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Wearables Sensing Devices for Safety Monitoring in Construction: A Perspective from the Field

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Despite Wearable sensing devices' (WSDs) capability to enhance real-time safety monitoring on construction jobsites, their adoption remains limited due to cost, privacy concerns, and worker acceptance. Existing studies on WSD acceptance have focused on workers with prior exposure, leaving limited insight into how those without experience assess their usefulness – a key determinant of adoption intention. This gap was addressed through semi-structured interviews with 17 construction fieldworkers (11 trade workers, 6 supervisors) across four project sites in Alabama, USA. Interview data were coded and organized into themes. Findings revealed five application areas: (1) heat-exposure nudges, (2) moving-equipment alerts, (3) electrical-proximity warnings, (4) edge/height reminders, and (5) air-quality notifications. Participants primarily valued alerts for proximity to moving equipment, energized rooms or cables, and early heat warnings. However, they will prefer not to get WSD alerts during less risky tasks or precision tasks that require full concentration. Also, most participants expressed concerns that false alarms would disrupt their workflow. Additionally, six enabling features were identified and thoroughly discussed. Collectively, the findings from this study clarify when WSD alerts will help or hinder work and specific design requirements that can improve acceptance and sustained use. Future research could examine data-sharing preferences and organizational enablers.

Keywords: Construction safety, safety monitoring, technology adoption, wearable sensing devices, worker acceptance

Introduction

Wearable sensing devices (WSDs), when utilized, can enhance safety due to their capability to enable continuous, real-time monitoring of construction workers on jobsites. WSDs are equipped with sensors that can collect safety and health-related data, such as electrocardiography (ECG) and photoplethysmography (PPG) for heart rate monitoring, electroencephalogram (EEG) for fatigue level monitoring, inertial measurement unit (IMU) for motion data collection, and global positioning system (GPS) for location tracking, etc., from the wearer (Fasoyinu et al., 2025b). This data can help identify early signs of heat stress, fatigue, unsafe proximity to heavy equipment, machinery, or restricted areas by sending early warning alerts of high-risk issues to users (Awolusi et al., 2018; Fasoyinu, Azhar, et al., 2025). In principle, such alerts allow workers and supervisors to intervene before incidents occur.

Realizing the benefits of WSDs, however, depends on workers' acceptance and continued use on construction sites. Prior research indicates that adoption is shaped by perceptions of value for the task at hand, implementation readiness, and the credibility of data handling practices (Schall et al., 2018; Häikiö et al., 2020). Evidence from construction and adjacent occupation safety and health studies shows that privacy, durability, and unclear cost–benefit can inhibit uptake, even when interest in principle is high (Schall et al., 2018; Awolusi et al., 2020; Okonkwo et al., 2023). Conversely, acceptance improves when devices exhibit useful features, can be trialed safely, and are supported by competent staff and clear rules (Awolusi et al., 2020). Understanding where frontline construction personnel perceive concrete utility of WSDs in their daily work is crucial to achieving successful integration into existing safety practices and workflows.

Previous research on WSDs in construction revealed that perceived usefulness, ease of use, and social influence positively influence workers' willingness to adopt a WSD (Choi et al., 2017; Nnaji et al., 2021; Okpala et al., 2021; Fugate & Alzraiee, 2023). Successful implementation depends on worker involvement in planning and decision-making, as acceptance and continued use rely on whether device features meet worker needs and if collected data are managed transparently and ethically (Jacobs et al., 2019). Adoption, therefore, hinges on whether specific device functions meet clear worker needs and are governed in ways that align with worker expectations.

While existing studies have identified several factors influencing WSD acceptance, two crucial gaps remain. First, most studies use data from workers who already have experience with these devices, often through surveys based on technology adoption models (Choi et al., 2017; Okpala et al., 2021; Fugate & Alzraiee, 2023; Awolusi et al., 2024). Notably, in a recent U.S. survey, 2,796 of 3,011 construction respondents reported no workplace experience with WSDs, while only 215 reported familiarity and active use (Awolusi et al., 2024). Most construction workers have not yet been exposed to WSDs on their jobsites. Second, task-level assessments of where WSD capabilities—such as proximity alerts or heat-related cues—are seen as helpful or disruptive during typical construction work remain insufficiently detailed in worker-centered terms. Addressing these gaps is necessary to guide deployment that aligns with worker expectations.

