

# **University of Wales Trinity Saint David. CertHE Applied Leadership and Management Outreach**

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# BMSK 4014: Problem Solving and Decision Making - Construction Site Safety

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## 1 - Executive Summary

This report investigates the persistent issue of construction site safety breaches and applies structured problem-solving methods to identify root causes and evaluate potential interventions. Initial analysis highlighted recurring problems linked to workforce behaviour, unclear processes, limited resources, and weak enforcement practices. To address these challenges, a range of decision-making tools were employed, including brainstorming, mind mapping, Ishikawa (fishbone) diagrams, and root cause analysis, which collectively provided a comprehensive understanding of underlying issues.

Three remedial options were then developed: **Enhanced Safety Training, Improved Signage and PPE Accessibility**, and **Stricter Enforcement with Incentives**. These were evaluated using a Weighted Grid Analysis (WGA) and Cost–Benefit Analysis (CBA). The WGA identified signage and PPE as the most effective short-term measure, while the CBA demonstrated that training delivers the most sustainable long-term cultural improvements. Enforcement was recognised as a useful supporting mechanism but insufficient as a standalone solution.

Based on these findings, a phased hybrid strategy is recommended. Immediate improvements will be achieved through signage and PPE upgrades, followed by comprehensive training to embed behavioural change, reinforced by consistent enforcement. Communication and monitoring plans accompany this approach to ensure stakeholder engagement, accountability, and continuous improvement.

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## 2 - Introduction

In the construction industry, ensuring a safe working culture on busy construction sites remains a constant challenge. Construction sites are complex, dynamic environments where multiple trades, temporary works, and shifting hazards intersect.

The complex problem identified is frequent near-miss incidents stemming from non-adherence to safety protocols, such as failing to wear personal protective equipment (PPE) or disregarding safety barriers around hazardous areas (Health and Safety Executive [HSE], 2023). This problem is critical as it heightens the risk of serious injuries or fatalities, disrupts project timelines, and raises concerns about regulatory compliance with bodies like the HSE in the UK. The issue impacts workers, who face immediate physical dangers and psychological stress; supervisors and managers, who must divert time from productivity to address safety breaches; and the organisation, which risks penalties, reputational damage,

and increased insurance premiums. External stakeholders, including clients and regulators, may also suffer from delays in project delivery and loss of confidence in the industry's standards.

Such breaches may result from factors like inadequate training, a weak safe working culture, fatigue, or conflicts between productivity demands and safety measures (Umar, 2021). For example, in the UK, the construction industry accounts for a high proportion of workplace fatalities, with 45 deaths reported in 2022/23, often linked to falls from height or being struck by moving vehicles (Health and Safety Executive, 2023). Addressing this requires a comprehensive approach, as unresolved issues lead to operational inefficiencies, financial losses, and long-term harm to staff morale. This report analyses the problem using various tools, proposes solutions, evaluates them, and outlines implementation and communication plans to foster a safer construction environment. By prioritising safety, organisations can meet legal obligations under the Health and Safety at Work etc. Act 1974 while enhancing overall project efficiency and sustainability (Carter, 2023).

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### **3 - Problem Analysis**

Before we take a look into specific analytical tools, it is essential to outline the broader context of construction site safety issues. The construction sector in the UK is one of the most hazardous industries, with statistics indicating that workers are four times more likely to be killed at work compared to the average across all sectors (HSE, 2023). Common problems include falls from height, slips and trips, exposure to harmful substances, and machinery accidents, often exacerbated by poor adherence to protocols. These issues are compounded by factors such as tight deadlines, subcontractor involvement, and varying levels of worker experience. Analysing this problem requires creative and structured methods to uncover root causes and potential solutions, ensuring a holistic understanding that informs effective interventions.

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### **4 - Brainstorming**

Brainstorming is a collaborative technique designed to generate a wide range of solutions for complex issues (Atlassian, 2024). Within construction safety, it encourages creative thinking and draws on diverse perspectives from site managers, workers, health and safety officers, and subcontractors. By exploring multiple options - such as enhanced training, clearer signage, or wearable technologies - brainstorming avoids over-reliance on a single fix and exposes underlying barriers like attitudes or resource limitations. Its inclusive nature ensures shared ownership of solutions, leading to more robust outcomes.

