TCM 2430 – Construction Safety

Week 14 – Course Recap for Final Exam



Dr. Tommy Tafazzoli

TCM 2430 – Construction Safety

Week 1 – What is OSHA?



Dr. Tommy Tafazzoli

What is the main reference for safe practices in construction?

The reference for construction safety practices are **OSHA standards**



What is OSHA



- OSHA stands for the **O**ccupational **S**afety and **H**ealth **A**dministration
- It is a **federal** agency within the United States **Department of Labor**.
- OSHA was established in 1970 with the goal of **ensuring safe and healthy working conditions** for employees across various industries.
- The agency **develops and enforces standards** to protect workers from **hazards** on the job.

What are OSHA's responsibilities *(slide 1 of 2)*

1. **Setting and enforcing workplace safety and health standards:** OSHA establishes regulations and standards that employers are required to follow to ensure the safety and health of their employees. These standards cover a wide range of topics, including exposure to hazardous chemicals, machinery safety, electrical hazards, and more.

2. **Providing training, education, and assistance:** OSHA offers training programs, materials, and resources to educate employers and employees about safety and health practices in the workplace. They also provide consultation services for businesses to help them identify potential hazards and improve their safety programs.

3. **Conducting inspections:** OSHA conducts inspections of workplaces to ensure that employers are complying with safety and health standards. Inspections can be planned or in response to complaints or reported accidents.

What are OSHA's responsibilities *(slide 2 of 2)*

4. ***Investigating complaints and accidents:*** OSHA investigates complaints from employees, reports of workplace accidents, and other incidents related to workplace safety to determine if any violations of safety standards have occurred.

5. ***Promoting worker rights:*** OSHA enforces various laws that protect workers' rights, including the right to a safe workplace, the right to file complaints about unsafe conditions, and protection against employer retaliation for reporting safety concerns.

6. ***Collaborating with states:*** While OSHA is a federal agency, some states have their own state-level OSHA programs that operate under federal guidelines. These state programs can have their own safety and health standards, but they must be at least as effective as the federal OSHA standards.



What is OSHA-30?

- OSHA 30 refers to a 30-hour training program designed by the Occupational Safety and Health Administration (OSHA) in the United States. It is aimed at providing comprehensive safety training for workers and supervisors in various industries to help them recognize, avoid, and mitigate potential hazards in the workplace. The training covers a wide range of occupational safety and health topics and is intended to enhance safety awareness and promote a safer work environment.

- The OSHA 30 training program is more in-depth than the OSHA 10 training program, which is a 10-hour training course covering fundamental safety topics. OSHA 30 is particularly suited for supervisors, managers, foremen, and workers who have responsibilities for safety oversight and who need a more comprehensive understanding of workplace safety regulations and practices.

What topics are covered in OSHA-30?

- Hazard recognition and prevention.
- Personal protective equipment (PPE).
- Electrical safety.
- Fall protection.
- Confined space entry.
- Hazardous materials handling.
- Emergency response procedures.
- Lockout/Tagout procedures (energy control).
- Machine guarding and equipment safety.
- Health hazards in the workplace.
- Recordkeeping and reporting requirements.



Who does OSHA cover?

- OSH Act (also known as Public Law 91-596) covers all private sector employers and their workers in the 50 states and all territories and jurisdictions under federal authority.

- OSHA coverage includes, but is not limited to manufacturing, construction, longshoring, agriculture, law, medicine, and charity and disaster relief



What is not COVERED?

Who are NOT covered in OSHA?

- The self-employed;
- Immediate members of farming families not employing outside workers;
- Mine workers, certain truckers and transportation workers, and atomic energy workers who are covered by other federal agencies;
- Public employees in state and local governments, although some states have their own plans that cover these workers.

Why is OSHA important to workers? *(Slide 1 0f 4)*

- **Ensures Workplace Safety:** OSHA sets and enforces safety and health standards in workplaces. This helps ensure that workers are provided with safe and healthy working conditions, reducing the risk of accidents, injuries, and illnesses on the job.

- **Reduces Injuries and Fatalities:** OSHA regulations are designed to identify and mitigate workplace hazards. By adhering to OSHA standards, employers can implement measures that prevent accidents and significantly reduce the likelihood of injuries and fatalities.

- **Empowers Workers:** OSHA empowers workers by giving them the right to know about the potential hazards they might encounter on the job. This includes access to information about hazardous substances, protective measures, and safety protocols. It also allows workers to report safety concerns without fear of retaliation.

- **Promotes Training and Education:** OSHA encourages employers to provide training and education to workers about workplace hazards and safety practices. Proper training increases workers' awareness of potential risks and equips them with the knowledge to protect

Why is OSHA important to workers? *(Slide 2 0f 4)*

- **Prevents Health Hazards:** OSHA not only addresses immediate safety risks but also focuses on long-term health hazards. Exposure to hazardous chemicals, noise, and other health risks can lead to chronic illnesses over time. OSHA standards aim to prevent these health hazards through regulation and awareness.

- **Supports Worker Rights:** OSHA protects workers' rights to a safe workplace. Workers have the right to report safety concerns, participate in safety committees, and be involved in the identification and mitigation of workplace hazards.

- **Reduces Financial Burden:** Workplace accidents and illnesses can lead to financial burdens for workers, employers, and society as a whole. Lost productivity, medical costs, and disability benefits can strain individuals and businesses. OSHA's emphasis on prevention helps reduce these financial burdens.

- **Boosts Morale and Productivity:** When workers feel safe and valued in their workplace, morale and job satisfaction increase. A safe work environment fosters better teamwork, productivity, and employee loyalty.

- **Industry Best Practices:** OSHA standards often reflect industry best practices for safety. Following these standards not only ensures regulatory compliance but also improves the overall quality of work processes and procedures.

- **Public Awareness:** OSHA's presence and efforts to promote workplace safety create public awareness about the importance of safe working conditions. This awareness encourages employers to prioritize safety and encourages workers to demand a safe workplace.

Why is OSHA important to workers? *(Slide 3 0f 4)*

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Why is OSHA important to workers? *(Slide 4 0f 4)*

- **Boosts Morale and Productivity:** When workers feel safe and valued in their workplace, morale and job satisfaction increase. A safe work environment fosters better teamwork, productivity, and employee loyalty.

- **Introduces Industry Best Practices:** OSHA standards often reflect industry best practices for safety. Following these standards not only ensures regulatory compliance but also improves the overall quality of work processes and procedures.

- **Raises Public Awareness:** OSHA's presence and efforts to promote workplace safety create public awareness about the importance of safe working conditions. This awareness encourages employers to prioritize safety and encourages workers to demand a safe workplace.

Why is OSHA Important to You?

- Take a look at Fatality Inspection Data at this link:
- http://www.osha.gov/dep/fatcat/dep_fatcat.html
- This table contains the weekly summaries of fatalities and catastrophes resulting in the hospitalization of three or more workers.
- Employers must report these incidents to OSHA within eight hours. OSHA investigates all work-related fatalities and catastrophes. After OSHA's investigation is complete, these reports will be updated with inspection results and citation information.

What are worker rights under OSHA? *(Slide 1 0f 3)*

- Under OSHA, workers have several important rights that are designed to protect their safety and well-being in the workplace. These rights are enforced by the Occupational Safety and Health Administration (OSHA). Here are some of the key worker rights under OSHA:

- **Right to a Safe Workplace:** Workers have the right to work in an environment that is free from recognized hazards that are likely to cause serious harm or death. Employers are responsible for providing a safe and healthy workplace.

- **Right to Information:** Workers have the right to be informed about potential hazards in the workplace. This includes access to information about hazardous chemicals, safety data sheets (SDS), and labels on chemical containers.

- **Right to Training:** Workers must receive appropriate training and education on workplace hazards and safety procedures. Training should be provided in a language and format that workers understand.

What are worker rights under OSHA? *(Slide 2 0f 3)*

- **Right to Participate:** Workers have the right to participate in safety activities and committees that focus on identifying and addressing workplace hazards. They can voice their concerns and contribute to making the workplace safer.

- **Right to File a Complaint:** Workers have the right to file a complaint with OSHA if they believe their workplace is unsafe or if they are facing retaliation for raising safety concerns. Complaints can be made confidentially.

- **Right to Whistleblower Protection:** Workers are protected from retaliation if they report safety violations, participate in OSHA inspections, or exercise their rights under the OSH Act. Employers are prohibited from firing or discriminating against workers for asserting their rights.

- **Right to Request an OSHA Inspection:** Workers or their representatives have the right to request an OSHA inspection if they believe there are hazardous conditions in the workplace that are not being adequately addressed by the employer.

- **Right to Review Records:** Workers have the right to review records of workplace injuries and illnesses, as well as records related to workplace exposure to hazardous substances.

What are worker rights under OSHA? *(Slide 3 0f 3)*

- **Right to Medical Records:** Workers have the right to access their own medical records and records of exposure to toxic substances or harmful agents.

- **Right to Request Correction:** Workers or their representatives can request that their employer correct workplace hazards identified during an OSHA inspection.

- These rights are meant to empower workers to take an active role in ensuring their own safety and health at work. Employers are required to inform workers about these rights, and they are not allowed to interfere with workers' exercise of these rights or to retaliate against workers who assert them.



TCM 2430 – Construction Safety

Week 2
Part 1: Hazards in the Construction Industry
Part 2: OSHA's Inspections



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Part 1
Hazards in the Construction Industry

Why is there a significant need to improve safety in construction industry?

- Construction is full of potential hazards.
- Year after year construction is one of the most dangerous industries, with approximately almost 1000 construction workers dying on the job each year.
- Although construction employment equals just over 5% of the workforce, construction injuries account for in excess of 17% of all occupational deaths.
- 1 One out of every seven construction workers is injured each year and one out of every fourteen will suffer a disabling injury.
- The occupational illnesses affecting construction workers have not been accurately measured, but an educated guess is that construction workers suffer both acute (short-term) and chronic (long-term) illnesses from their exposure to chemicals, dusts, fibers, noise, radiation, vibration, and temperature extremes.
- Precautions need to be taken to limit exposures which have the potential to cause detrimental health effects to construction workers

What makes practicing safety on a construction site a challenge?

1. Contractors perform their specialties at unique worksites, such as building skyscrapers or paving highways.
2. The equipment varies with the task being performed, from small tools to large earthmoving equipment.
3. The variety of materials needed to complete the project greatly varies and can include anything from 2 × 4 studs to large steel I-beams.
4. There is a great variety of procedures used during the work being performed, like tying rebar (Figure 1.1) or digging a trench.
5. Each construction process has its own safety or health hazards which can dictate different precautions, from the need for fall protection to the need for respirators for asbestos abatement.
6. The workers or trades (electricians, roofers, etc.) possess special skills and training to perform their specific tasks. This might include operating engineers using cranes or carpenters performing framing.

What challenges will owners, construction managers, contractors, and subcontractors may face if safety standards are not practiced on the field?