Consequently, this paper assesses how construction fieldworkers and front-line supervisors without prior experience with WSDs on their jobsites perceive the usefulness of core WSD capabilities. Given the crucial role of perceived usefulness in the adoption intention of WSDs in construction, this paper provides: (1) role-aware evidence from the workforce majority that has not yet used WSDs on site, and (2) task-anchored reasoning that clarifies where workers foresee benefits or little added value. The research question of this paper is: RQ1 - *How do construction fieldworkers and front-line supervisors with no prior workplace use of wearable sensing devices understand and assess the usefulness of core wearable device capabilities for their typical work activities, and why*? The remainder of the paper presents the literature review, methods, results, discussion, and conclusions.

Literature Review

Research on WSDs in construction has clarified factors influencing acceptance and early adoption. Studies based on the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) consistently identify perceived usefulness, ease of use, social influence, and facilitating conditions as key to intention to adopt WSDs in construction (Choi et al.,2017; Jacobs et al., 2019; Okpala et al., 2021; Fugate & Alzraiee, 2023). Empirical findings emphasize the importance of useful features, trialability, compatibility with existing workflows, qualified staff to facilitate training, and transparent data use policies as critical for successful WSD implementation (Awolusi et al., 2020; Okpala et al., 2020; Fasoyinu et al., 2025). This body of work collectively reveals that WSD acceptance depends not only on technical capabilities but also on perceived value and supportive organizational conditions.

Beyond beliefs and attitudes, WSD usability and embodiment strongly affect perceived usefulness. Construction tasks require precision, mobility, and comfort; therefore, body placement, weight, and interference with movement strongly influence whether workers will perceive a device as practical and convenient, or as intrusive (Fasoyinu et al., 2025). A survey of 952 occupational safety and health professionals in the U.S. revealed that concerns about durability, sensor reliability, and information burden can erode willingness to wear wearable devices in the workplace (Schall et al., 2018). Chong et al. (2023) suggest that perceived benefits often emerge when devices combine several enablers—such as simple interfaces, brief vibration cues, and low false-alarm rates—rather than through a single dominant feature. Functions such as posture correction, fatigue monitoring, and proximity detection are particularly relevant when these features align with field task rhythms. In practice, usefulness and usability are intertwined: a device's effectiveness in supporting safety depends on whether it complements, rather than disrupts, work performance.

WSD adoption in construction has been examined from both managerial and worker perspectives, with findings revealing clear differences in priorities between the two groups. Surveys of management personnel identify trialability, staff competence, and technological compatibility as crucial to successful implementation (Awolusi et al., 2020). In contrast, worker-focused studies emphasize trust, transparency, and clear rules governing data collection and use as key drivers (Häikiö et al., 2020). Studies capturing both viewpoints suggest convergence, where each group sees value in alerts that improve situational awareness, such as smoke/fire detection, proximity to energized cables, detection of toxic gases or chemicals, and proximity to potential falling objects or heavy equipment (Nnaji et al., 2021).

Despite these contributions, a limitation remains in how adoption intention and implementation success factors have been studied. Most existing studies draw on datasets from workers with prior WSD experience, excluding those without workplace exposure. Understanding how this majority, who have not yet used WSDs on their jobs, assesses the usefulness of specific device capabilities based on the jobsite tasks and risks they face daily can align implementation with real needs. When workers perceive a clear need or direct value in their safety or workflow, they are more likely to welcome and adopt protective measures, including technology-driven solutions such as WSDs. Capturing these firsthand insights of perceived usefulness – particularly from workers with no exposure to WSDs is essential for designing practical, worker-centered deployment strategies.

