance. Class E (Electrical) reduces exposure to high voltage conductors, offering dielectric protection (to the head) up to 20,000 volts (phase to ground). Class G (General) reduces exposure to low voltage conductors, offering dielectric protection (to the head) up to 2,200 volts (phase to ground). Finally, Class C (Conductive) are not designed to provide any protection against electrical conduction. Instead, they normally come with ventilation slots and increased breathability (Hard Hat Types and Class Standards).

Research Objective

The purpose of this research is to determine the types of training that is being used by Californian contracting firms and whether this training is actually understood and practiced in the field. Note: Research was performed on various types of contracting firms, with the intention of looking at California construction as a whole.

Literature Review

In 1977, a study was conducted by the National Institute of Occupational Safety and Health (NIOSH). Six industrial "safety helmets" supplied by NIOSH were subjected to the impact force of an 8lb spherical mass, dropped from five feet (Safety Helmet-Head). These impacts were evaluated using 1000 frame-per-second x-ray cinematography to determine their force and duration. All six helmets were found to function properly under these testing conditions. In 1987, a study was published by Mills and Gilchrist of impact tests on industrial helmets. The results of these tests led to a better understanding of impacts and improvements in dynamic response (Mills and Gilchrist).

According to the OSHA Directorate of Construction website, as of September 30, 2017, head protection is the 7th most cited construction violation (OSHA DOC). The specifics of these citations are not described, but it can be assumed that they have to do with hard hats either not being worn or not in proper working condition.

According to Kristin Bacon, hard hat shells should be inspected for "cracks, nicks, dents, gouges, and any damage caused by impact, penetration, abrasions, or rough treatment" in addition to "stiffness, brittleness, fading, dullness of color, or a chalky appearance" if it is made of thermoplastic materials (Bacon). In addition, she describes the damaging effects of UV light and why hard hats that suffer from prolonged exposure to the sun and being stored inside a vehicle's windows must be replaced more frequently.

Performing a hard hat shell inspection is easy to do and consists of compressing the shell inward from the sides about 1 inch with both hands, then releasing the pressure without dropping the shell. The shell should quickly return to its original shape, showing elasticity. If the shell does not demonstrate elasticity, or if it cracks or leaves behind a residue, it must be replaced immediately. The hard hat suspension must also be inspected, as it is a crucial protection element and often gets overlooked. The suspension should be checked for "cracks and tears, frayed or cut straps, loss of pliability, or other signs of wear" (Bacon). Also, all of the pins (slots or tabs) should be tightly secured in place.

When it comes to inspections, they have been affected by the practice of placing stickers on hard hats. This has become common as workers like to personalize their equipment or are obligated to use the stickers as a method of identification. If a hard hat is covered in stickers, it can cover up any deformations or dents and make it more

difficult to inspect properly. To resolve this, the amount of stickers should be kept to a minimum or placed away from the edge of the shell. This prevents the possibility of a sticker acting as a conductor in the case of electrical shock.

Hazard		Provides Protection
Head trauma from small falling objects		Hard outer shell usually made from HDPE (High-Density Polyethylene), ABS (Acrylonitrile Butadiene Styrene) or other Thermoplastic material.
Force transmission down the spine from impact		Inner suspension that is attached to the shell reduces forces that would otherwise be transmitted to the head and spine
Low level electrical shock		Hard outer shell. The homogeneous material insulates against low level electrical shock. Not all hard hats provide electrical protection. Always review the hard hat user instructions and warnings to evaluate electrical protection.

Figure 1: Hard Hat Protection(How Does...)

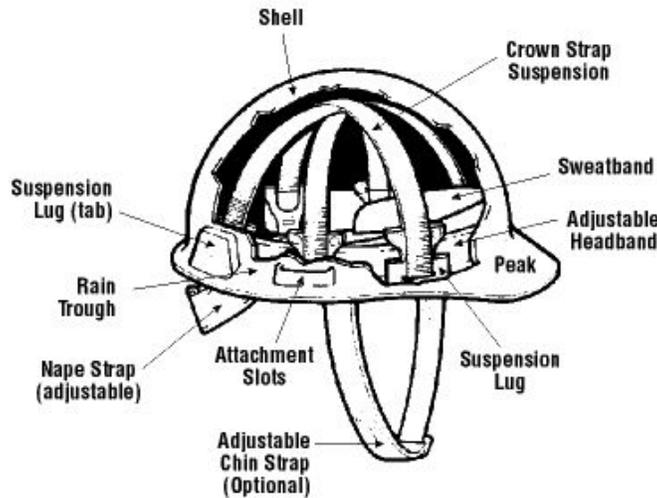


Figure 2: Components of a Hard Hat (Headwear, Care of)