1. Hazardous conditions may go unchecked, which can cause death or serious injuries.
2. Subcontractors who have bad safety records or perform their work in an unsafe manner are very culpable.
3. Courts may take a jaundiced view of prime contractors, owners, or managers who cannot separate their control and responsibility over production and safety.
4. Legal actions can result in large awards.
5. Legal fees, increased insurance costs, and loss of other resources (e.g., lost time, lost production) are outcomes of poor control.

What are some actions that can be undertaken to mitigate legal liability about safety for contractor?

1. Make sure that all parties are aware of the content of the contract and knowledgeable of everyone's responsibilities regarding safety.
2. Maintain the power to inspect and monitor safety and health, and work practices to assure safe completion of the project.
3. Hold each contractor and subcontractor accountable for the daily activities of its workforce and the workers' safety.
4. Employ only reputable contractors who can verify their work quality and safety practices.
5. Have a safety policy in place with job safety and health provisions clearly spelled out.
6. Use Hold Harmless/Indemnity provision to waive worker's compensation while assuring certification of insurance and worker's compensation programs.
7. Comply with OSHA Regulations and require all others to do so.

What is the advantage of hiring union workers for a project?

- The unions' contributions to the construction industry include providing productive, quality, and highly trained workers.
- All of the Building and Construction Trade Unions are dedicated to selecting the best individuals to enter their apprentice training programs and assuring that those individuals coming out of their programs are highly trained and some of the most skilled and productive workers in the world.
- A contractor who uses a union crane operator knows that operating a crane is what that worker does for a living on a regular basis and is not a nonunion laborer who only operates a crane at times. Thus, contractors who use union workers have a sense of confidence that they have experienced and trained workers to do specific tasks at the jobsite.

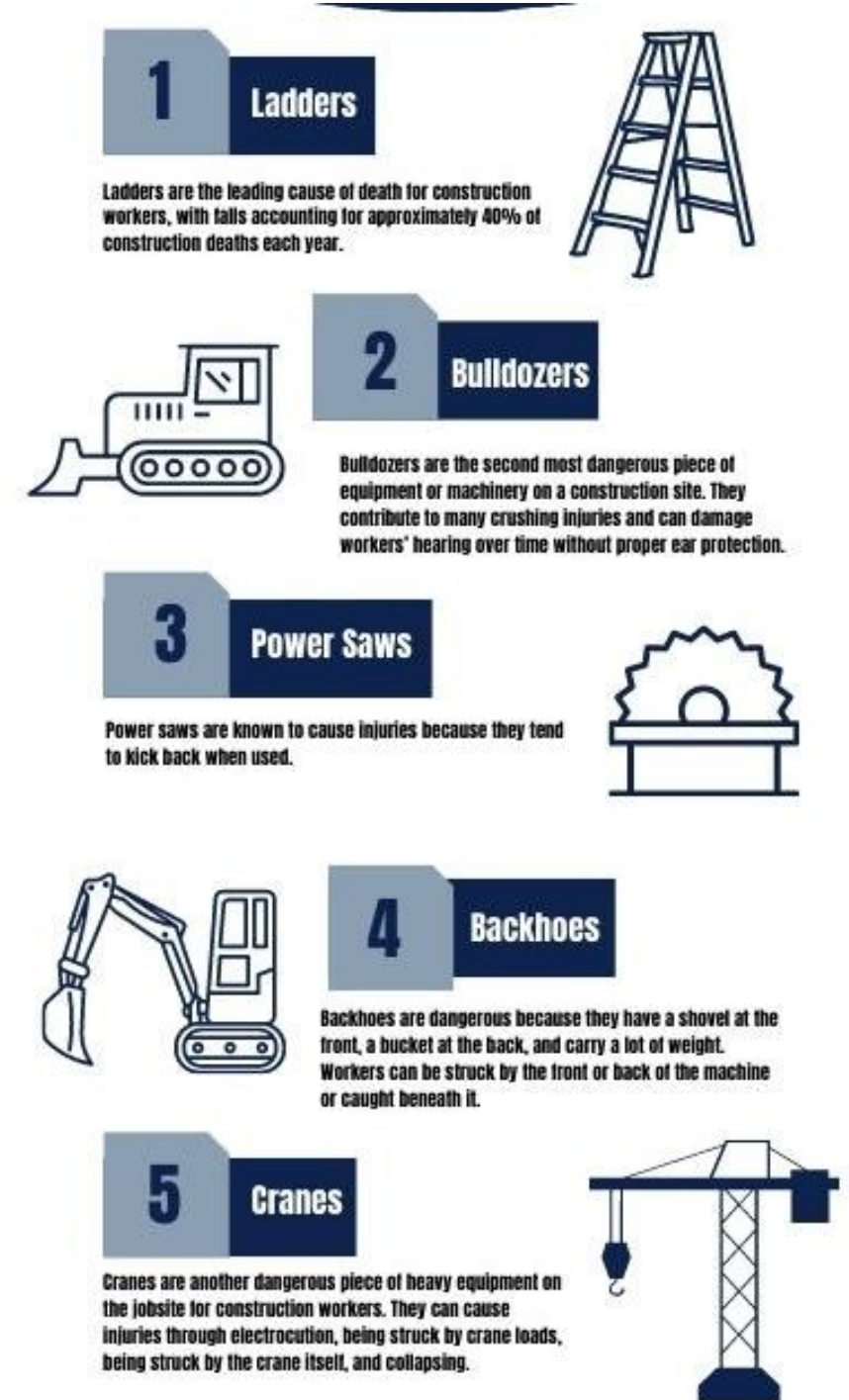
Why does construction differs from other industries when it comes to safety?

- 1. Worksites are dynamic (constantly changing) and temporary as work progresses and other construction trade workers enter the process
- 2. Each worksite may involve several small contractors (subcontractors) performing different types of work in close proximity to each other.
- 3. Several trades may be present on the worksite at the same time, bring with them the specific hazards of their trade, such as operating engineers with heavy equipment or painter with their exotic paints. Thus, there is the potential for exposure to all workers at the worksite not just those of that specific trade.
- 4. At times, on small sites one trade ends up doing all of the tasks usually performed by another trade; therefore, the workers may not be familiar with the hazards involved in performing tasks that are not part of their normal job.
- 5. Working surfaces, equipment, machinery, trenching, and scaffolding are regularly being moved, being assembled and disassembled, or modified. Thus, new hazards are constantly emerging.
- 6. Construction workers frequently change worksites and employers over the course of a year. This results in using new procedures and equipment for which they have not been trained.
- 7. The work is often seasonal which results in both contractors and workers feeling rushed due to a sense of urgency to quickly complete projects. This increases the chances that an accident might occur or that occupational exposure to harmful agents will go unnoticed.
- 8. Construction regulations are often difficult to understand. Sometimes the safety standards or standards governing chemicals do not exist for construction or are designed for factory workplaces, such as the use of asphalt, for which no specific regulation exists.

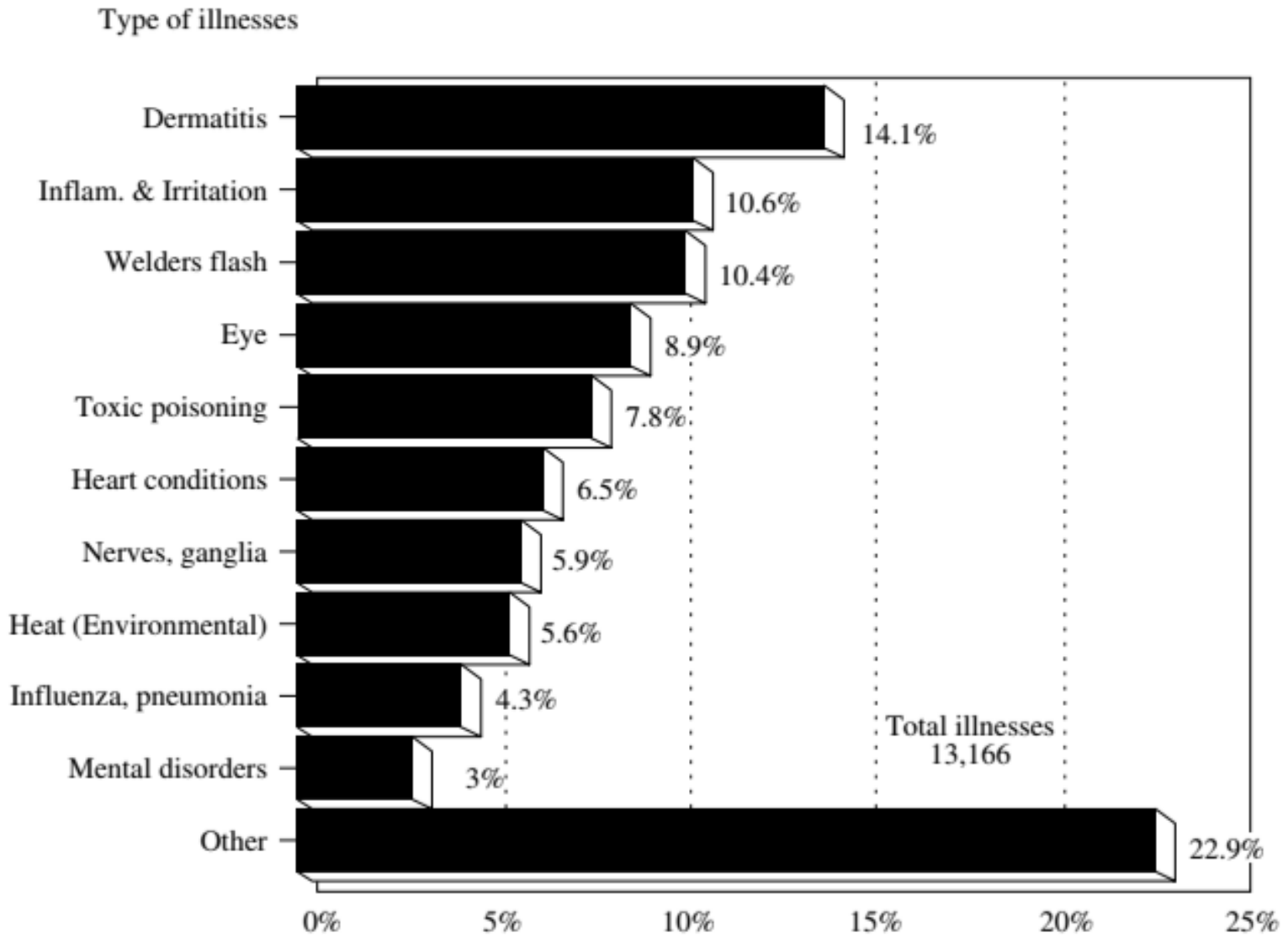
Why do accidents on the jobsite happen?

- 1. Actual physical hazards such as an unstable wall that is being erected.
- 2. Environmental hazards such as toxic atmospheres, oxygen deficiency, noise, radiation, and dust.
- 3. Human factors such as a supervisor's or worker's failure to follow safe work practices
- 4. Lack of or poorly designed safety standards such as no standard for confined space entry or a construction standard or a chemical that is never used in the construction industry.
- 5. Failure to communicate within a single trade such as one equipment operator not following the standard travelway rules and colliding with another operator's equipment, resulting in potential injuries and damage.
- 6. Failure to communicate between two or more trades such as a crane operator contacting high voltage lines while another trade (construction worker) is guiding the piece with a tagline on the material being hoisted.

