Inclusive Safety: Understanding Safety Managers’ Views on the Fit and Function of Construction Safety Vests for all Body Types

Oliver Leograndis
California Polytechnic State University
San Luis Obispo, California

With the construction industry evolving to embrace a more diverse workforce, it is crucial that personal protective equipment (PPE) adapts alongside this demographic shift to better accommodate women and those with diverse body types in the industry. To provide tangible momentum for the growing need of inclusive PPE, the Cal Poly Construction Management Department developed and hosted a “Verifying Everybody’s Safety Together” (VEST) Hackathon Event. This event provided an all-encompassing look at women’s construction vests and how they can be improved upon. The event had a variety of construction industry personnel in attendance, including five safety managers of different companies. These safety managers offered their insights, perspectives, and experiences regarding ill-fitting construction vests through a series of individually conducted, semi-structured interviews. The perspectives shared by these safety managers proved to be especially significant, because they are often directly responsible for the PPE acquisition and distribution process for all construction personnel at their respective firms. The perspectives shared by the safety managers helped reveal how and why safety vests fail to properly accommodate women and those with diverse body types, and what can be done about it to support them while promoting a more inclusive and accommodating construction industry at large.

Key Words: PPE, Hackathon, Women’s Construction Vests, Diverse Body Types, Safety Managers

Introduction

After administrative controls, work practices, and engineering controls, personal protective equipment (PPE) is generally regarded as the last line of defense for construction worker safety. Therefore, it is imperative that all construction personnel, regardless of gender or body type, receive equal benefits from PPE that suits them properly and keeps them safe. The Occupational Safety and Health Administration (OSHA) is the governing body for workplace health and safety. OSHA’s safety standards stress the importance of properly fitted PPE, stating that “All PPE should fit comfortably, encouraging worker use. If the personal protective equipment does not fit properly, it can make the difference between being safely covered or dangerously exposed” (OSHA, 1978). However, the demographics of the construction industry has drastically evolved since OSHA originally wrote their PPE standards in 1978. Between 1985 and 2007, the number of women employed in the U.S. construction industry grew by 81.3% (OSHA, 2022). Furthermore, in August of 2022, “the number of
women construction workers reached an all-time high” (NAHB, 2022). While the general landscape of the construction industry has observed a significant increase of females in its sector, developments within the PPE for these women, particularly the safety vest, has lagged.

Galvez (2020) conducted a study that raises great concern that females in the industry are not being served by the standard “One Size fits All” construction vest in its current design. The study's participants reported that the vests provided by employers were excessively large, causing discomfort, and endangering personal safety. However, to achieve optimal design, a diverse group of perspectives, particularly those of women, must be considered (Bernabei, 2022). This study led to the emergence of the “Verifying Everybody’s Safety Together” (VEST) Hackathon, which maintained the goal of uniting students, faculty, and construction industry members together in a collaborative, multi-day event designed to foster the development of a more suitable construction vest that accommodates women and those of varying body types.

The VEST Hackathon provided an enormous opportunity to examine the shortcomings of the current construction vest. Through the event, the plight of those who have experienced poor results due to improperly fitted construction vests could be better understood, and possible solutions could be explored. The objective of this study is to gain insights from safety managers in attendance at the VEST Hackathon and use their perspectives to investigate why the construction vest, as currently designed, fails to accommodate all body types. Additionally, their perspectives will be shared to analyze how the construction vest can become more inclusive, accommodating, and safer for all users, regardless of body type.

**Literature Review**

*The Construction Vest as a means for Safety, and why Fit Matters*

Safety vests are a vitally important component of personal protective equipment. They are designed to keep workers visible and protected from potential hazards. “About one-fifth of all fatal incidents at construction sites in the United States were due to not having a safety vest” (OSHA, 2022). The effectiveness of a construction vest is heavily influenced by two key factors: compliance to be worn, and its capacity to be visible. When construction vests are not worn, the potential for devastating consequences rises significantly. Between 2011 and 2015, “800 construction workers have died due to “struck-by” injuries. Of those injuries, 57% of the struck-by vehicle deaths occurred due to not wearing safety vests” (Stephen, 2020 p. 6). Safety vests should be highly visible in all light conditions and must ensure that the worker stands out from the background, including heavy equipment, machinery, materials, and motor vehicles. Thus, it is important to use safety vests that are made from resilient, high-quality material, and for the user to keep the vest properly maintained, clean, and devoid of damage.