Research Methodology

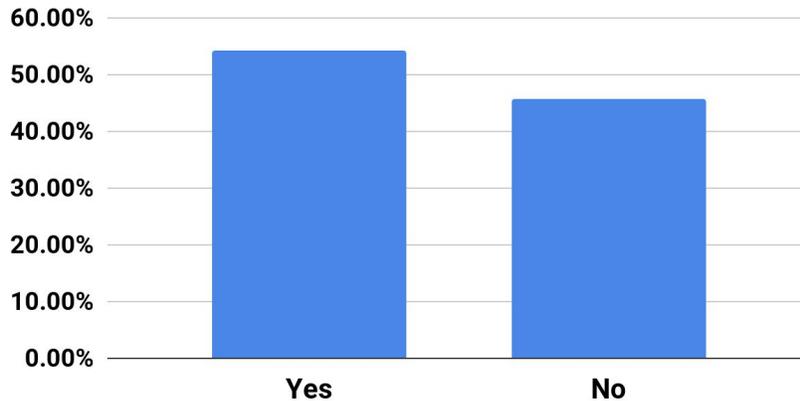
The research was performed with the intention of discovering how contractors are educating their employees in terms of hard hat safety, and if these teachings were actually being applied in the field. To achieve this, a survey was electronically distributed to a list of contractors with offices in California and a survey was taken on the site of one construction project in Los Angeles.

Company Survey

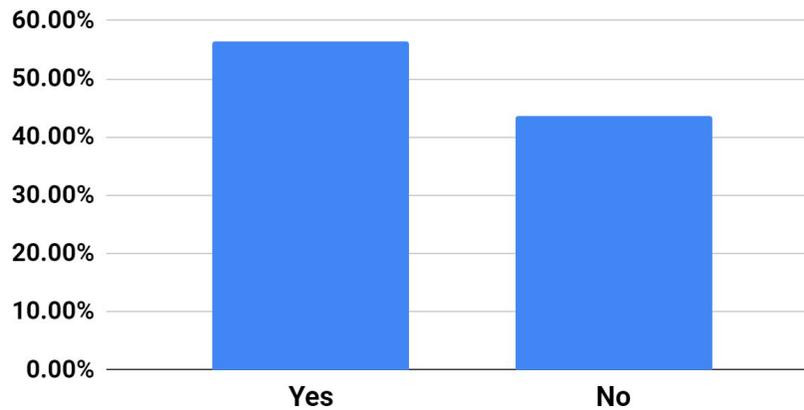
To begin, the companies were asked if they were present in Northern California, Southern California, or both. About half of the companies (45.65%) are present in both, followed by only Northern California (34.78%) and only Southern California (19.57%). In addition, the responding companies mainly consisted of general contractors

(76.09%) with some specialty contractors (23.91%). Of those general contractors, about 64% responded that they also self-perform some work (the specific type of work was not requested in this survey). Of the responding companies, about 84% stated that their average annual revenue is over \$100 million. Additionally, almost 70% of the responding companies state that, on average, they have over 100 employees in the field on their projects. These last two figures show that most of these responding companies could be considered large firms, especially in California. The following charts highlight how many of them actually train their employees in hard hat safety.

Does Your Company Train Employees In The Risks Of Using A Damaged Or Old (5+Years) Hard Hat?

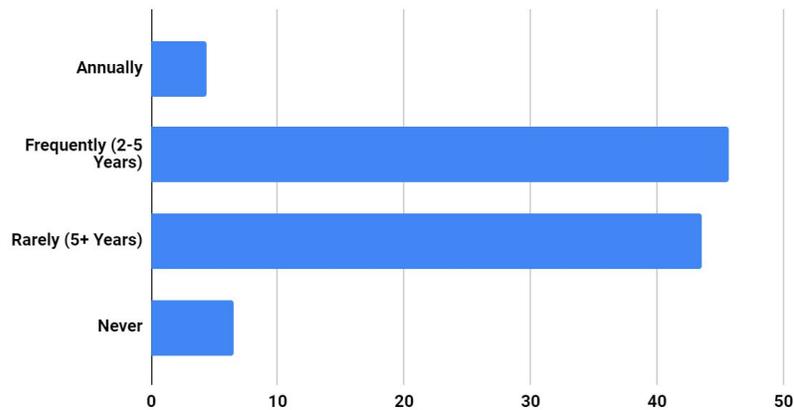


Does Your Company Currently Have A Program To Replace Hard Hats?