What are the 5 construction equipment are involved in most jobsite accidents?



Statistics on illnesses in the construction sector



Explain the construction industry relationship to OSHA

- The Construction Industry is regulated by the US Department of Labor's Occupational Safety and Health Administration (OSHA) regarding workplace safety and health.
- As a part of the Occupational Safety and Health Act of 1970, OSHA was mandated to develop a set of regulations specifically for the construction industry that would safeguard those working in the construction industry.
- These standards and regulations have been developed to guide and direct the construction industry in developing and maintaining safe and healthy workplaces for themselves and their workers.

Are OSHA's standards sufficient to establish safety on site?

- The standards or regulations are minimum requirements, and the construction industry should strive to go beyond these minimum requirements in order to insure a safe and healthy jobsite.
- A safe site can be accomplished by adhering to and going beyond the intent of the standard.



TCM 2430 – Construction Safety

Week 3

Part 1: Hazard Perception on the Field

Pert 2: How to motivate staff to practice safety and health practices

Part 3: Construction Safety and Health Programs



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Part 1:
Hazard Perception on the Field





What do we mean by safety perception on a construction job site

- Safety perception on a construction job site refers to how workers, supervisors, and other stakeholders **perceive** and **understand** the level of safety present in the work environment.
- It encompasses their **attitudes, beliefs**, and **opinions** regarding the **potential hazards**, **risks**, and **safety practices** in place on the construction site.
- Safety perception is a **critical aspect** of **ensuring a safe working environment** and **preventing accidents** and **injuries**.

As a construction manager, how can I improve the perception of hazard by workers on the job site? *(Slide 1 of 4)*



1. ***Train and educate the workers:*** Proper training and education about potential hazards and safety protocols can significantly improve hazard perception. Workers who are well-informed are more likely to recognize and respond to dangerous situations.
2. ***Hire more experienced workers:*** Workers with more experience in the construction industry tend to develop a keener sense of hazard perception. They become accustomed to identifying risks and understanding the nuances of various job site scenarios.
3. ***Perform Regular Site Inspections:*** Regular inspections by safety professionals can identify and address potential hazards. When hazards are consistently identified and corrected, it trains workers to be more vigilant in spotting them.

As a construction manager, how can I improve the perception of hazard by workers on the job site? *(Slide 2 of 4)*



4. ***Use Clear Signage and Markings:*** Clearly visible signs and markings that indicate hazardous areas or conditions help workers stay alert and cautious in those zones.
5. ***Establish Effective Communication:*** Open lines of communication among workers and between workers and supervisors are crucial. Encouraging workers to report unsafe conditions or practices can lead to quicker identification and resolution of hazards.
6. ***Use Real-Life Scenarios and Simulations:*** Engaging workers in realistic simulations of potential hazards can enhance their ability to recognize and respond to dangerous situations.

As a construction manager, how can I improve the perception of hazard by workers on the job site? *(Slide 3 of 4)*



7. ***Utilize Technology:*** Implementing technologies like sensors, wearables, and cameras can provide additional layers of hazard detection and alert systems.

8. ***Enhance your Leadership and Supervision:*** Strong leadership and proactive supervision can foster a culture of safety where workers are more attuned to recognizing and addressing hazards.

9. ***Ensure using Personal Protective Equipment (PPE):*** Wearing appropriate PPE not only protects workers but also reminds them of the potential dangers around them, encouraging heightened awareness.

10. ***Maximize Worker Involvement:*** Involving workers in safety discussions and decision-making processes empowers them and makes them more invested in hazard perception and prevention.

As a construction manager, how can I improve the perception of hazard by workers on the job site? *(Slide 4 of 4)*



11. ***Use Feedback and Incident Analysis:*** Regularly reviewing near-miss incidents and accidents can provide valuable insights into potential hazards and encourage workers to be more vigilant.

12. ***Emphasize on Situational Awareness:*** Encouraging workers to constantly be aware of their surroundings can significantly improve their ability to perceive hazards.

Improving hazard perception involves a combination of **education**, **experience**, **communication**, and a **proactive approach** to safety. It's a collective effort that involves workers, supervisors, and management working together to create a safer work environment.

Part 2:
How to motivate staff to practice safety and health practices



Why is self motivation a fundamental element to improve safety on the construction job site?



Self motivation contributes to the following

Personal Responsibility: Self-motivated individuals take ownership of their safety and well-being. They understand that their actions directly affect their safety and the safety of others. This sense of responsibility drives them to consistently follow safety protocols and make safe choices.

Risk Awareness: Self-motivated workers are more likely to be aware of potential hazards and risks. They actively seek out information about safety practices and stay vigilant to identify and mitigate risks in their work environment.

Proactive Behavior: Self-motivated workers are proactive in identifying and addressing safety issues. They don't wait for someone else to take action; they take the initiative to resolve safety concerns promptly.

Adherence to Protocols: Individuals who are self-motivated consistently adhere to safety procedures, even when they're not being closely monitored. They recognize the importance of these protocols in preventing accidents and injuries.

Why is team motivation a fundamental element to improve safety on the construction job site? *(slide 1 of 2)*



Team motivation contributes to the following

- ***Collaboration:*** Team motivation encourages workers to look out for one another. When everyone is motivated to ensure each other's safety, they are more likely to communicate hazards, share knowledge, and intervene when they see unsafe behavior.

- ***Positive Peer Pressure:*** A motivated team sets a positive example for safety behavior. When coworkers actively prioritize safety, it creates a culture of peer pressure in which everyone feels motivated to follow suit.

- ***Shared Responsibility:*** Team motivation reinforces the idea that safety is a collective responsibility. This shared commitment fosters a sense of unity and common purpose, making it more likely that safety standards will be upheld.

Why is team motivation a fundamental element to improve safety on the construction job site? *(slide 2 of 2)*



- ***Mutual Support:*** Motivated teams support each other in upholding safety standards. If a worker is struggling to follow a safety procedure, motivated colleagues can offer assistance and guidance, reducing the likelihood of errors.

- ***Reinforcement of Safety Culture:*** A motivated team contributes to the development of a strong safety culture. This culture becomes a shared value that informs decision-making at all levels of the organization.

By focusing on both self-motivation and team motivation, construction job sites can create a comprehensive safety framework that encompasses individual responsibility and collective commitment. Workers who are self-motivated take the initiative to uphold safety practices, while a motivated team reinforces these efforts through peer support and shared commitment. This two-pronged approach helps establish a safer work environment, reduces accidents and injuries, and contributes to a positive safety culture overall.

How can I be a motivational construction manager for behaving safely on the job site? *(Slide 1 of 3)*



1. ***Lead by Example:*** Your actions speak louder than words. Always adhere to safety protocols and wear the required personal protective equipment (PPE) yourself. When your team sees you prioritizing safety, they are more likely to follow suit.

2. ***Communication Clearly:*** Regularly communicate the importance of safety to your team. Explain the rationale behind safety measures and how they contribute to the overall success of the project and the well-being of everyone involved.

3. ***Set High Standards:*** Establish clear expectations for safety behavior from the beginning. Emphasize that safety is non-negotiable and that everyone's commitment is essential.

4. ***Empower and Involve:*** Involve your team in safety discussions and decisions. When they have a voice in shaping safety protocols, they are more likely to take ownership of their safety practices.

How can I be a motivational construction manager for behaving safely on the job site? *(Slide 2 of 3)*



5. ***Recognize and Reward:*** Acknowledge individuals and teams that consistently exhibit safe behavior. Publicly recognize their efforts and highlight how their actions contribute to a safer work environment.

6. ***Create a Positive Environment:*** Foster a positive atmosphere where workers feel comfortable reporting unsafe conditions without fear of reprisal. Encourage an open dialogue about safety concerns.

7. ***Celebrate Safety Milestones:*** Celebrate safety milestones, such as completing a certain number of accident-free days. This reinforces the idea that safety achievements are valuable accomplishments.

8. ***Share Stories and Lessons:*** Share real-life examples of how adhering to safety protocols has prevented accidents. Personal stories can resonate and remind everyone of the importance of their actions.

How can I be a motivational construction manager for behaving safely on the job site? *(Slide 3 of 3)*



10. ***Stick to Inspections:*** People don’t do what you expect. They do what you inspect!

11. ***Continuous Improvement:*** Actively seek feedback from your team about safety practices. Use their insights to refine existing protocols and make safety an evolving process.

12. ***Lead with Positivity:*** Approach safety discussions with a positive attitude. Instead of focusing solely on rules and regulations, highlight the benefits of a safe work environment.

13. ***Stay Informed:*** Keep yourself updated on the latest safety regulations and industry best practices. Your expertise will be valuable in guiding your team towards safer practices.

By embodying these principles and consistently demonstrating a commitment to safety, you'll become a motivational construction manager who inspires your team to prioritize safety on the job site. Your dedication will foster a culture where safety is not just a requirement, but a shared value that everyone actively upholds.

Part 3:
Construction Safety and Health Programs





Why is Construction Safety and Health Program a fundamental element in establishing safety on a construction job site?

- a Construction Safety and Health Program provides a strategic framework for creating a safe work environment.

- It brings together various components, including policies, procedures, training, communication, and leadership commitment, to systematically enhance safety practices, reduce risks, and foster a culture of safety on the construction job site.



What is a fundamental component in structuring safety in a project?

- A written safety and health program is the key component in providing and structuring that foundation.

- This written program should set the tone for safety and health within the work environment.

What should a safety program for a project include? *(Slide 1 of 3)*



1. ***A Safety Policy Statement:*** A clear and concise statement that outlines the company's commitment to safety and the importance of protecting the well-being of workers.

2. ***Roles and Responsibilities:*** Clearly define the roles and responsibilities of all personnel involved, from management to workers, in terms of safety management and implementation.

3. ***Safety Training and Orientation:*** Detail the training programs and orientations provided to ensure that all workers are informed about potential hazards, safety procedures, and emergency protocols.

4. ***Project-Specific Hazard Identification and Assessment:*** Describe how hazards are identified, assessed, and mitigated through regular inspections, risk assessments, and job hazard analyses.

What should a safety program for a project include? *(Slide 2 of 3)*



5. ***Safe Work Practices and Procedures:*** Document the specific safety procedures and practices to be followed for various tasks and activities, including equipment operation, material handling, and confined space entry.

6. ***Personal Protective Equipment (PPE):*** Specify the types of PPE required for different tasks, along with guidelines for proper selection, use, maintenance, and disposal.

7. ***Emergency Response Plans:*** Outline procedures for responding to emergencies, including evacuation routes, assembly points, communication methods, and roles during emergencies.

8. ***Incident Reporting and Investigation:*** Detail the process for reporting incidents, near misses, and accidents, as well as the steps for conducting thorough investigations to prevent recurrence.

9. ***Safety Meetings:*** Describe the frequency and format of safety meetings, emphasizing the importance of open communication, sharing lessons learned, and addressing worker concerns.