Methodology

To answer the research question (RQ1), we employed qualitative, semi-structured interviews. This approach elicits deeper task-anchored reasoning, allowing participants to express in detail where WSD alerts would be helpful or disadvantageous to their work.

Sampling, Setting, and Participants. Data were collected on four construction sites in Alabama (May–August 2025) managed by an anonymized general contractor. We adopted purposive sampling to cover variation in job roles (fieldworkers, front-line supervisors) and trades (steel erector/ironworker, concrete/rebar, electrical). Eligibility required participants to: (1) be 18 years or older, (2) be working on an active jobsite, and (3) report no prior workplace WSD use. With site leadership approval, the interviewer invited workers during breaks. Participation was voluntary, and all interviews were conducted one-on-one inside the jobsite trailer or a quiet space nearby.

Instrument and procedures. After brief demographic questions, the interviewer provided a neutral definition of WSD: "a small device that senses conditions and gives a timely heads-up or alert to support safer decisions," accompanied by simple examples. Questions progressed from general usefulness to (1) identifying one most-useful heads-up, (2) discussing where it would not help, and (3) describing what would make a heads-up more useful. No brand names, demonstrations, or predefined function lists were used. The interview guide was piloted with a bilingual safety manager, two workers, and one superintendent. Questions were simplified, examples were aligned with local tasks, and consistency was confirmed across both English and Spanish. During data collection, the same bilingual safety manager provided consecutive Spanish–English interpretation at two sites; clarifications were noted. Table 1 summarizes core questions and alignment with RQ1.

Data analysis and quality. Interviews were not audio-recorded. The researcher took structured notes during sessions and completed expanded notes within two hours of concluding each interview. When Spanish interpretation was used, the interpreter conveyed participant statements verbatim where feasible, and clarifications were annotated in the notes. Brief analytic memos were used to document emergent ideas and potential codes. Two researchers independently coded statements on usefulness, non-use, and enabling conditions. Codes were reconciled through discussion with reference to excerpts. Unmapped codes were retained. All Coding decisions were documented via an audit trail.

Table 1. Key excerpts from interview questions

Interview Questions	**How it Supports Answering the RQ**
"For your usual work, where could a heads-up like this help, if at all? Why? Which situations would that alert prevent or make easier?"	Provides primary contexts of perceived value and mechanisms of benefit (e.g., heat strain awareness during extended pours, approach to moving plants, poor air quality in enclosed rooms).
"Where would it not help, or might get in the way? Why?"	Identifies boundaries and negative cases (e.g., perceived distraction, task rhythm disruption, false alerts, clutter concerns), which define the limits of perceived usefulness.
"If you could get one helpful heads-up during your work, what should it say or do?"	Elicits the participant's top-priority function they would like to get from a WSD. This will allow comparisons with earlier findings.
"What would make a heads-up/alert like this more useful for your work?"	Captures conditions of use (feedback modality, timing, simplicity, placement) that could help us understand why usefulness succeeds or fails in context.

Results

Seventeen participants completed interviews (workers, 11; front-line supervisors, 6) across four active sites (A–D). Trades were concrete/rebar (9), ironwork/steel (4), and electrical (4). Spanish was the primary language for 11 participants, and English for 6; a bilingual safety manager interpreted 7 of the interviews. Notably, 4 of the 11 Spanish respondents were fluent in English, so their interviews were conducted in English. Table 2 below presents the key demographic details of the participants.

For each question, we open-coded all 17 responses, merged close variants, and retained recurrent, job-relevant ideas. Counts are reported as percentages of participants and as n/17 at first mention. After consolidation, every participant contributed to at least one theme in each section. To keep terms plain, we use short vibration (a quick device vibration), one-press confirm that works with gloves on (acknowledge with a single press while wearing gloves), and the path where a moving machine or suspended load could hit a person (instead of "line of fire").