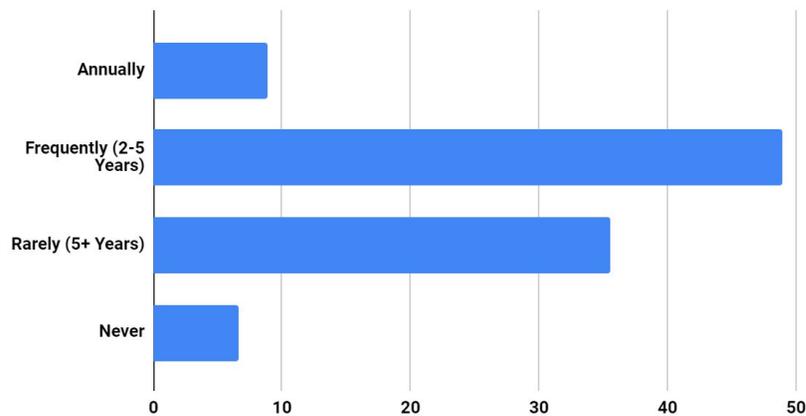


While it wasn't the case for every respondent, we can see a correlation between companies that train their employees in the dangers of using an old or damaged hard hat and those that have established programs to replace those old or damaged hard hats. An additional space in the survey was provided for the respondents to briefly describe how they train their employees on this topic, the full responses are available as an appendix. Some of the more common responses include the topic being taught in toolbox talks, safety meetings/trainings/orientations, and through the OSHA 10 and 30 programs.

Based On Your Company Policies, How Often Are Your Employee's Hard Hat Shells Replaced, Even If Undamaged?



Based On Your Company Policies, How Often Are Your Employee's Hard Hat Suspensions Replaced?



When it comes to how often the old or damaged items are replaced, we can see that most of the respondents tend to replace the entire hard hat system at once instead of replacing the individual components at their manufacturer recommended time periods. Most of the companies replace the shell during the recommended 2-5 year period, while many tend to go past the recommended 12-month period for suspensions. There were also a few companies that they stated they replace the items on an annual basis, which shows a great commitment to their employees' safety. Surprisingly, about 7% of the responding companies state that they never replace their employee's hard hats. It is unknown why they do not replace the hard hats, but this is a dangerous practice that can lead to serious injury or death in the event that somebody wearing an outdated hard hat is forcibly struck on the head.

On-Site Survey

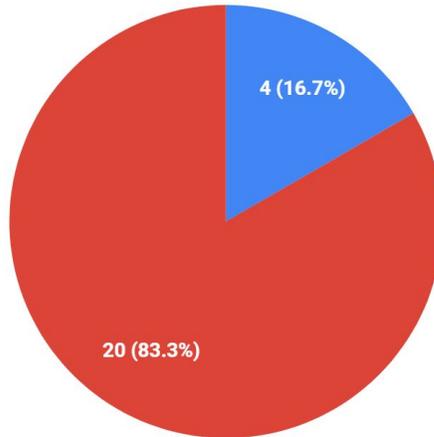
In addition to the company survey, an additional survey was taken on the site of a construction project in Los Angeles. The survey was taken during a weekly meeting consisting of superintendents, field engineers, and trade foremen. As such, the results come from individuals that work for the general contractor or the subcontractors. This

meeting was specifically chosen with the expectation that because all of these individuals hold positions of leadership on the jobsite, that they would understand safety topics and how they relate to those that they oversee.

To begin, the employees were asking how long they have been wearing their current hard hat. The majority of the respondents (60%) were wearing fairly new hard hats, those that are 2 years old or less. Surprisingly, only 12% of the respondents were wearing their current hard hat for 5 years or more, meaning that there is some element of prudence by their company or the individuals themselves for proper head protection. The remaining 28% stated that they had been wearing theirs for 2-5 years, which is still within the recommended usage period for a hard hat shell.

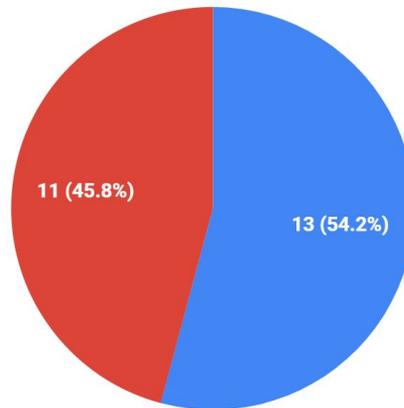
Has The Suspension On Your Hard Hat Ever Been Replaced?