What should a safety program for a project include? *(Slide 3 of 3)*



10. ***Subcontractor Safety:*** Address how subcontractors will adhere to the safety program, ensuring that their practices align with the project's safety goals.

11. ***Safety Inspections and Audits:*** Explain how routine inspections and audits will be conducted to monitor compliance with safety procedures and regulations.

12. ***Recordkeeping:*** Specify the types of safety records that will be maintained, including incident reports, training records, inspections, and safety audits.

13. ***Communication Channels:*** Provide information on how safety-related information will be communicated throughout the project, including safety notices, updates, and changes in procedures.

14. ***Safety Performance Metrics:*** Define the key performance indicators (KPIs) that will be used to measure safety performance and evaluate the success of the program.



What questions must be answered by the health and safety programs?

1. What is the policy of the contractor regarding safety and health on the projects?
2. What are the safety and health goals for the company?
3. Who is responsible for occupational safety and health?
4. How are supervisors and employees held accountable for job safety and health?
5. What are the safety and health rules for this type of construction?
6. What are the consequences of not following the safety rules?
7. Are there set procedures for addressing safety and health on the jobsite?



What are the minimum requirements of a safety program for a contractor?

1. have a demonstrated commitment to job safety and health
2. commit budgetary resources
3. train new personnel
4. insure that supervisors are trained
5. have a written safety and health program
6. hold supervisors accountable for safety and health
7. respond to safety complaints and investigate accidents
8. conduct safety audits



What are the fundamental elements of a health and safety program?

1. Rules and responsibilities of staff
2. Communication Channels: including safety meetings, workshops, safety bulletin boards, new employee orientation, safety talks
3. Training: see next slide

What should an effective construction safety training workshop include? *(Slide 1 of 4)*

1. Introduction to Safety Culture:
   - Emphasize the importance of a strong safety culture in construction.
   - Explain how individual actions contribute to the overall safety of the team and project.



2. Overview of Regulations and Standards:
   - Provide an overview of relevant local, state, and federal safety regulations and industry standards.
   - Explain how non-compliance can lead to legal and financial consequences.

3. Hazard Recognition and Assessment:
   - Train participants to identify potential hazards and risks on construction sites.
   - Teach hazard assessment techniques, including job hazard analysis (JHA) and risk assessment.

What should an effective construction safety training workshop include? *(Slide 2 of 4)*



4. Personal Protective Equipment (PPE):
   - Detail the types of PPE required for different tasks.
   - Demonstrate proper selection, use, maintenance, and storage of PPE.

5. Safe Work Practices:
   - Cover safe work practices for common construction activities, such as excavation, scaffolding, welding, and material handling.
   - Provide guidelines for using tools and equipment safely.

6. Emergency Procedures:
   - Explain evacuation procedures, assembly points, and emergency communication methods.
   - Train participants in responding to various emergencies, such as fires, chemical spills, and medical incidents.

What should an effective construction safety training workshop include? *(Slide 3 of 4)*

7. Explain how to handle primary hazards
   - Confined Space and Fall Protection
   - confined spaces
   - Electrical Safety
   - Material Handling (lifting, moving, and storing materials)
   - Scaffold and Ladder Safety
   - fire prevention



8. Health Hazards and First Aid
   - basic first aid techniques and CPR

What should an effective construction safety training workshop include? *(Slide 4 of 4)*

9. Communication and Reporting

10. Interactive Exercises and Simulations

11. Q&A and Discussion

12. Evaluation and Assessment

13. Documentation and Certification



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Week 4: Analyzing Construction Hazards



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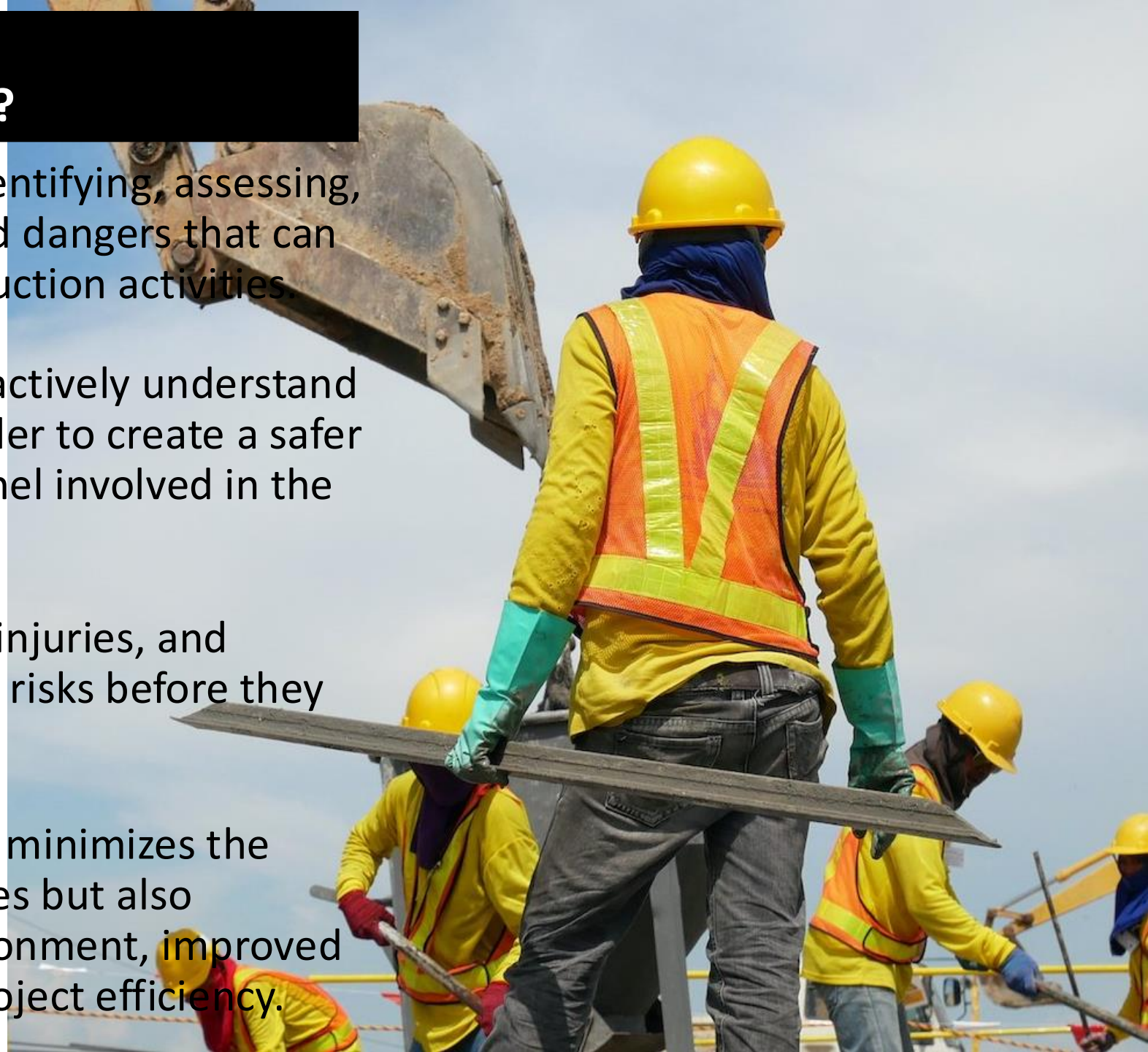
What do we mean by Analyzing Construction Hazards?

- It is the systematic process of identifying, assessing, and evaluating potential risks and dangers that can arise during the course of construction activities.

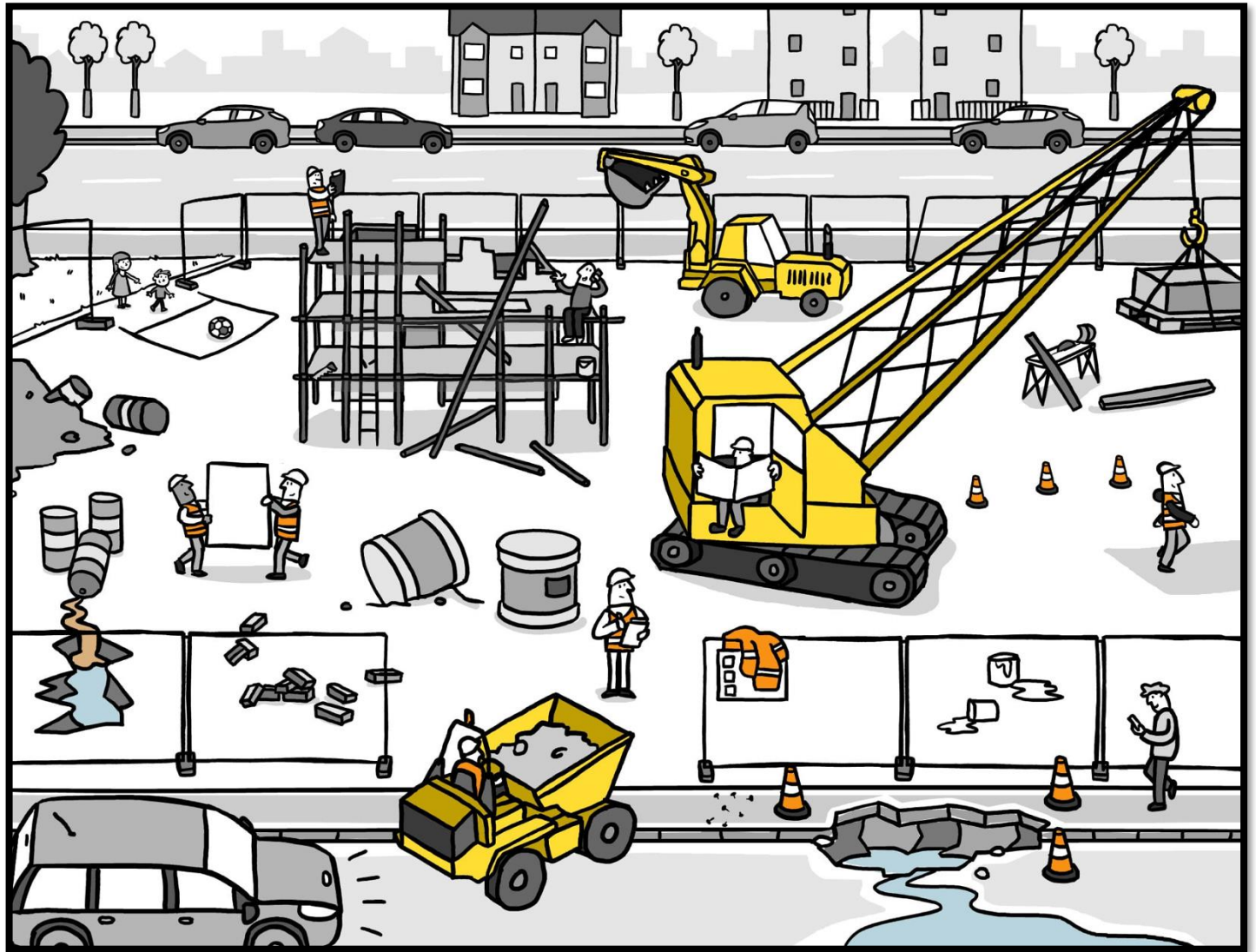
- This analysis is conducted to proactively understand and mitigate these hazards in order to create a safer work environment for all personnel involved in the construction project.