Brainstorming was used to generate a broad set of problem hypotheses and solution ideas. Ground rules included deferment of judgement, quantity over quality in the first pass, and building on others' suggestions.

### The exercise surfaced recurring themes:

- PPE access and placement.
- Inconsistent signage.
- Gaps in refresher training for transient labour.
- Unclear accountability among subcontractors.

### On the solutions side, the strongest candidates included:

1. Enhanced, scenario-based safety training.
2. Redesigned signage and PPE points.
3. A fair, transparent enforcement scheme with recognition for positive behaviours.

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## **5 - Mind Mapping**

Mind mapping provides a visual method of organising safety challenges and possible remedies around a central theme (Colman, 2016). It clarifies links between workforce behaviour, company policies, hazards, and regulations, offering a comprehensive overview in one diagram. The technique simplifies complex issues, shows how improvements in one area affect others (e.g., training reducing fatigue errors), and breaks problems into manageable parts such as “human factors” or “site risks.” This structured yet visual approach makes problem-solving more systematic and transparent.

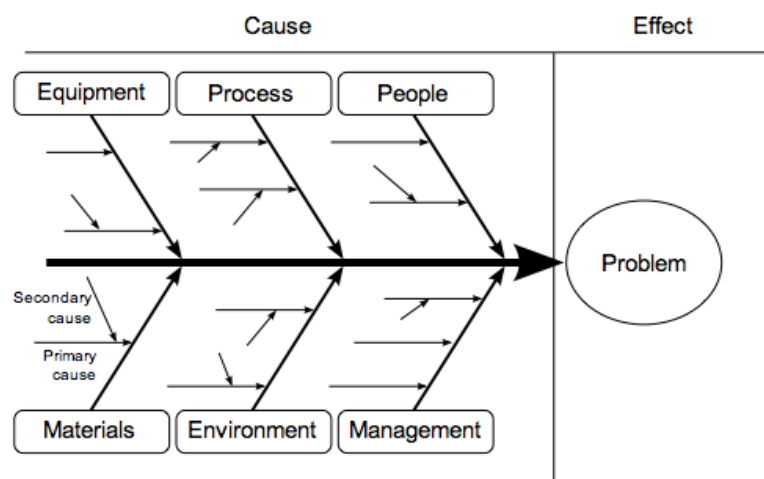


## 6 - Ishikawa (Fishbone) Diagram

The Ishikawa, or fishbone diagram, categorises causes of safety breaches into people, process, equipment, materials, environment, and management (Thompson, 2019).

- **People:** Inadequate training, resistance to change, and fatigue-related errors.
- **Process:** Poor communication, unclear procedures, and inconsistent enforcement.
- **Equipment:** Outdated tools, limited digital monitoring, or insufficient PPE.
- **Materials:** Low-quality or inaccessible PPE, unclear manuals, and ineffective signage.
- **Environment:** Congested layouts, poor lighting, weather hazards, and remote sites.
- **Management:** Weak safety culture, poor planning, limited investment, or competing priorities.

By grouping issues under these categories, the diagram highlights how different factors interact to create unsafe conditions. It provides a structured overview that helps organisations identify not only surface-level problems but also root causes requiring long-term solutions.



## 7 - 5 Whys Analysis

The Five Whys technique is a structured problem solving method designed to uncover the root cause of an issue through iterative questioning (Liker, 2004). By asking "Why?" successively - typically five times - investigators can move beyond surface-level symptoms to identify deeper systemic causes. The process begins with a clear statement of the problem, followed by the first "Why?" question to explore the reason for its occurrence. Each subsequent "Why?" builds upon the previous answer until the fundamental cause is identified, enabling the development of more effective and lasting corrective actions.