Table 2. Participant characteristics (n=17)

ID	**Site**	**Role**	**Trade**	**Language**	**Experience**	**Age Range**	**Employer**
P01	A	Worker	C/R	Sp (B)	6-10 years	30-39 years	Sub
P02	A	Worker	C/R	Sp (B)	6-10 years	20-29 years	Sub

P03	A	Foreman	C/R	Sp (B)	11-15 years	30-39 years	Sub
P04	A	Superintendent	GC	En	> 20 years	40-49 years	GC
P05	B	Worker	I/S	En	1-5 years	20-29 years	Sub
P06	B	Worker	I/S	Sp (B)	11-15 years	30-39 years	Sub
P07	B	Foreman	I/S	En	11-15 years	30-39 years	Sub
P08	C	Worker	EL	Sp	6-10 years	20-29 years	Sub
P09	C	Worker	EL	Sp	11-15 years	30-39 years	Sub
P10	C	Worker	EL	En	16-20 years	30-39 years	Sub
P11	C	Supervisor	EL	En	> 20 years	40-49 years	Sub
P12	D	Worker	C/R	Sp	1-5 years	20-29 years	Sub
P13	D	Worker	C/R	Sp	6-10 years	20-29 years	Sub
P14	D	Worker	C/R	Sp	16-20 years	40-49 years	Sub
P15	D	Foreman	C/R	Sp	> 20 years	40-49 years	Sub
P16	D	Safety Manager	C/R	Sp	> 20 years	50-59 years	Sub
P17	B	Worker	I/S	En	16-20 years	30-39 years	Sub

Note: Experience is their years of construction experience; C/R is Concrete/Rebar; I/S is Ironworker/steel erector; EL is Electrical; GC is General Contractor; Sub is Subcontractor; Sp is Spanish; Sp (B) is bilingual Spanish workers; En is English.

WSDs Usefulness Contexts

Question addressed: ***For your usual work, where could a heads-up help, if at all, and why*?** Five themes emerged: Heat (76%), Moving Equipment (59%), Energized Work (24%), Edges/Heights (24%), and Ceiling Air/Dust (18%). Lower-percentage themes were retained when they reflected distinct task contexts, involved high-consequence exposure, or offered actionable design guidance.

Heat—Early Nudge. Crews described afternoons, upper decks, and steady hose control as times when heat quietly builds until focus declines. Workers preferred a short vibration before symptoms emerge to support pacing rather than stopping. "If it vibrates before I start to feel light-headed from the heat, I will stop for water and come back steady" (P01, Rebar/Concrete, Worker). Supervisors emphasized brevity: "Heat warnings help when they come early and stay short, so I can act without losing rhythm" (P03, Rebar/Concrete, Supervisor).

Moving Equipment—Clear Lane. Participants wanted a brief vibration with a simple direction just before a pump arm, cart, or suspended load enters their lane. Congested placement and alignment consume attention, so the cue provides the moment to move safely. "Vibrate and point before the pump or cart comes into our lane so we move first, not after" (P03, Rebar/Concrete, Supervisor). "If a load is coming into my lane, I want a strong vibration and an arrow that tells me which way to step" (P05, Ironworker/Steel, Worker).

Energized Work—Keep Distance. Electricians described ceiling rough-ins and energized rooms, where a gentle reminder helps maintain distance without breaking concentration. "Turn it on for energized windows and hot equipment rooms so the alert reminds me to keep distance" (P11, Electrical, Supervisor). "A small vibration is enough to keep me off the panel while I finish the pull" (P08, Electrical, Worker).

Edges/Heights—Footing Check. Around picks, landings, and changeovers near open edges, a light cue prompts a stance reset. "During critical picks and at atrium edges, a gentle cue makes me look down again and stay clear" (P07, Ironworker/Steel, Foreman/Supervisor). Alerts should stay brief and quiet to avoid interrupting lifts.

Ceiling Air/Dust—Step Down. Electricians working overhead described stuffy or dusty air that worsens gradually. A short vibration prompting a brief step-down provides quick recovery without derailing work. "When the ceiling space turns stuffy or dusty, a short nudge to step down for a minute helps" (P09, Electrical, Worker). This matters most during long runs as air quality slowly declines.