- Yes
- No

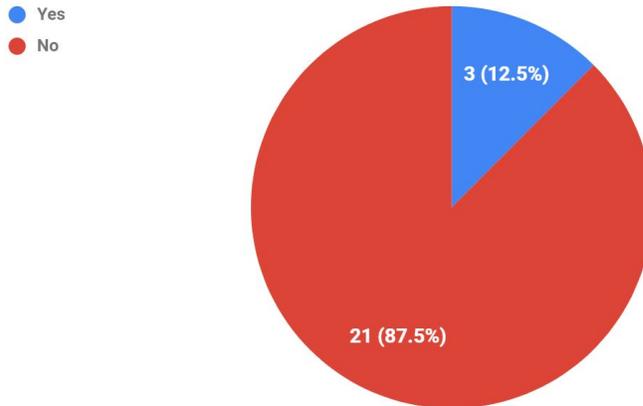


Did You Know Manufacturers Recommend Replacing A Whole Hard Hat/Hard Hat Shell Every 2-5 Years?

- Yes
- No

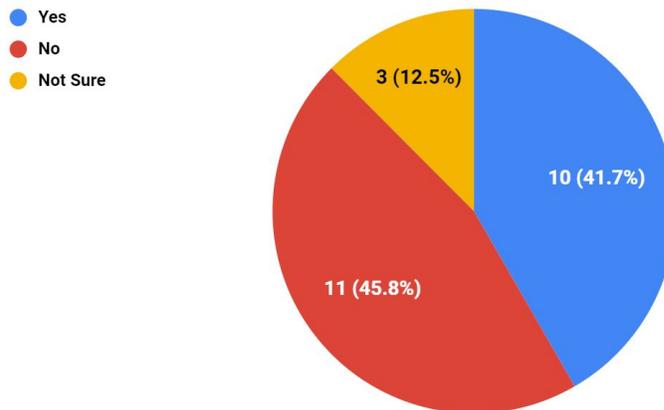


Did You Know Manufacturers Recommend Replacing The Hard Hat Suspension Every 12 Months?



When it comes to knowledge about replacing the hard hat shell or suspension, a slight majority (54.2%) knew about the recommended 2-5 year period for a shell and only a very small amount (12.5%) knew about the recommended 12 month period for a suspension. This latter figure, combined with the fact that only 16.7% of respondents stated that their suspension system had been replaced in the past, show that the suspension is often overlooked in terms of proper inspection or safety knowledge. This item must be addressed through the training more, as the shell and suspension system work together to protect the wearer, and it is dangerous to disregard either item.

Does Your Company Have An Established Replacement Program For Whole Hard Hats/Shells/Suspensions?



Finally, the employees were asked if they knew whether their company has an established replacement program for either of the components, or the hard hat as a whole. Of the respondents, 41.7% stated that their company does have an established program, 45.8% stated that their company does not have a program, and 12.5% were not sure. The latter figure is of some concern, as the respondents oversee other workers in the field and it is important they know about their employer's safety policies. Comparing these figures to those received from the firms themselves, we can see that the percentage of companies without a replacement program are about the same (~45%).

Future Research

Future research is recommended of the hard hat safety measures that are taken by California contractors. It would be beneficial to focus on those general contractors that self-perform work, as they have larger workforces to teach about and enforce hard hat safety. With larger workforces, it is understood that teachings do not thoroughly reach every person, leading to a higher chance of unsafe hard hats being used on a jobsite. In addition, further research should be done to understand which methods of training are the most effective in ensuring that workers understand the dangers of old or damaged hard hats.

Conclusion

As arguably the most important item of PPE, it is important that the hard hat is properly worn and maintained to ensure the wearer's safety. Using various methods, a majority of companies train their employees in these dangers and also actively replace those that are old or damaged. As the results showed, there is more to be done in training people on the importance of the suspension system, as well as the shell. Many tend to think that the shell is the only protective item, but the suspension is what absorbs and distributes the blows to prevent damage to the user's head. These two pieces work together and neither can be ignored if proper protection is to be achieved.

There are many ways to improve worker knowledge on proper usage and inspection, such as having everyone inspect their hard hat during a toolbox talk or morning huddle. When it comes to companies passing on the knowledge, they could have their employees assemble their hard hat straight out of its packing instead of handing them one that has been assembled. By assembling it themselves, they can see how the components interact with each other and why they are important. In addition, during a safety orientation or training, they could place stickers on the hard hat with reminder dates for when to replace each of those components.

Hard hat safety is an issue that cannot be taken lightly, as these pieces of equipment can be the difference between life and serious injury or death in the event of an accident. Companies must stress their importance to their employees and those employees must understand that they exist to protect you, but they only work when they are properly worn, not old, and undamaged.

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