- The goal is to prevent accidents, injuries, and incidents by addressing potential risks before they lead to harm.

- This proactive approach not only minimizes the likelihood of accidents and injuries but also contributes to a safer work environment, improved worker morale, and increased project efficiency.



Look at the construction site below; can you analyze the potential hazards?



What is the process of analyzing construction hazards?



What is the process of analyzing construction hazards? *(Slide 1 of 2)*



Identify the Hazard: This step involves **recognizing** and listing all possible hazards that could occur on the construction site. Hazards can be related to various aspects, such as the work environment, equipment, materials, processes, and tasks being performed.



Assess the Risk: Once hazards are identified, a risk assessment is conducted to determine the likelihood and potential severity of each hazard. This assessment involves considering factors such as the frequency of exposure, potential consequences, and the number of people at risk.



Evaluate Risks : The results of the risk assessment are then evaluated to prioritize hazards based on their level of risk. Hazards that pose a higher risk in terms of severity and likelihood are typically addressed with greater urgency.



Develop Control Measures: For each identified hazard, appropriate control measures are developed and implemented to mitigate or eliminate the associated risks. These measures could include engineering controls (modifying equipment or processes), administrative controls (changing work procedures), or personal protective equipment (PPE).

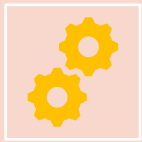
What is the process of analyzing construction hazards? *(Slide 2 of 2)*



Implement the measures: The identified control measures are put into **practice** on the construction site. Workers are **trained** on the new **procedures** or safety **measures**, and proper **equipment** is provided.



Monitoring and Review: The **effectiveness** of the control measures is continuously monitored and reviewed. This involves checking if the measures are being **followed correctly** and **assessing** whether any **new hazards** have **emerged**.



Adjust and Improve: Based on the monitoring and review process, **adjustments** and **improvements** are made to the **control measures**. This might involve **refining procedures**, **enhancing training**, or **updating equipment**.



Document: Throughout the process, **documentation** is important. Hazard identification, risk assessments, control measures, training records, and incident reports should all be documented to provide a **record** of the **safety efforts undertaken**.

What is a pre-construction conference?



- A pre-construction conference is a **meeting** that typically takes place **before** the actual construction work begins on a construction project.
- It serves as an important step in the project **planning** and **preparation** process, bringing together key **stakeholders** to discuss various aspects of the project and ensure that everyone is on the **same page**.
- The specific **details** and **objectives** of a pre-construction conference can **vary** depending on the **type** and **size** of the project, but it generally includes the following components:

Stakeholder Introduction

Project Overview

Project Documents

Roles and Responsibilities

Safety Procedures

Construction Schedule

Communication and Reporting

Permits and Inspections

Budget and Payments

Questions and Clarifications

Next Steps

How can safety topics be discussed in the preconstruction conference?

- A pre-construction conference is a crucial step in ensuring the safety of a construction project.
- It is a meeting that brings together key stakeholders, including project managers, contractors, subcontractors, safety personnel, and others, to **discuss safety measures** and **establish** a **comprehensive plan** for **maintaining** a **safe work environment** throughout the construction process.



What are the safety goals of a pre-construction conference?

- *Establish a Safety Culture*
- *Set Safety Expectations*
- *Identify Hazards*
- *Maximize Collaboration*
- *Reviewing Safety Plans*
- *Clarify Roles and Responsibilities*
- *Plan for Emergency Response*
- *Check Safety Training Requirements*
- *Discuss Equipment and PPE*
- *Building Relationships*



What are the safety goals of a pre-construction conference? *(Slide 1 of 3)*



1. ***Establish a Safety Culture:*** One of the primary goals of a pre-construction conference is to **set the tone for a strong safety culture** on the project. This includes emphasizing the **importance** of **safety**, creating a **shared commitment** to safety among all **stakeholders**, and **fostering** a sense of **responsibility** for **maintaining** a **safe** work environment.

2. ***Set Safety Expectations:*** The conference provides an **opportunity** to clearly **communicate** safety **expectations** to all **parties** involved. This includes outlining specific safety **policies**, **procedures**, and **guidelines** that everyone must follow.

3. ***Identify Hazards:*** Stakeholders discuss **potential hazards** and **risks associated** with the construction **project**. This helps ensure that everyone is **aware** of the specific **risks** and can collectively **brainstorm** ways to **mitigate** them.

What are the safety goals of a pre-construction conference? *(Slide 2 of 3)*



4. ***Maximize Collaboration:*** The conference promotes **collaboration** among all **stakeholders**, encouraging them to share their **insights** and **concerns** related to safety. This collective input helps in identifying **potential blind spots** and finding **effective solutions**.

5. ***Reviewing Safety Plans:*** Any **safety plans**, **protocols**, or **procedures** that have been developed prior to the conference are **reviewed in detail**. This ensures that everyone understands the safety measures in place and how to implement them.

6. ***Clarify Roles and Responsibilities:*** The conference clarifies the **roles** and **responsibilities** of each party in terms of safety. This **prevents confusion** and ensures that everyone **understands** their **role** in maintaining a safe work environment.

What are the safety goals of a pre-construction conference? *(Slide 3 of 3)*



7. ***Plan for Emergency Response:*** Emergency response procedures, including **evacuation plans**, **first aid** protocols, and **communication strategies**, are discussed and established. This ensures that all stakeholders know how to **respond** in case of accidents, incidents, or emergencies.

8. ***Check Safety Training Requirements:*** If there are specific **training** requirements, they are discussed during the pre-construction conference. This includes ensuring that all workers have the necessary **training** and **certifications** to perform their tasks safely.

9. ***Discuss Equipment and PPE:*** Discussions about the **proper use** of equipment, machinery, and personal protective equipment (PPE) are held. Stakeholders ensure that workers have access to the right tools and gear to **protect** themselves.

10.

11. ***Building Relationships:*** The pre-construction conference also provides an opportunity for stakeholders to build **relationships** and establish open lines of **communication**. A positive working relationship enhances the **effectiveness** of safety efforts.

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WHAT IS JOB HAZARD ANALYSIS?



What is JOBSITE HAZARD ANALYSIS

- Worksite analysis is the process of **identifying hazards** related to a project's construction activities and the construction site.
- In this process, we identify the **workplace** hazards before **determining** how to **protect employees**.

What hazards must be considered in worksite hazard analysis?

- In performing worksite analyses, consider not only hazards that currently exist in the workplace, but also those hazards that could occur because of **changes** in operations or procedures or because of other factors, such as **concurrent** work activities.



How de we perform worksite hazard analysis? *(Slide 1 of 3)*

1. Gather Relevant Information:

- Collect detailed information about the construction project, including project plans, blueprints, schedules, and task lists.
- Identify the types of work to be performed, equipment to be used, materials to be handled, and specific tasks involved.

2. Form a Hazard Analysis Team:

- Create a multidisciplinary team that includes project managers, safety officers, supervisors, experienced workers, and any other relevant stakeholders.
- Ensure that team members have knowledge of the construction process and potential hazards.

3. Identify Potential Hazards:

- Review each task, operation, and work area to identify potential hazards. Consider hazards related to equipment, machinery, materials, processes, and environmental factors.
- Consult safety regulations, guidelines, and industry standards to ensure comprehensive hazard identification.

4. Determine Potential Risks:

- Assess the likelihood and severity of each identified hazard. This involves evaluating the frequency of exposure and the potential consequences of an incident.

How de we perform worksite hazard analysis?



(Slide 2 of 3)

5. Rank Hazards by Risk Level:

- Prioritize hazards based on their risk level. Focus on high-risk hazards that have the potential for severe consequences and are more likely to occur.

6. Develop Control Measures:

- For each high-risk hazard, develop appropriate control measures to mitigate or eliminate the risks. Control measures can be engineering controls (changing equipment design), administrative controls (revising work procedures), or personal protective equipment (PPE).

7. Implement Controls:

- Put the identified control measures into practice. Ensure that workers are trained on the new procedures and are provided with the necessary equipment and PPE.

8. Review and Verify:

- Regularly review and verify that control measures are being effectively implemented.
- Ensure that workers are adhering to safety protocols and using PPE as required.

How de we perform worksite hazard analysis?



(Slide 3 of 3)

9. Continuous Monitoring:

- Monitor the worksite for changes in conditions that could introduce new hazards or affect existing ones. This includes changes in weather, equipment, tasks, and personnel.

10. Periodic Reassessment:

- Conduct regular reassessments of hazards as the construction project progresses or changes occur.
- Consider feedback from workers and any incidents or near-misses that have occurred.

11. Documentation:

- Document the hazard analysis process, identified hazards, risk assessments, control measures, training records, and any incidents or near-misses.
- Maintain a record of changes, improvements, and updates to the analysis over time.

What are the direct causes of accidents in construction projects?

- Direct causes are the **immediate** and **tangible** factors that directly lead to an accident. They are often the **last event** in a sequence of events that results in the accident.
- Direct causes are usually more **visible** and **straightforward** to identify.



What are examples of direct causes of accidents?



Examples of direct causes in construction accidents include:

- **Unsafe Acts:** These are actions taken by individuals that **violate** safety **procedures**, such as using equipment without proper training or not wearing required personal protective equipment (PPE).
- **Unsafe Conditions:** These are **physical** conditions in the work environment that create a hazard, such as inadequate lighting, slippery surfaces, or unstable scaffolding.
- **Equipment Failures:** **Malfunctioning** or **improperly maintained equipment** can directly lead to accidents, such as machinery breakdowns or tools malfunctioning during use.
- **Lack of Communication:** **Miscommunication** or **lack of clear communication** regarding tasks, procedures, and potential hazards can lead to accidents.
- **Improper Procedures:** **Failure to follow established safe work procedures and protocols** can directly result in accidents.



What are the indirect causes of accidents in construction projects?

Indirect causes, also known as **root causes** or underlying causes, are factors that contribute to creating an environment where **direct causes** become more **likely**. Indirect causes are often **systemic** or **organizational** issues that influence worker **behavior** and work **conditions**. Addressing indirect causes is essential for preventing accidents at their source.

What are some examples of indirect causes of accidents?



Examples of indirect causes in construction accidents include:

1. **Inadequate Training:** Insufficient or inadequate training can lead to workers not fully **understanding** safety **procedures** or how to **operate equipment** correctly.
2. **Lack of Supervision:** Inadequate supervision can lead to workers taking shortcuts, **neglecting safety procedures**, or **not receiving timely guidance**.
3. **Poor Safety Culture:** A weak safety culture within an organization can influence workers to **prioritize productivity** over **safety**, leading to increased risk-taking behavior.
4. **Inadequate Planning:** Insufficient planning, scheduling, and coordination can create **rushed work situations** where safety protocols are **overlooked**.
5. **Inadequate Resources:** A lack of necessary resources, such as proper equipment, tools, and materials, can force workers to **improvise** or take **shortcuts** that **compromise safety**.
6. **Time Pressure:** **Tight** project **deadlines** can encourage workers to **skip safety** steps to save time, leading to accidents.
7. **Ineffective Communication:** Poor communication between workers, supervisors, and management can lead to **misunderstandings** about safety **requirements** and **procedures**.