Action Enabled by WSDs Alerts

Question addressed: **Which situations would that alert prevent or make easier?** Four key actions emerged that participants said a well-timed alert would enable: Clear Path (71%), Pace Heat (76%), Avoid Energized (24%), and Step Down (18%). Each theme describes the action that follows a useful signal—what workers said they would do differently once an alert appeared.

Clear Path—Step Out Early. Crews emphasized that during concrete placement, steel picks, and heavy equipment operations, a split-second advantage can prevent contact or near misses. A short vibration just as movement begins can allow workers step clear before a machine or suspended load enters their lane. As stated by P06, "If it vibrates when the boom begins to swing, we can clear the area sooner and avoid close calls". Concrete workers linked this action to hose-and-cart coordination, noting that "the signal helps me pick a side and keep pouring" (P12, Concrete/Rebar, Worker). The consistent theme is early redirection—alerts that guide a clean step aside, not a pause after the fact.

Pace Heat—Water or Brief Recoveries. Workers viewed heat cues as a prompt to make micro-adjustments that sustain output, rather than as a signal to stop work. "Tell me to drink and cool down before dizziness so I do not push into a mistake" (P02, Rebar/Concrete, Worker). Another added that the alert "keeps me from over-pushing during sustained pours" (P16, Concrete/Rebar, Worker). By nudging self-regulation—such as brief hydration and shade breaks—these alerts convert passive awareness into active pacing that preserves performance.

Avoid Energized—Maintain Distance. Electricians described this as a spatial correction, a quiet signal that interrupts muscle memory before entering an energized zone. "It helps me avoid stepping into an energized room by habit when my focus is on the task" (P11, Electrical, Supervisor). In tight ceiling spaces, a light vibration rather than sound was preferred: "A small vibration is enough to keep me off the panel while I finish the pull" (P08, Electrical, Worker [translated]). The emphasis is on subtle, location-aware distance control, not alarm fatigue.

Step Down—Recover from Ceiling Air. Electricians performing overhead tasks reported that the air can become stale or dusty during long runs. A short vibration, prompting a quick step down, allows recovery without disrupting progress. "When the ceiling turns dusty or hot, a short cue to step down helps me reset" (P10, Electrical, Worker [translated]). This context captures a distinct physical response—stepping down, taking a breath, and resuming work.

Non-Usefulness Boundaries

Question addressed: ***Where would it not help, or might it get in the way, and why?*** Four "quiet zones" emerged: Idle or Low-Risk Times (59%), Fine-Detail Tasks (41%), Equipment Parked or De-Energized (24%), and Too Many or False Alerts (47%). Each reflects a different reason to stay silent: limited exposure, distraction risk, hazard removal, or loss of credibility through over-alerting.

Idle or Low-Risk Times. Participants agreed that alerts should remain off during periods of low exposure, such as weather holds, paperwork, or light work under shade. "During weather holds or light tying under shade, extra alerts become background and are ignored" (P04, Rebar/Concrete, Superintendent). When activity slows or conditions are safe, alerts shift from helpful to noise.

Respondents suggested using time or context logic—linking alerts to active zones or hotter hours—to preserve trust.

Fine-Detail Tasks. Ironworkers and electricians described moments of precision work where extra gear or vibration could distract or snag. "On tight bolt-up, sounds and straps pull my attention and can snag on steel" (P07, Ironworker/Steel, Foreman/Supervisor). An electrician added that "extra gear catches on ceiling grid when I'm trimming fixtures" (P10, Electrical, Worker [translated]). Alerts should pause automatically when work shifts from heavy activity to fine alignment or finishing tasks.

Equipment Parked or De-Energized. When machinery is parked or circuits are verified de-energized, participants viewed alerts as unnecessary noise. "If the area is locked out and verified de-energized, I do not need reminders" (P11, Electrical, Supervisor). Workers expect alerts to reflect real hazard states, not generic rules.