Since the effectiveness of safety vests is contingent on compliance and capacity for visibility, it is important to understand what may prevent and encourage these factors. For the vest to be optimized for compliance, it must fit properly. If a vest is too loose or too tight, it is less likely to be worn when required. The findings of Galvez (2020) highlight the emerging demand for construction vests that fit women and those of varying body types. “The fit of safety vests needs to be updated to accommodate the changing gender demographics within the construction industry. It is crucial to implement safety vests that consider diverse body types for personal and professional growth in the industry. If safety vests do not develop to accommodate for all body types, the safety of individuals in the construction industry will continue to be neglected” (Galvez, 2020 p. 8).
ANSI (American National Standards Institute) and ISEA (International Safety Equipment Association) are two organizations that develop and publish standards for a wide range of industries, including construction. ANSI is a private, non-profit organization that coordinates and develops voluntary consensus standards, while ISEA is a trade association that represents manufacturers of PPE and other safety equipment.

The ANSI/ISEA 107 standard is a comprehensive guideline for high-visibility safety apparel and accessories, and it plays a vital role in protecting the safety and well-being of workers in the construction industry. The ANSI/ISEA 107 standard was first developed in 1999 by ANSI and ISEA to ensure the safety of workers who are exposed to low-light and high-traffic environments (ISEA, 2015). The standard outlines the requirements for the design, performance, and testing of high-visibility safety apparel and accessories, including jackets, pants, and headwear. It also provides guidelines for the placement and size of retroreflective material, as well as requirements for the color of the fluorescent background material. Compliance with the standard is essential for workers who require high-visibility safety apparel to perform their duties safely and efficiently.

Updated every five years, the ANSI/ISEA 107-2015, was a significant revision to the previous standard of 2010. The 2015 revision to the code addressed the needs of an increasingly diverse construction industry by modifying the most used safety vest in the construction industry, the Type-R. As displayed in Figure 1 below, the background material for the smallest size had been significantly reduced to accommodate smaller body types (ISEA, 2015). “This adjustment to this sizing metric is a step in the right direction toward developing a code that takes appropriately fitting PPE into account” (Stewart, 2022 p. 4).

![Figure 1: ANSI/ISEA 107-2015 Code of Minimum Required Material for Type R High Visibility Safety Vest (source: ISEA, 2015)](image)

Although the ANSI/ISEA 107 standard is effective in providing high visibility, there is evidence that suggests an increased propensity for objects to become caught or snagged on one’s protective clothing. The ANSI/ISEA 107-2015 set of standards, which govern the design of a compliant vest, seems to be “the largest hurdle in addressing the issue of improper fit. Under the current metrics of testing within this standard, it prevents a safety vest which both accommodates all body types and limits the concern of material being snagged” (Stewart, 2022 p. 9).

_The VEST Hackathon_
Galvez (2020) brought to light various concerns and discomforts about the sizing of safety vests, and these findings presented a great opportunity to propel forward new solutions. California Polytechnic State University, prides itself on its “learn-by-doing educational philosophy” (Cal Poly, 2023). By using this philosophy and applying it to this issue at hand, it was determined that the best way to troubleshoot the issue was to create a Hackathon. Hackathons are multipurpose social events that serve as a place of open collaborative ingenuity to solve a problem, invent something brand new, or prioritize the redevelopment of a flawed product to make it better. The Hackathon’s was designed to unify industry members, students, and faculty to prioritize reimagining the construction vest that can then be introduced as a final product to the building industry (Bernabei, 2022).

After logistical and financial planning, the VEST Hackathon was scheduled. The Hackathon had four primary goals: encouraging innovation, fostering collaboration, solving real-world problems, and developing prototypes. In preparation of the event, “three preliminary designs of newly created vests were designed for use and discussion at the VEST Hackathon” (Schrader, 2022). The Hackathon hosted over 30 industry members, in addition to students and faculty. The industry members in attendance at the Hackathon included project engineers, project managers, design specialists, and safety managers.