Unsafe Acts and Conditions

Unsafe Acts

1. Failure to wear PPE
2. Failure to warn coworkers or to secure equipment
3. Ignoring equipment/tool defects
4. Improper lifting
5. Improper working position
6. Improper use of equipment:
   - At excessive speeds
   - Using defective equipment
   - Servicing moving equipment
7. Operating equipment without authority
8. Horseplay
9. Making safety devices inoperable
10. Drug misuse
11. Alcohol use
12. Violation of safety and health rules

Unsafe Conditions

1. Congested work areas
2. Defective machinery/tools
3. Improperly stored explosive or hazardous materials
4. Poor illumination
5. Poor ventilation
6. Inadequate supports/guards
7. Poor housekeeping
8. Radiation exposure
9. Excessive noise
10. Hazardous atmospheric conditions
11. Dangerous soil conditions
12. No firefighting equipment
13. Unstable work areas/platforms

What are examples of basic causes of accidents in policies and decisions ?



Basic Causes

Policies and Decisions

1. Safety policy is not
   - in writing
   - signed by top management
   - distributed to each employee
   - reviewed periodically
2. Safety procedures do not provide for
   - written manuals
   - safety meetings
   - job safety analysis
   - housekeeping
   - safety audits/inspections
3. Safety is not considered in the procurement of
   - supplies
   - equipment
   - services
4. Safety is not considered in the personnel practices of
   - selection
   - hiring
   - training
   - placement
   - medical surveillance
   - authority
   - responsibility
   - accountability

What are accident report forms?


INCIDENT REPORT FORM

Use this form to report accidents, injuries, medical situations, criminal activities, traffic incidents, or student behavior incidents. If possible, a report should be completed within 24 hours of the event.

Date of Report: _____, 20___

PERSON INVOLVED

Full Name: _____ Address: _____

Identification: ☐ Driver's License No. _____ ☐ Passport No. _____ ☐ Other: _____

Phone: (___) ___-____ E-Mail: _____

THE INCIDENT

Date of Incident: _____, 20___ Time: ___:___ ☐ AM ☐ PM

Location: _____

Describe the Incident: _____

INJURIES

Was anyone injured? ☐ Yes ☐ No

If yes, describe the injuries: _____

WITNESSES

Were there witnesses to the incident? ☐ Yes ☐ No

If yes, enter the witnesses' names and contact info: _____

Page 1 of 2

- They are documents used to capture essential information about accidents incidents, and near-miss occurrences that happen on the construction site.
- These forms are a critical component of a construction project's safety management system, as they provide a standardized way to record and document incidents for analysis, investigation, and reporting purposes.
- Accident report forms help in understanding the causes of accidents, identifying trends, and implementing corrective actions to prevent similar incidents in the future.
- Accident report forms serve as a valuable tool for learning from incidents, improving safety measures, and maintaining a record of safety-related events on the construction site.
- They facilitate communication between workers, supervisors, safety officers, and management, contributing to a proactive approach to safety management.

Samples of accident report forms



EMPLOYEE INCIDENT REPORT FORM

Use this form to report accidents, injuries, medical situations, criminal activities, traffic incidents, or student behavior incidents. If possible, a report should be completed within 24 hours of the event.

Date of Report: _____, 20____

PERSON INVOLVED

Full Name: _____ Address: _____

Identification: ☐ Driver's License No. _____ ☐ Passport No. _____
☐ Other: _____

Phone: (____) ____-_____ E-Mail: _____

THE INCIDENT

Date of Incident: _____, 20____ Time: ____:_____ ☐ AM ☐ PM

Location: _____

Describe the Incident: _____
_____
_____

INJURIES

Was anyone injured? ☐ Yes ☐ No

If yes, describe the injuries: _____
_____
_____

WITNESSES

Were there witnesses to the incident? ☐ Yes ☐ No

If yes, enter the witnesses' names and contact info: _____
_____
_____

What information should an Accident Report Form include? (slide 1 of 2)



- ***Date and Time:*** The exact date and time of the incident.
- ***Location:*** The specific location on the construction site where the incident occurred.
- ***Description of Incident:*** A detailed description of what happened, including the sequence of events leading up to the incident.
- ***Injured Persons:*** Information about individuals involved in the incident, including their names, job roles, and contact details.
- ***Witness Information:*** Contact details and statements from any witnesses to the incident.
- ***Type of Incident:*** Indicating whether it was an accident, near-miss, injury, property damage, or any other relevant incident type.
- ***Severity:*** The extent of injuries, property damage, or other consequences resulting from the incident.

What information should an Accident Report Form include? (slide 2 of 2)



- ***Equipment or Tools Involved:*** Identification of any equipment, tools, machinery, or materials involved in the incident.
- ***Contributing Factors:*** Identification of direct and indirect causes that contributed to the incident, such as unsafe acts, hazardous conditions, lack of training, etc.
- ***Root Causes:*** Identification of underlying or systemic factors that played a role in the incident.
- ***Weather Conditions:*** If weather played a role, relevant details about conditions at the time of the incident.
- ***Photographs or Diagrams:*** Visual documentation of the accident scene, if available, to provide additional context.
- ***Supervisor or Manager's Comments:*** Comments from supervisors, managers, or safety officers who responded to the incident or were involved in its investigation.
- ***Actions Taken:*** A summary of the immediate corrective actions taken after the incident and plans for further investigation or preventive measures.
- ***Follow-Up Actions:*** Details of any follow-up actions required, including changes to procedures, additional training, equipment repairs, etc.
- ***Report Filer:*** Information about the person filing the report and their contact details.

TCM 2430 – Construction Safety

Week 5 – Construction Accident Prevention Techniques



Dr. Tommy Tafazzoli

What do we mean by construction Accident Prevention Techniques (APT)?

- Construction Accident Prevention Techniques (APT) are **strategies** and **practices** implemented in construction sites to **reduce** the **likelihood** of **accidents**, **injuries**, and **fatalities** among **workers** and **visitors**.

- These techniques aim to **create a safe working environment** by identifying and addressing **potential hazards** and **risks** associated with **construction activities**.



What are the common construction accident prevention techniques? *(Slide 1 of 3)*

1. Train and Educate	• Properly trained and informed workers are more likely to recognize potential hazards and use safety measures effectively. Regular training sessions on safety protocols, equipment operation, emergency procedures, and hazard identification are crucial.
2. Provide Appropriate Personal Protective Equipment (PPE)	• Providing appropriate PPE, such as helmets, safety goggles, gloves, steel-toed boots, and high-visibility vests, ensures that workers are adequately protected from various hazards like falling objects, debris, and hazardous materials.
3. Develop and Enforce Safety Plans and Procedures	• Developing and enforcing comprehensive safety plans and procedures specific to each construction project helps ensure that everyone on the site understands the protocols for handling different tasks safely.
4. Inspect, Identify and Assess Hazards	• Regularly inspecting the construction site to identify potential hazards, such as uneven terrain, unstable structures, and exposed electrical wires, helps in taking preventive measures before accidents occur.
5. Protect against Falls	• Falls from heights are a common cause of construction accidents. Implementing guardrails, safety nets, and personal fall arrest systems can greatly reduce the risk of falls.

What are the common construction accident prevention techniques? *(Slide 2 of 3)*

6. Ensure Scaffolding and Ladder Safety	• Proper installation and maintenance of scaffolding and ladders, as well as following guidelines for safe use, help prevent accidents related to working at elevated levels.
7. Maintain Machine and Equipment Safety	• Regular maintenance, operator training, and clear guidelines for operating heavy machinery and equipment reduce the risk of accidents caused by equipment malfunction or improper operation.
8. Ensure Electrical Safety	• Ensuring that electrical systems and equipment are properly installed, grounded, and inspected can prevent electrocution and fire hazards.
9. Implement Excavation and Trenching Safety Systems	• Implementing protective systems, such as shoring, sloping, or shielding, for excavations and trenches helps prevent collapses and cave-ins.
10. Train for Material Handling Safety	• Providing proper training and equipment for handling, transporting, and storing construction materials reduces the risk of injuries caused by mishandling heavy objects.

What are the common construction accident prevention techniques? *(Slide 3 of 3)*

11. Prepare for Emergencies	• Having clear emergency response plans, including first aid kits, evacuation routes, and communication protocols, is essential for addressing accidents promptly.
12. Establish High Quality Housekeeping	• Maintaining a clean and organized construction site reduces the chances of tripping hazards and makes it easier to identify potential dangers.
13. Inspect the Site Regularly	• Conducting routine safety inspections and audits helps identify issues that might have been overlooked and allows for timely corrective actions.
14. Communicate Effectively and Clearly	• Effective communication among workers, supervisors, and management about potential hazards, safety procedures, and changes in the work environment is crucial for accident prevention.
15. Establish Incentive Programs	• Establishing programs that recognize and reward workers for following safety protocols can foster a culture of safety and encourage responsible behavior.

What is a hazard hunt form?



A form to identify, document, and address potential hazards and risks within the construction environment.



It is a proactive approach to improving safety by involving workers, supervisors, and management in identifying and mitigating hazards before they lead to accidents or injuries.



The hazard hunt form serves as a checklist or template that guides individuals through the process of observing and noting any unsafe conditions, practices, or situations that could pose a threat to workers' health and well-being.

HAZARD HUNT FORM

Worker's Name (Optional): _____

Date: _____

Jobsite: _____

Job Titles: _____

_____

1. Describe the hazard that exists.

_____

2. Has the hazard been discussed with your supervisor? When? (Date)

_____ Yes _____ No

_____

3. What preventive action needs to be taken?

_____

4. Do you know what state or federal safety regulations is being violated?

_____ Yes _____ No

(Please list it if your answer is yes.)

_____

5. Have there already been injuries or illnesses caused by the hazard?

_____ Yes _____ No

(List the names, dates, events, or symptoms)

_____

6. How long has the hazard been present?

_____

Manager's or Supervisor's Response to Hazard Concern Identified.

_____

NOTE: Use a Separate Form for Each Hazard Identified.

What are SAFE/STANDARD OPERATING PROCEDURES (SOPs)?

- Workers may not automatically understand a task just because they have experience or training.
- Many jobs, tasks, and operations are best supported by a Safe or Standard Operating Procedure (SOP).
- The SOP walks the worker through the steps of how to do a task or procedure in a safe manner and calls attention to the potential hazards at each step.