Too Many or False Alerts. Across trades, participants warned that excessive or poorly targeted notifications erode trust. "Constant pings become like radio chatter and are ignored" (P17, Concrete/Rebar, Worker [translated]). Another explained that inaccurate cues make people tune out: "If it goes off at the wrong time, no one listens when it matters" (P13, Concrete/Rebar, Worker [translated]). Alerts must be rare, specific, and meaningful to retain value.

One Priority WSDs Heads-Up/Alerts

Question addressed: ***If you could get one helpful heads-up during your work, what should it say or do?*** Table 3 summarizes participants' single top-choice alert—the one they would keep if only one function existed. The question isolates what workers truly find essential rather than generally useful. Related responses were merged into three clear functions.

Table 3. One Most-Helpful Heads-Up (n = 17)

Function (standardized)	**Description**	**Participants (ID, Trade, Role)**	**%**
Moving-Equipment Proximity	Short vibration and direction arrow when a pump arm, cart, or suspended load enters the work zone.	P05, P06, P07, P12, P13, P15, P16, P17	47%
Heat Trend / Water / Rest Prompt	Early signal when body or environment heat rises, prompting water or a short break before fatigue or heat stroke sets in.	P01, P02, P03, P04, P14	29%
Electrical Proximity	Gentle vibration near energized rooms or panels to maintain a safe distance without distraction.	P08, P09, P10, P11	24%

Nearly half the sample (47%) prioritized proximity to moving equipment, reflecting the constant motion of cranes, carts, and pump arms in tight zones. About one-third (29%) chose heat-pacing alerts, emphasizing hydration and a steady rhythm during long pours. The remaining 24%, all electricians, preferred electrical proximity reminders that preserve focus while avoiding energized areas. Workers primarily selected proximity to moving equipment for immediate hazard avoidance, while supervisors favored *heat* or *electrical* cues linked to oversight and situational control.

Enablers of WSDS Usefulness

Question addressed: ***What would make a heads-up or alert more useful?*** Participants identified six enablers that make wearable alerts practical: vibration-first feedback, glove-press confirmation, bilingual cues, quiet windows, durable low-profile design, and role- or area-specific modes.

Collectively, these features ensure that alerts remain fast, glove-friendly, language-agnostic, respectful of precision work, and fair in visibility.

Vibration First—Fastest Attention. Workers emphasized that a short vibration before any sound or visual cue allows quick reaction without interruption. “Start with vibration; I will feel it and react without stopping” (P01, Rebar/Concrete, Worker). A second worker added that vibration cuts through deck noise better than tones (P14, Concrete/Rebar, Worker). Participants agreed that this order keeps signals private, fast, and compatible with gloves in loud environments.

Glove-Press Confirm—Single Press. Participants requested a one-press acknowledgment while wearing gloves, avoiding screens or menus. “I should press once with gloves to say, ‘got it’ and keep working” (P05, Ironworker/Steel Worker). A supervisor noted this single confirmation keeps crews moving during busy pours (P03, Rebar/Concrete, Supervisor). Such simplicity maintains focus and prevents alert backlog.

Bilingual + Icons—Shared Understanding. Clear icons and short phrases in Spanish and English ensure comprehension across mixed crews. “Icons with Spanish and English make it clear for everyone” (P08, Electrical, Worker). A supervisor added that bilingual icons aid instant recognition when seconds matter (P11, Electrical, Supervisor).

Quiet Window—Brief Mute. For detailed work such as bolt-up or terminations, workers preferred temporary muting. “Give me a two-minute quiet window while I land bolts, then bring alerts back” (P06, Ironworker/Steel, Worker). This prevents distraction and preserves trust.

Durable & Low-Profile—All-Shift Comfort. Participants requested all-shift battery life, water resistance, and slim hardware that avoids snagging. “It should last the whole shift, be sweat-proof, and not catch on anything” (P06, Ironworker/Steel Worker).

Role/Area Modes—Anonymous Views. Workers favored area-based data displays without names. “Show heat by crew area without names; supervisors can set lift zones” (P12, Concrete/Rebar, Worker). Such anonymity promotes fairness and prevents misuse.