### **Example – Construction Site Safety Breach**

**Safety Breach:** A construction worker used an angle grinder without wearing eye protection.

1. **Why** was the worker not wearing safety goggles?  
→ Because none were available at the workstation.
2. **Why** were there no goggles at the workstation?  
→ Because the last pair had broken earlier that day.
3. **Why** was the broken pair not replaced immediately?  
→ Because the replacement PPE stockroom was locked, and only a supervisor had access.
4. **Why** was the supervisor not available to unlock the stockroom?  
→ Because they were attending an off-site meeting during work hours.
5. **Why** was there no backup process for PPE access when the supervisor is away?  
→ Because the site's safety procedures do not include contingency measures for PPE distribution.

**Findings:** The worker's failure to wear eye protection was caused by unavailable PPE, but the root issue is the lack of a backup process for PPE access when supervisors are absent. Implementing a contingency system and ensuring sufficient stock at workstations will prevent similar incidents and improve overall site safety.

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## **8 - Root Cause Analysis**

The main cause of non-compliance is a weak safety culture that does not prioritise training and enforcement, leading to habitual disregard for safety protocols. Secondary root causes include inadequate resources for PPE and signage, as well as environmental factors like site overcrowding, supported by incident logs showing 15 near-misses in the past month (HSE, 2023; Umar, 2021).

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## **9 - Possible Solutions to remedy Construction Site Safety Breaches**

### **Enhanced Safety Training Programme:**

Implement regular, interactive safety training sessions, including simulations, practical exercises, and virtual reality modules to engage workers effectively. This would cover PPE usage, hazard recognition, and emergency responses, with sessions tailored to different worker groups such as subcontractors.

**Advantages:** Highly effective at building awareness and reducing incidents. Improves long-term safety culture. Scalable for large sites.

**Disadvantages:** High initial costs for trainers and materials. Time-consuming, potentially disrupting work schedules. Requires ongoing commitment.

### **Improved Site Signage and PPE Accessibility**

Install clear, multilingual safety signs and ensure PPE is readily available at all site entrances, with automated dispensers and regular stock checks. Integrate digital signage for dynamic hazard updates.

**Advantages:** Low-cost, quick implementation. Immediate impact on visibility and compliance. Minimal training needed.

**Disadvantages:** Ongoing maintenance required. Potential for vandalism or wear. Does not address behavioural root causes.

### **Stricter Enforcement with Incentives**

Enforce protocols through regular inspections, coupled with rewards like bonuses or recognition for compliant workers, and penalties for violations. Use apps for real-time reporting.

**Advantages:** Encourages positive behaviour change. Balances enforcement with motivation. Can integrate with existing processes.

**Disadvantages:** May create resentment if seen as punitive. Ongoing costs for incentives. Risk of short-term compliance only.

These solutions link directly to root causes: training addresses people and process factors, signage tackles equipment and environment, and enforcement strengthens management (Smith & Brown, 2021; Chan et al., 2023).

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## **10 - Decision-Making Technique: Evaluating Solutions for Construction Site Safety Issues**

### **Weighted Grid Analysis (WGA)**

A weighted grid analysis was a tool used to evaluate the three possible solutions for remedying construction site safety breaches: Enhanced Safety Training Programme, Improved Site Signage and PPE Accessibility, and Stricter Enforcement with Incentives. The data collected can be reviewed via cost-benefit analysis, grid evaluation, and ratio analysis. The aim isn't merely selecting the cheapest but pinpointing the most fitting, offering optimal balance among cost, impact, and long-term gains. The analysis assigns weights to key factors (Cost, Speed of Implementation, Complexity, and Effectiveness) based on their importance, scores each solution against these factors, and calculates a total to identify a possible best option.