SOP for an excavator



SAFE OPERATING PROCEDURES FOR AN EXCAVATOR

WHAT TO DO (Steps in sequence)	HOW TO DO IT (Instructions)	KEY POINTS (Items to be emphasized)
1) Climb onto engine compartment.	1) Place hand on rail of operator's compartment and foot on step of track frame. Gently pull yourself up onto track. Continue around operator's compartment following the steps and rails.	1) Be sure to use rails and steps or a fall may occur causing serious injury. Make sure shoes are free of mud for proper traction.
2) Unlock engine compartment and check all fluids. (Engine oil, hydraulic oil, coolant, and batteries.)	2) Place key in lock of engine compartment handle. Turn key and remove. Turn handle and lift to open. Remove dip sticks to check fluids. Fluid should register in the shaded area of the stick. If low, fill immediately. Wear safety glasses while checking fluids.	2) Engine compartment is spring loaded. Be sure to stand back while opening. Fluid levels are very important. Low fluid levels means machine will not operate properly and could cause injury or loss of productivity.
3) Unlock and open operator's door.	3) Place key in lock and turn. Open door and securely latch it so that it doesn't slam closed during operation.	3) Machine can be operated with door closed, but will not be able to hear coworkers outside which is very important due to the number of blind spots while operating.
4) Climb into operator's seat.	4) Grab handle and place foot on step of track frame and pull yourself up onto the track. Step inside operator's compartment and sit in seat.	4) Seat should be adjusted to fit operator's posture.
5) Check warning lights on instrument panel.	5) Place key in ignition and push test button to illuminate all warning lights and sound all warning buzzers.	5) Warning signals are very important and should always be carefully checked. They will alert the operator to problems or failures within the machine itself. They could prevent serious injury from occurring.

FIGURE 6.3 A safe operating procedure for an excavator

When are SOPs recommended?

There are times when an SOP or step-by-step checklist is useful. Some of these times are when

- a new worker is performing a job or task for the first time;
- an experienced worker is performing a job or task for the first time;
- an experienced worker is performing a job which he/she has not done recently;
- a mistake could cause damage to equipment or property;
- a job is done on an intermittent or infrequent basis;
- a new piece of equipment or different model of equipment is obtained.

When do we need an engineer to inspect safety? (Slide 1 of 2)

Structural Integrity	High-Risk Activities	Excavations and Trenching	Heavy Machinery and Equipment:	Electrical Systems	Fire Safety
When dealing with the construction or modification of structures, such as buildings, bridges, or towers, an engineer is often required to assess the structural integrity and stability. This is especially crucial during critical phases like foundation work, structural framing, and load-bearing elements.	Construction activities involving high-risk elements, such as scaffolding, formwork, and elevated platforms, should be inspected by an engineer to ensure proper design, installation, and safety measures are in place to prevent collapses and falls.	For projects involving excavations and trenching, an engineer's expertise is needed to assess soil stability, design protective systems (such as shoring), and ensure worker safety from potential collapses.	When using heavy machinery, cranes, or specialized equipment, an engineer should be involved to ensure proper setup, operation, and safety measures are in place to prevent accidents.	Engineers with electrical expertise are necessary to inspect and approve electrical installations and systems to prevent electrocution hazards and ensure compliance with electrical codes.	Construction sites need fire protection measures and systems. Engineers with fire safety knowledge can evaluate fire detection, suppression systems, and safe evacuation plans.

When do we need an engineer to inspect safety? (Slide 2 of 2)

Hazardous Materials	Demolition	Unique Design or Challenges	Emergency Preparedness	Compliance with Codes and Regulations	Third-Party Verification
• When working with hazardous materials or substances, an engineer can assess containment measures, ventilation, storage, and disposal procedures to prevent environmental and health risks.	• Prior to demolishing structures, an engineer's evaluation is important to determine the safest methods, sequences, and precautions to prevent unintended collapses and hazards.	• For projects involving unique designs, innovative construction methods, or challenging environments, an engineer's input is crucial to ensure that safety considerations are properly integrated.	• Engineers can help develop emergency response plans, evacuation routes, and safety protocols for various scenarios, improving the site's readiness to handle unexpected situations.	• Engineers are well-versed in local, national, and international building codes and safety regulations. They can verify that construction practices align with these standards.	• In some cases, third-party verification by an engineer is required by regulatory authorities or project owners to ensure impartial evaluation of safety measures.



What are Preventive Maintenance Programs (PMP)?

- PMP depends heavily on an inspection form or checklist to assure that a vehicle or equipment inspection procedure has been fully accomplished and its completion documented.

- Incorporating a comprehensive equipment preventive maintenance program not only ensures the longevity and efficiency of construction equipment but also plays a pivotal role in creating a safer construction site for everyone involved.

What are the benefits of Preventive Maintenance Programs?

- Reduction of Equipment Failures
- Minimized Downtime
- Consistent Performance
- Optimal Safety Features
- Enhanced Operator Confidence
- Reduction in Accidents
- Improved Efficiency
- Decreased Risk of Fire or Explosions
- Mitigation of Environmental Hazards
- Longer Equipment Lifespan
- Regulatory Compliance
- Cultivating a Safety Culture
- Cost Savings
- Insurance Benefits



What is a fleet safety program?

- A fleet safety program in a construction project is a comprehensive set of policies, procedures, and practices designed to ensure the safe and responsible operation of vehicles and equipment within the project's fleet.

- This program aims to reduce the risk of accidents, injuries, and property damage associated with the use of construction vehicles, such as trucks, bulldozers, cranes, and other heavy equipment.

- Fleet safety programs are crucial for maintaining a safe work environment for construction workers, operators, and the public.



What are the key components of a fleet safety program in a construction project?



1. **Driver Training:** Providing thorough training for vehicle operators on safe driving techniques, proper equipment operation, and understanding the specific risks and challenges of operating construction vehicles.
2. **Licensing and Certification:** Ensuring that operators possess the appropriate licenses and certifications required for operating specific construction vehicles. Regular checks of credentials and renewals should be part of the program.
3. **Vehicle Inspections:** Establishing a routine inspection schedule for all fleet vehicles and equipment. Regular inspections help identify and address any maintenance or safety issues promptly.
4. **Maintenance Protocols:** Defining maintenance procedures, including regular servicing, repairs, and maintenance checks. Well-maintained vehicles are less likely to experience mechanical failures that could lead to accidents.
5. **Safety Equipment:** Ensuring that all vehicles are equipped with necessary safety features, such as seat belts, backup alarms, lights, mirrors, and any additional safety equipment relevant to the vehicle type.
6. **Vehicle Load Safety:** Providing guidelines for safe loading and unloading of materials and equipment onto vehicles, preventing overloading, and securing loads properly to prevent shifting during transport.
7. **Driving Policies:** Establishing rules for safe driving behaviors, including speed limits, proper following distance, no-phone policies, and adherence to traffic laws.

What are the key components of a fleet safety program in a construction project?



8. **Fatigue Management:** Implementing policies to prevent driver fatigue, including limits on driving hours and mandatory breaks for operators.
9. **Incident Reporting:** Creating a reporting system for accidents, incidents, and near-misses. This helps identify trends and areas where additional safety measures might be necessary.
10. **Emergency Procedures:** Outlining procedures for handling emergencies, including vehicle breakdowns, accidents, and medical incidents involving fleet vehicles.
11. **Driver Accountability:** Defining consequences for violating safety policies, which may include additional training, suspension of driving privileges, or other appropriate disciplinary measures.
12. **Driver Monitoring:** Implementing mechanisms to monitor driver behaviors, such as telematics systems that track speed, braking patterns, and other driving habits.
13. **Regular Review and Improvement:** Continuously reviewing and updating the fleet safety program based on feedback, incident reports, and changes in regulations or technology.
14. **Communication and Training:** Regularly communicating safety updates and changes to all vehicle operators and providing ongoing training to reinforce safe driving practices.
15. **Public Safety:** Ensuring that construction vehicles are operated safely around pedestrians, cyclists, and other road users, particularly in areas adjacent to the construction site.

How do we perform accident investigation?

- Performing an accident investigation on a construction job site is crucial to understand the causes and contributing factors of an incident, with the goal of preventing similar accidents in the future.

- Proper accident investigations help identify shortcomings in safety procedures, equipment, training, and work practices.





What are the steps to perform an effective accident investigation on a construction site? (Slide 1 of 3)

1. **Ensure Immediate Safety:** Before starting the investigation, ensure that the accident scene is safe for investigators and that any injured individuals receive prompt medical attention.
2. **Gather Information:**
   - Identify the involved parties: Determine who was directly affected by the accident, including workers, witnesses, and supervisors.
   - Gather evidence: Collect photographs, videos, sketches, and any physical evidence related to the accident scene.
   - Interview witnesses: Interview individuals who witnessed the accident to gather their firsthand accounts of what happened.
3. **Secure the Accident Scene:** Preserve the accident scene as much as possible to maintain the integrity of evidence. This may involve restricting access to the area or marking off hazardous zones.
4. **Document the Scene:** Take detailed notes, measurements, and photographs of the accident scene, including the positioning of equipment, machinery, and any relevant conditions.
5. **Identify Root Causes:**
   - Use the "5 Whys" method: Ask "why" multiple times to dig deeper into the chain of events and uncover underlying causes.
   - Consider human factors: Examine whether factors like lack of training, fatigue, stress, or inadequate communication contributed to the accident.
   - Analyze equipment and procedures: Evaluate whether faulty equipment, inadequate maintenance, or improper procedures played a role



What are the steps to perform an effective accident investigation on a construction site? (Slide 2 of 3)

6. **Review Safety Procedures:**
   - Examine relevant safety protocols and procedures to determine if they were followed or if there were deficiencies.
   - Consider if there were any deviations from standard operating procedures and whether these deviations contributed to the accident.
7. **Examine Training Records:**
   - Review training records to determine if workers involved in the accident had received proper training for their tasks.
   - Identify any gaps in training that might have contributed to the accident.
8. **Review Equipment and Materials:**
   - Check equipment involved in the accident for defects or malfunctions that might have contributed to the incident.
   - Inspect materials used and assess their condition and storage.
9. **Interview Involved Individuals:**
   - Interview individuals directly involved in the accident to gather their accounts of the events leading up to the incident.
   - Ask open-ended questions to encourage detailed responses and avoid leading the witnesses.
10. **Compile Findings:**
    - Organize the information gathered during the investigation into a coherent report.
    - Clearly outline the sequence of events, contributing factors, root causes, and recommendations for preventing future accidents.



What are the steps to perform an effective accident investigation on a construction site? (Slide 2 of 3)

11. **Develop Corrective Actions**
    - Propose specific actions to address the identified root causes and prevent similar accidents.
    - Prioritize actions based on their potential impact on safety.
12. **Implement Recommendations**
    - Ensure that the corrective actions are communicated to relevant parties and that responsible individuals or departments are assigned to implement them.
13. **Monitor and Follow Up**
    - Regularly review the effectiveness of implemented corrective actions.
    - Make adjustments as needed based on feedback and ongoing safety assessments.
14. **Learn and Improve**
    - Share the lessons learned from the accident investigation with the entire construction team to promote a culture of safety and continuous improvement.

Remember, the goal of an accident investigation is not to assign blame but to uncover the underlying factors that led to the incident. By identifying and addressing these factors, you can prevent similar accidents and promote a safer construction work environment.

GEORGIA SOUTHERN

TCM 2430 – Construction Safety

Week 6 - Personal Protection



Dr. Tommy Tafazzoli

What do we mean by personal safety?