Discussion

Workers and supervisors without prior WSD experience could clearly identify where these technologies would improve safety and how alerts should function to be practical. Most favored short, well-timed cues that help pace heat, avoid moving equipment, and maintain distance from energized areas—framing usefulness as a matter of timing and specificity: a brief vibration before a hazard arises. These findings extend earlier model-based studies by grounding perceived usefulness in lived, task-level reasoning (Awolusi et al., 2020; Nnaji et al., 2021).

Participants’ perspectives reinforced patterns reported in prior surveys while adding trade- and task-level detail. Nnaji et al. (2021) found that both managers and field personnel rated WSD functions such as “Smoke/Fire detect,” “Proximity to energized cable,” and “Proximity to potential falling object” as among the most critical. The interview findings reported in this paper align with these priorities but also elevate heat pacing as equally salient. This added emphasis is expected because the interviews were conducted during the summer, when heat conditions on jobsites are typically more intense and therefore more noticeable in workers’ reasoning about which alerts would help. In parallel, the eight WSD functions identified by Fasoyinu et al. (2025a), which are: health monitoring, hazard identification, and environmental sensing, map closely onto the themes surfaced in this study, further suggesting convergence between model-based evidence and field-grounded assessments.

Equally important were boundaries where alerts lose value. Participants cited low-risk periods, fine-detail tasks, inactive equipment, and excessive or false alerts as situations requiring quiet modes. These align with prior warnings that intrusive or unreliable cues undermine trust and cause device abandonment (Schall et al., 2018). Collectively, workers underscored that effective WSDs must be nonintrusive, credible, and integrated into task rhythms—embodying the principle of “less but better” to ensure usefulness, trust, and sustained adoption.

Conclusion, Limitations, and Future Work

This paper reports findings from a qualitative study examining how construction fieldworkers and front-line supervisors with no prior workplace use of wearable sensing devices (WSDs) perceive their usefulness for jobsite safety monitoring. Semi-structured interviews were conducted with 17 participants (11 trade workers and 6 supervisors) across four active project sites and three trades (concrete/rebar, steel/ironwork, and electrical) to identify where WSD alerts are most and least useful during construction work.

Interview data were coded following a two-stage process and organized into themes. Findings show that perceived usefulness is practical and task-dependent. Five WSD safety application areas emerged: (1) heat-exposure nudges, (2) moving-equipment proximity alerts, (3) electrical-proximity warnings, (4) edge/height reminders, and (5) ceiling air or dust notifications. Participants most valued proximity alerts for moving equipment, followed by early heat prompts and warnings near energized rooms or cables. The interviews also clarified “quiet zones” where alerts should pause or reduce intensity, including low-risk periods, precision tasks requiring full attention, verified safe conditions (for example, parked equipment or de-energized work), and situations where alerts are too frequent or inaccurate.

These findings point to clear implementation priorities. Early use should focus on a small, high-value alert set and on simple delivery methods that minimize disruption, such as vibration-first cues, glove-compatible device interfaces, multiple-language cues (for Spanish-speaking workers), role-specific modes, and logic that stays quiet when risk is low. Limitations include a modest sample size (n=17), a single general contractor scope, and reliance on structured notes rather than audio recordings. Nonetheless, multi-trade representation, rapid post-interview note expansion, and bilingual verification strengthen the credibility of the qualitative record and coding decisions. Accordingly, the findings should be interpreted as exploratory and generalized with caution.

Future research could extend this work in two directions: data governance (transparency, visibility, trust) and organizational enablers (policy, leadership, training for sustained use). Governance studies should specify what data are collected, who can view them, how they are shared, and how long they are retained, because these rules shape willingness to participate. Organizational studies should examine rollout strategies, supervisor practices, and training that make alerts actionable and fair. Further work should test these requirements in jobsite pilots, quantify false-alert burden and disruption, and replicate across regions and trades to confirm transferability. It should also compare area-level versus individual-level displays and document accountability mechanisms.

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