**Critical Role of the Safety Manager**

The role of safety managers in construction is multi-faceted, and they play a critical role in ensuring the safety of workers on construction sites. They are responsible for identifying potential hazards and developing safety procedures to mitigate them, which requires a thorough understanding of the risks associated with the construction process. One of the most important aspects of a safety manager's role is overseeing the use of PPE on site. Safety managers are responsible for ensuring that all workers have effective and appropriate PPE and that it is worn and used correctly. This includes providing training to workers on the proper use and maintenance of PPE, as well as regular monitoring and inspecting PPE to ensure its condition.

Additionally, safety managers play a crucial role in acquiring and distributing properly fitted PPE to construction personnel. Their role involves identifying the specific PPE required for each job and ensuring that the appropriate PPE is available and distributed to workers. The safety manager will typically work with vendors to procure the necessary PPE. They may also work with individual workers to identify any specific needs or preferences related to PPE, such as size and comfortability.

Though the issue of the ill-fitting construction vest has long been present, awareness of the issue is new. As a result, there is a lack of existing literature regarding safety managers’ current perspectives and experiences on the matter. However, their knowledge and experience regarding PPE acquisition, distribution, and maintenance is obvious, and can help educate and shed light on common themes regarding the setbacks and challenges of ineffective PPE. Therefore, the safety managers’ perspective and experiences of the issue at hand was extremely valuable and highly sought after at the VEST Hackathon.

**Methodology**

The abundance of industry members at the event provided for an exceptional opportunity to understand their individual experiences with ineffective safety vests. With their combined wealth of experience on site, it was clear that the next step would be to investigate their personal experiences to identify the specific shortcomings of the existing vest and how to improve upon it. Each construction
industry attendee at the VEST Hackathon was categorized into four categories: project engineers, project managers, design specialists, and safety managers. To best understand how the “One Size Fits all Approach” fails to serve women and those with diverse body types within the construction industry, safety managers were deemed to be one of the most important subcategories to pursue semi-structured interviews with.

These semi-structured interviews were conducted with each of the five safety managers in attendance, and they ranged from 20-50 minutes in length. The specific methodology within these semi-structured interviews was to use the qualitative research strategy to develop data. Although this research strategy typically lends itself to being subjective in nature, it enables the experiences given by the safety managers to be conveyed with great meaning, description, phenomena, and context (Cleland, 2017). By doing so, the safety managers were freely allowed to expand on the “how” and “why” of their experiences with ineffective safety vests, in addition to the variety of ways in which the vests (and the process of acquiring and distributing them) can be improved upon.

In preparation of the semi-structured interviews, a comprehensive interview guide was created. This interview guide, which contained ten questions, was curated to ask five yes/no questions, and five open ended questions. The interview guide allowed for the collection of qualitative data that is both measurable and expansive regarding the issue of construction vests that fail to properly fit women and those with diverse body types. While conducting the semi-structured interviews, several avenues of communication became available, ranging from the brief answering of a series of specific questions, to long-forum based conversations that included thoughtful anecdotes that shed light on their own experiences and challenges with unaccommodating construction vests. The semi-structured interviews were recorded by a software called “Otter” which highlights common themes seen in each interview. These interviews, recorded by Otter, was collected, and organized to provide qualitative data.

See Appendix A for Interview Guide.

**Results and Discussion**

**Theme 1 – A Better Fitted Vest that is More Available**

The first common theme shared among the five safety managers interviewed at the Hackathon was their combined desire for a larger variety of safety vests to be readily available for their workers. When asked whether their company provides options for specialized and/or customizable vests for women and those of diverse body types, two safety managers said no. These managers were asked to describe their experiences regarding improperly fitted vests.

Participant 1, a risk management coordinator for a midsize electrical contractor, expanded on a situation where even the smallest vest in the company’s inventory was still too large for an employee. “When I put [the smallest vest] on her, a men’s small, I told her that it still didn’t fit. The employee answered that it’s OK, and they had dealt with it before.” When the safety manager asked the employee about what they typically do about the vest being too large, the employee responded, “Oh, you know, I get it altered [by a tailor].” This employee was not provided with an adequately fitted vest and resorted to spending their own time and money to get the vest altered for their specific body type. If the employee had not shared this information with the safety manager, “They would not have been reimbursed for the alterations made to the vest and could have even been penalized for modifying company issued equipment.” In this instance, the employee was not able to receive a properly fitted vest because the safety manager did not have access to proper inventory that contained a variety of sizes.
Participant #2, a safety coordinator for a mechanical contractor, shared a similar experience that also highlighted their company’s lack of inventory. “For a long time, we didn’t even carry smalls. I kept ordering small vests, and they would send me mediums.” Now, the company keeps in stock a larger range of sizes, from small to XXXL. However, “We do not carry women’s sizes. Our selection is between men’s small and XXXL, and we provide these sizes for the entire company, including women.” Thus, the smallest size available for women at this company is a men’s small. Additionally, Participant #2 shared that although they now have a wider range of sizes, the less common sizes are not readily easily accessible. “I always have [men’s] larges and extra-larges on hand. These sizes fit most of my workers, so it’s easy to hand them out in a pinch. The other sizes are held elsewhere and can be tougher to get.”