| Factors                 | Weights           | Enhanced Safety Training Programme | Improved Site Signage and PPE Accessibility | Stricter Enforcement with Incentives |
|-------------------------|-------------------|------------------------------------|---------------------------------------------|--------------------------------------|
| Cost                    | 25% (25)          | 3 (15)                             | 4 (20)                                      | 3 (15)                               |
| Speed of Implementation | 20% (20)          | 2 (10)                             | 5 (20)                                      | 4 (16)                               |
| Complexity              | 20% (20)          | 3 (12)                             | 5 (20)                                      | 3 (12)                               |
| Effectiveness           | 35% (35)          | 5 (35)                             | 3 (21)                                      | 4 (28)                               |
| <b>Total</b>            | <b>100% (100)</b> | <b>72</b>                          | <b>81</b>                                   | <b>71</b>                            |

### Explanation of Scores and Weights:

- **Cost (25%):** Reflects initial and ongoing financial investment. Improved Site Signage and PPE Accessibility scores highest (4) due to its affordability and quick setup, while Enhanced Safety Training Programme (3) and Stricter Enforcement with Incentives (3) involve higher costs for trainers/incentives.
- **Speed of Implementation (20%):** Measures how quickly the solution can be rolled out. Improved Site Signage and PPE Accessibility leads (5) with its immediate deployment potential, followed by Stricter Enforcement with Incentives (4), and Enhanced Safety Training Programme (2) due to time needed for planning and sessions.
- **Complexity (20%):** Assesses ease of implementation. Improved Site Signage and PPE Accessibility scores highest (5) with minimal training required, while Enhanced Safety Training Programme (3) and Stricter Enforcement with Incentives (3) involve more coordination and effort.
- **Effectiveness (35%):** The most weighted factor, reflecting long-term impact on safety. Enhanced Safety Training Programme scores highest (5) for addressing root causes and building culture, followed by Stricter Enforcement with Incentives (4), and Improved Site Signage and PPE Accessibility (3) for its limited behavioural influence.

### Cost Benefit Analysis (CBA)

A cost–benefit analysis was used to assess three interventions for improving site safety. **Enhanced safety training** (£28k–£32k) is expected to reduce incidents by 25%, lower insurance claims, and improve safety culture, achieving a positive return within one to two years. **Improved signage and PPE accessibility** (£6k–£7k) provides immediate compliance benefits, fewer near-misses, and minimal disruption, with payback projected within six months. **Stricter enforcement with incentives** (£12k–£15k annually) can strengthen accountability and short-term compliance, though its return depends on consistent application. Overall, signage and PPE offer the quickest gains, training supports long-term improvement, and enforcement is most effective when backed by sustained management focus.

| Intervention                | Estimated Cost (Year 1) | Anticipated Benefits                                                                    | ROI / Payback Period                   |
|-----------------------------|-------------------------|-----------------------------------------------------------------------------------------|----------------------------------------|
| Enhanced Safety Training    | £28k–£32k               | 25% reduction in incidents; lower insurance claims; improved culture                    | Positive ROI within 1–2 years          |
| Signage & PPE Accessibility | £6k–£7k                 | Immediate compliance gains; fewer near-misses; low disruption                           | ROI within 6 months                    |
| Enforcement with Incentives | £12k–£15k annually      | Stronger short-term compliance; improved accountability; recognition of safe behaviours | Moderate ROI, dependent on consistency |

## Conclusion:

The combined evaluation using the Weighted Grid Analysis (WGA) and Cost–Benefit Analysis (CBA) highlights the importance of balancing short-term practicality with long-term sustainability. The WGA identifies **Improved Site Signage and PPE Accessibility** (score 81) as the strongest immediate measure, due to its low cost, ease of implementation, and rapid impact on compliance. In contrast, the CBA demonstrates that the **Enhanced Safety Training Programme**, despite higher upfront costs, delivers the most sustainable long-term benefits by reducing incidents, lowering insurance claims, and fostering a stronger safety culture. **Stricter Enforcement with Incentives** ranks lower in both analyses; while it can support compliance and accountability, its effectiveness is highly dependent on consistent application and may risk workforce resistance if applied in isolation.

Taken together, the findings suggest that a **phased hybrid approach** is optimal: signage and PPE accessibility should be prioritised for immediate gains, training integrated to secure enduring cultural improvements, and enforcement mechanisms applied as a complementary tool to reinforce behaviours. This integrated strategy provides both cost-effective short-term results and a sustainable foundation for future safety practices (Johnson, 2020; Lee & Patel, 2022).