Additionally, Participant #3, a senior environmental, health, and safety (EHS) director of a global construction company, shared a similar experience regarding barriers to access of varying vest sizes. However, this company typically does carry vests in women’s sizes, but due to the company’s extremely high volume of workers, they use regional equipment yards to keep less commonly used PPE, like women’s safety vests, offsite and in storage. Though the company is supposed to carry women’s vests within these equipment yards, Participant #3 shared that “There have been times when we’ve been out of stock [of women’s vests] for months.” When in stock, Participant #3 also shared that “It could take up to a week to receive any shipments from the equipment yards.”

Theme 2 – Fit and Adjustability

A second common theme that arose among the safety managers interviewed at the Hackathon was how the safety vest could be significantly improved by implementing two key design changes: fit and adjustability.

One of the guest keynote speakers at the Hackathon, shared an account where their excessively large construction vest put them in danger. One day, while performing a routine jobsite walk, the excess material of the vest was caught on the edge of an exposed length of rebar next to an open excavation. Had the vest been caught on the rebar more severely or at a slightly different angle, it was possible for them to fall into the excavation zone. Not only was the user’s improperly fitted vest to blame this occurrence, but it could have had led to potentially fatal implications. Many of the safety manager participants interviewed at the Hackathon resonated with this story and the need for a more properly fitted vest, and they were asked to expand on how it could be accomplished.

Each of the managers cited a lack of proper fit as the biggest improvement needed to better the safety vest. Participant #2 cited complaints about fit given by field workers, “Many employees, especially women, have said that it is too lose in some areas and too tight in others, but generally the largest complaint we receive [pertaining to the vest] is that it is too big and baggy. When asked about how women and those of varying body types could be better served by a properly fitted vest, Participant #2 explained that “It would be beneficial for vest manufacturers to take specific measurements in multiple locations. Then there would be a better product.”

Participant #5, the senior safety director of a national construction company who oversees 80 safety managers throughout 17 states, was asked about their experiences regarding ineffective safety vests. “We had a standard, low level class two vest come out last year. It was not effective for many of our female managers.” After beta testing vest various prototypes due to employee complaints, Participant #5 reported that, “Now, we have two types. We have an office style, which is a lighter vest, and a
more robust option with double fabric designed for field workers. We also now have adjustability options with drawstrings.” Participant #5 has noticed that the changes made, especially regarding the options for adjustability, have drastically improved the overall fit and function of vests for women and those of diverse body types, “We have received great overall feedback, especially from female managers, of the new design, and have heard no new complaints.” The positive feedback received from Participant #5 regarding the implementation of drawstrings in the safety vest is a testament to the importance of adjustability and how it allows for a more effective vest.

**Theme 3 – Safety through Advocacy**

Each of the five safety managers interviewed at the Hackathon were individually given the opportunity to share their thoughts on how to effectively champion the issue of inadequate safety vests for women and those of varying body types. When asked about how we can continue to create change for those unaccommodated by the current “One Size Fits All” approach to the safety vest, a common theme that arose was safety through advocacy.

Participant #4, an assistant safety manager for a national general contractor, discussed the importance of creating a unified safety culture and its specific downstream effects. “You can typically tell how effective a project will be based on its safety culture. If you can’t do the safety well, that means the QC isn’t doing well and neither is the schedule.” Additionally, Participant #4 elaborated on the implications of when subcontractors are unwilling to adopt the general contractor’s safety procedures. “If [subcontractors] don’t want to follow our safety guidelines, then we ultimately have to make a decision whether to let them go and find a new partner, or double down the enforcement of our standards.” When asked how to best create change for women and those of varying body types who are not properly served by current safety vest options, Participant #4 shared that “We need to look at this problem with the same level of scrutiny as we have [looked at] others in the past. Of course, the construction industry is far safer than it was in the 1970’s, but that’s only because we dissected each issue and fixed it one-by-one.” As a result of the construction industry becoming far safer over time through sweeping changes to safety standards, the hazards that may inflict an individual’s safety have become less glaringly obvious, but as Participant #4 states, “We can’t become complacent. This event highlighted the issue [of women’s construction vests] and it needs to be taken seriously.”

Participant #5, emphasized the importance of providing field teams the opportunity to communicate their problems with executives via email forum, stating that, “Helping our people is something that we are really working on. We want to make sure that our people have a voice, so we have provided them with a way to communicate any problem. Then, we listen, and they get what they need. Without this forum for communication, we wouldn’t have developed two new prototypes of vests” When asked about the how this inlet for communication between workers and executives has helped employees advocate for themselves, participant #5 stated, “It’s been huge, it has let us listen to our employees and fix many issues. It’s also communicated to our workforce that they are heard and that we are willing to do anything to improve their experience.

**Conclusion**

This study brought to light several insights gained at the VEST Hackathon from the perspective of the safety manager. It confirms that the “One Size Fits All” approach to the construction safety vest fails to support the safety of women and those with diverse body types in the construction industry. The observations gathered have showcased that companies struggle to acquire and maintain inventory of varying vest sizes, and even when they have ample variety, safety vest performance regarding fit and
adjustability remains abysmal for certain body types in the industry. To create a safety vest that is optimized for all in the industry, construction industry members of all kinds, including employees, safety managers, executives, and manufacturers, must come together (like the Hackathon) to rally around this issue to advocate for those not currently served by the current safety vest offerings.

In a diverse industry that draws from nearly all population demographics, it is inexcusable for companies to not have proper PPE that accommodates all employees, regardless of their gender or body type. The use of PPE is a critical aspect of ensuring workplace safety, and it is essential component of protecting all employees. Workplace safety is a fundamental right of every worker, and companies must recognize this and take necessary steps to provide a safe working environment. Failure to do so not only puts workers at risk of injury, but also exposes companies to legal liabilities and reputational damage. Furthermore, with today’s focus on diversity, equity, and inclusion, it is essential that companies adopt an inclusive approach to safety equipment that accommodates employees of all body types.

Regardless of whether companies have varying sizes available, the construction vest needs to be redeveloped to fit better and be more adjustable to accommodate all body types. While it is important for companies to provide a range of sizes, this alone does not address the underlying issue of inadequate design. By taking diversity into account in the comprehensive redesign and manufacturing of construction vests, companies can ensure that all workers have access to PPE that fits properly, is comfortable to wear, and provides adequate safety, and can be adjusted if needed.

The discoveries made through the VEST Hackathon demonstrate the benefits of collaboration, and addressing the issue of inadequate safety vest design will require a joint effort from all stakeholders in the construction industry. While executives, safety managers, and PPE manufacturers have the authority in driving changes in PPE procurement and design, it is essential for employees to have a voice as well. Therefore, it is important for all construction industry members to come together and advocate for better safety vest designs that meet the needs of everyone in the industry for those who are not served.
References


## Appendix A

<table>
<thead>
<tr>
<th>PARTICIPANT NAME</th>
<th>COMPANY</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERVIEW DATE</td>
<td>INTERVIEW START TIME</td>
</tr>
<tr>
<td>POSITION TITLE</td>
<td>YEARS EXPERIENCE</td>
</tr>
</tbody>
</table>

All (*) questions pertain to women and those with diverse body types in subject:

**Yes / No questions:**

*As a safety manager, have you previously encountered issues regarding fit and/or function of employees’ safety vests?*

*Do you see the fit of safety vests as an issue that needs to be addressed?*

*Have you received any feedback from employees about the comfort and fit of their safety vests?*

*Does your company enable you with options to provide specialized and/or customizable safety vests?*

*Do you believe there to be a demand for new vests that make adequate accommodations?*

**Open Ended Questions:**

Describe your experience as a Safety Coordinator:

Expand on the importance of safety in the construction industry:

*Describe your previously encountered issues regarding fit and/or function of employee’s safety vests:*

*What are the most common challenges you face in providing properly fitted safety vests?*

*How (specifically) can the construction vest be improved?*

*How can continue the fight for those unaccommodated?*