## 11 - Implementation: Enhanced Safety Training Programme

### Gantt Chart

A Gantt chart is a project management tool that visually represents the sequencing and duration of activities over time. It is particularly effective for demonstrating how multiple interventions can be scheduled, overlapped, and monitored to ensure efficient implementation (Kerzner, 2017). In this case, the Gantt chart provides a structured timeline for rolling out the three proposed safety interventions: **Improved Site Signage and PPE Accessibility**, **Enhanced Safety Training**, and **Stricter Enforcement with Incentives**.

The purpose of the chart is to illustrate how these measures can be delivered in a phased yet overlapping manner to maximise impact. Signage and PPE upgrades are prioritised in the early months to deliver immediate compliance gains. Training is introduced shortly afterwards to reinforce behavioural change and embed long-term improvements, while enforcement and incentives are layered in from Month 3 onwards to consolidate progress. By mapping these activities against time, the Gantt chart clarifies responsibilities, prevents scheduling conflicts, and ensures that short-term actions align with longer-term cultural and operational safety objectives.

Detailed Gantt Chart (Months 1–6)

| Activities                                | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 |
|-------------------------------------------|---------|---------|---------|---------|---------|---------|
| Signage & PPE                             |         |         |         |         |         |         |
| Site audit (hazard mapping)               | xxxxxxx |         |         |         |         |         |
| Install new signage                       | xxxxxxx | xxxxxxx |         |         |         |         |
| Upgrade PPE stations (distribution pts)   | xxxxxxx | xxxxxxx |         |         |         |         |
| Awareness campaign (multilingual posters) |         | xxxxxxx |         |         |         |         |
| Ongoing monitoring & adjustments          |         |         | xxxxxxx | xxxxxxx | xxxxxxx | xxxxxxx |
| Enhanced Safety Training                  |         |         |         |         |         |         |
| Develop training modules                  |         | xxxxxxx |         |         |         |         |
| Hire/brief trainers                       |         | xxxxxxx |         |         |         |         |
| Schedule training sessions                |         |         | xxxxxxx |         |         |         |
| Conduct Batch 1                           |         |         | xxxxxxx |         |         |         |
| Conduct Batch 2                           |         |         |         | xxxxxxx |         |         |
| Evaluate effectiveness                    |         |         |         |         | xxxxxxx |         |
| Follow-up refresher sessions              |         |         |         |         |         | xxxxxxx |

|                                       |         |         |         |         |
|---------------------------------------|---------|---------|---------|---------|
| <b>Enforcement &amp; Incentives</b>   |         |         |         |         |
| Define enforcement policies           | xxxxxxx |         |         |         |
| Launch incentive scheme (recognition) | xxxxxxx |         |         |         |
| Apply monitoring & reporting systems  | xxxxxxx | xxxxxxx | xxxxxxx | xxxxxxx |
| Issue monthly compliance reports      |         | xxxxxxx | xxxxxxx | xxxxxxx |
| Adjust incentives based on feedback   |         |         |         | xxxxxxx |

### **Conclusion:**

**Month 1:** Prioritise signage installation, PPE station upgrades, and initial hazard mapping to deliver quick compliance gains (WGA).

**Month 2:** Continue signage roll-out and awareness campaigns while developing training resources and recruiting instructors.

**Month 3:** Launch the first training sessions, supported by enforcement policies and incentive schemes to reinforce early adoption.

**Month 4:** Deliver the second wave of training, extend enforcement monitoring, and begin issuing compliance reports.

**Month 5:** Evaluate training effectiveness through questionnaires and incident data, refine incentive measures, and maintain signage/PPE oversight.

**Month 6:** Conduct refresher sessions, adjust enforcement mechanisms, and review overall safety impact to secure long-term cultural improvements (CBA).

This phased hybrid approach reflects the WGA’s identification of signage and PPE as the most effective short-term measure, the CBA’s recognition of training as the most sustainable investment, and the role of enforcement as a complementary mechanism to reinforce compliance. Together, these measures ensure both immediate improvements and lasting organisational benefits.

## **12 - Communication Plan**

To secure full stakeholder engagement, the communication strategy integrates procedures and timelines that align with the phased introduction of signage and PPE improvements, enhanced safety training, and enforcement with incentives. The overarching objective is to ensure that all key groups—workers, supervisors, senior management, clients, and regulators—are consistently informed, prepared, and supportive of the staged implementation.

Internally, the plan begins with early briefing sessions to introduce the phased approach, followed by weekly email updates outlining progress on signage upgrades, training schedules, and enforcement measures. Workers will receive concise, accessible communications emphasising both the immediate benefits of improved signage/PPE and the longer-term cultural value of training. Supervisors and managers will be given tailored updates through meetings and digital dashboards to monitor compliance trends and address potential resistance.

Externally, clients and regulators will be kept informed through formal progress reports and compliance updates, highlighting the evidence-based rationale drawn from the Weighted Grid Analysis (WGA) and Cost–Benefit Analysis (CBA). This ensures transparency and demonstrates that the interventions not only meet immediate compliance needs but also strengthen organisational resilience over time.

The communication plan spans from planning through to post-implementation evaluation, supporting smooth adoption, reinforcing accountability, and ensuring that feedback loops are established. By coordinating consistent, clear, and audience-specific messages throughout the six-month roll-out, the plan aims to build trust, identify emerging issues, and secure stakeholder commitment to both short-term improvements and long-term safety outcomes (Davis & Green, 2020).

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## **13 - Monitoring Plan**

The successful implementation of the safety interventions—**Improved Site Signage and PPE Accessibility, Enhanced Safety Training, and Stricter Enforcement with Incentives**—requires a comprehensive set of monitoring and review procedures. These mechanisms ensure that activities progress according to schedule, resources are used efficiently, and both short-term and long-term safety objectives are achieved.

### **Progress Tracking and Reporting**

Weekly status reports will document completed tasks, upcoming deadlines, and emerging issues across all three interventions. These will be distributed to project managers, site supervisors, and key stakeholders to maintain transparency and accountability. Signage and PPE upgrades will be tracked against installation milestones, training against participation targets, and enforcement against compliance metrics.

### **Project Management Software**

Tools such as Microsoft Project will be used to monitor real-time progress. This allows visual tracking of timelines, responsibilities, and interdependencies between interventions, fostering ownership and accountability at every level (Wilson, 2021).

## Reviews

Formal review sessions will be scheduled after major stages: signage installation, training delivery, and enforcement roll-out. These reviews will assess whether milestones have been achieved, evaluate quality standards, and identify deviations from the original plan. Performance measures will include metrics such as:

- Worker participation rates in training sessions.
- Reduction in near-misses and incidents (target: 50% within six months).
- Worker and supervisor feedback on signage clarity, PPE accessibility, and enforcement fairness.

## Testing and Quality Control

Quality assurance procedures will verify that each intervention delivers its intended impact. For signage and PPE, site audits will confirm accessibility and maintenance; for training, pilot sessions and participant surveys will provide feedback for refinement; and for enforcement, compliance reporting systems will track behavioural outcomes. A structured review cycle will ensure feedback from workers, supervisors, and regulators is systematically collected and integrated into ongoing improvements (Oakley, 2024).

## Post-Implementation Evaluation

Effective risk management, feedback loops, and contingency planning will underpin the entire monitoring process. Issue-tracking systems will log challenges in real time, while regular stakeholder meetings will support rapid problem resolution. At the conclusion of the roll-out, a comprehensive evaluation report will assess the overall impact of the hybrid strategy, drawing on both WGA and CBA findings. This will highlight reductions in safety breaches, return on investment, and improvements in organisational culture, ensuring lessons are captured for continuous development (Lee & Patel, 2022; Dörner & Funke, 2017).

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