- Personal safety is an individual's ability to go about their everyday life free from the threat or fear of psychological, emotional, or physical harm from others.
- It is often said that personal safety is a matter of common sense. However, **common sense does not always result in common practice**.
- For personal safety in the workplace to become common practice, it needs to be **prioritized across the organization** and **championed** by strong **leadership**.
- Without a clear **organizational approach** to personal safety, the **response** of each worker to a threatening or confrontational situation can **differ dramatically** and will rely heavily on **individual judgments**.



Personal Protective Equipment (PPE)

PPE is considered **the last line of defense** when it comes to protecting workers from injuries on the job site.

Employers are expected to enforce **engineering controls** and other safety measures to prevent accidents and injuries.



Who should provide the PPE?

- **Employers** are expected to **pay** for and supply workers with all **PPE** and are responsible for **ensuring** their **use** where appropriate.

- Employers can **allow** workers to **use their** own PPE.

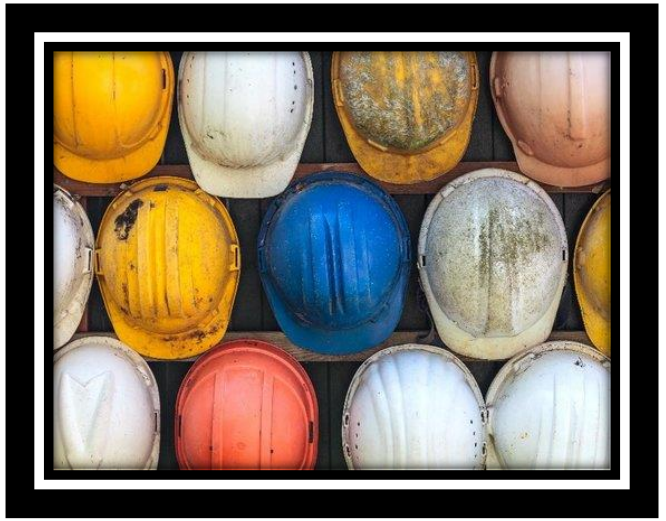
- If employee-owned equipment is allowed, **employers** are responsible for **ensuring** that the PPE is in good **working condition**, but they are not **required** to **reimburse** workers for PPE they **provide themselves**.





Head Protection

Head Protection



- Head injuries are commonly caused by **falling** or **flying** objects, or by **bumping** the head against a **fixed** object.

- Head injuries can be **minor** or **deadly**. Injuries can include minor abrasions, concussions, lacerations, fractures, burns, or even electrocution.

- The **employer** must **assess** the hazards in the **workplace** to **determine** if head protection is **needed**.



Play this video here
(not in YouTube)

When is head protective equipment needed?

Risk of falling objects	Overhead Hazards	Construction Machinery and Equipment	Working with Hand and Power Tools
Structural Work	Demolition Work	Working in Trenches or Excavations	Tree and Brush Clearing
Working near Elevated Platforms	Confined Spaces	Safety Inspections and Site Walks	Specific Job Requirements



Hearing Protection



When is hearing protection needed?

- Hearing protection is needed on a construction job site when workers are exposed to **hazardous noise** levels that have the potential to cause **hearing damage** over time.
- Loudness is measured in **decibels**(dB). Intensity that exceeds an average of **85 dB** over an **8-hour** day may cause hearing loss.
- According to OSHA standards, employers must provide hearing protection when workers are exposed to noise at levels of 85 dB or more averaged over an 8-hour period.
- How you're affected by noise depends on several things—**loudness** and **frequency**, **length** of **exposure**, and even your **age** and **health**.

What are some types of hearing protection tools?

- Enclosure
- Earplugs
- Canal caps
- Earmuffs





Why is hearing loss hard to measure?

Hearing loss due to noise in the workplace is frequently ignored because it usually takes place **over a long period of time** and may not be readily apparent **until the damage is done**. There's no visible wound or other sign of injury.

When should you ask workers to use hearing protection equipment?

- Heavy Machinery
- Power Tools
- Most Loud Construction Equipment
- Demolition Work
- Traffic and Transportation
- Welding and Grinding
- Prolonged Exposure
- Specialized Tasks
- Indoor Construction
- Worksite Assessments





Eye & Face Protection

When is eye and face protection needed?



- Flying Debris
- Welding and Cutting
- Chemical Exposure
- Grinding and Chipping
- Concrete and Masonry Work
- Pneumatic Tools
- Demolition Work
- Electrical Work
- High-Pressure Fluids
- Working at Heights
- Woodworking
- Nail and Screw Gun Use
- Hazardous Weather Conditions



Hand Protection

When is hand protection needed?

- Handling Tools and Equipment
- Handling Materials
- Chemical Exposure
- Heat and Cold Exposure
- Electricity and Electrical Work
- Welding and Cutting
- Handling Glass or Sharp Objects
- Mechanical Hazards
- Hand and Wrist Support
- Biological Hazards from Impact
- Climbing and Rigging







Foot Protection

When is foot protection needed?

- General Work Activities
- Falling Objects
- Piercing Hazards
- Crushing Hazards
- Electrical Hazards
- Chemical Exposures
- Extreme Temperatures
- Slip and Trip Hazards
- Uneven Terrain
- Concrete Work
- Welding and Hot Work
- Climbing and Working at Heights



What are some examples of foot protection tools?



- **Metatarsal Guards.** Shoes with metatarsal or instep guards protect the upper foot from impacts. For these shoes, the metal guards stretch over the foot rather than just over the toes.
- **Conductive Shoes.** Conductive shoes allow the static electricity which builds up in the wearer's body to drain to the ground harmlessly.
- **Chemical-Resistant Safety Boots.** Rubber or plastic safety boots offer protection against oil, water, acids, corrosives, and other industrial chemicals. They are also available with features such as steel-toe caps, puncture-resistant soles, and metal guards. Some rubber boots are designed to be pulled over regular safety shoes.





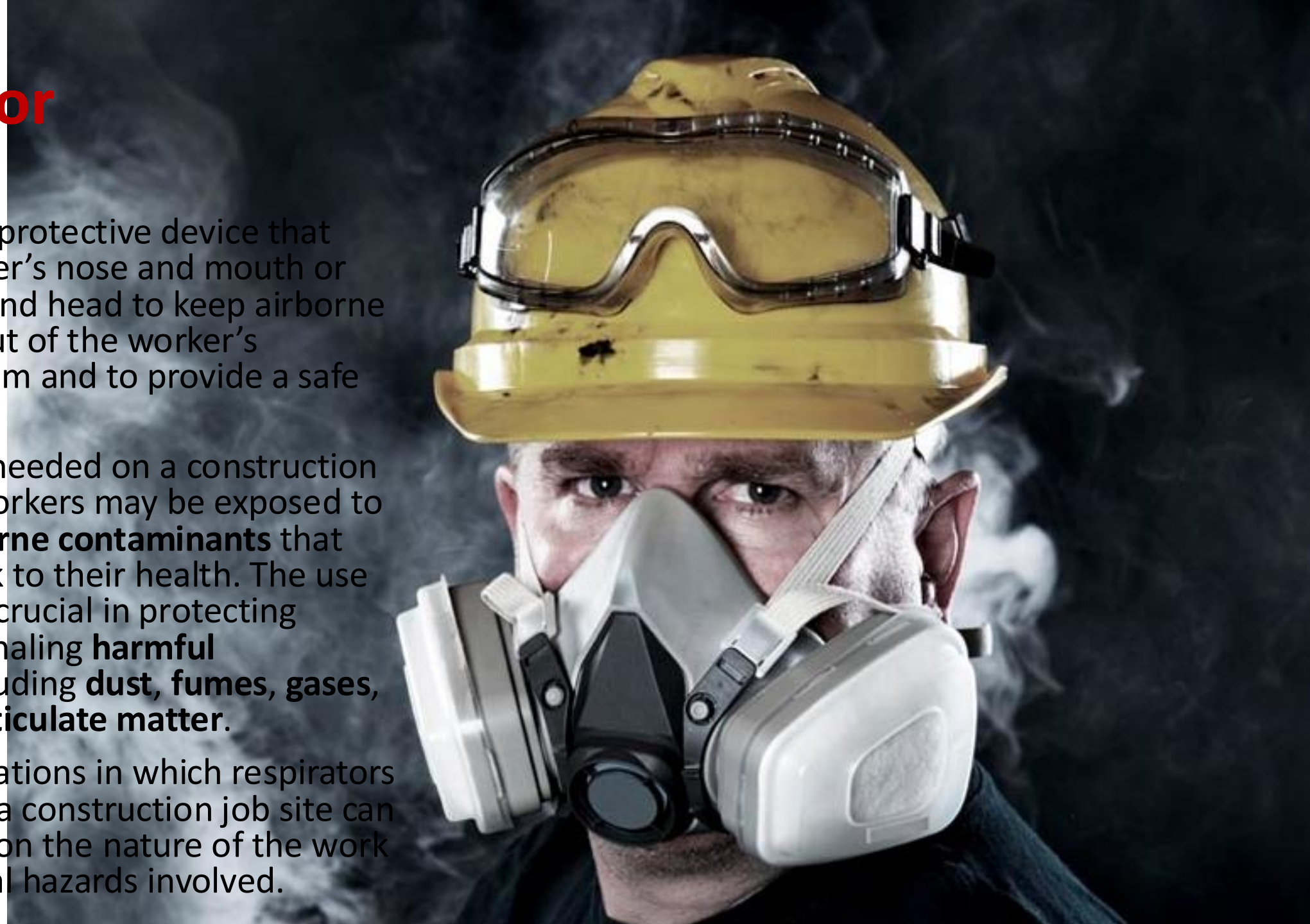
What are some examples of foot protection tools?



- **Electrical Hazard Shoes.** Electrical hazard shoes offer insulation from electrical shock hazards from contact with circuits of 600 Volts or less under dry conditions. These shoes are used in areas where employees work on live or potentially live electrical circuits. The toe box of the shoe is insulated, so there is no exposed metal. These shoes are most effective when dry and in good repair.
- **Sole Puncture-Resistant Footwear.** Puncture-resistant soles in safety shoes protect against hazards of stepping on sharp objects that can penetrate standard shoe soles. They are used primarily in construction work.
- **Static Dissipative Shoes.** Static dissipative footwear is designed to reduce the accumulation of excess static electricity by conducting the body charge to the ground while maintaining some resistance to electrical shock. Such shoes are worn by workers in the electronics industry, where static items can be harmful.
- **Foundry Shoes.** Foundry shoes are used by welders and molders in foundries or steel mills

Respirator

- A respirator is a protective device that covers the worker's nose and mouth or the entire face and head to keep airborne contaminants out of the worker's respiratory system and to provide a safe air supply.
- Respirators are needed on a construction job site when workers may be exposed to hazardous **airborne contaminants** that could pose a risk to their health. The use of respirators is crucial in protecting workers from inhaling **harmful substances**, including **dust**, **fumes**, **gases**, **vapors**, and **particulate matter**.
- The specific situations in which respirators are required on a construction job site can vary depending on the nature of the work and the potential hazards involved.



When is a respirator needed?

Slide 1 of 2



- **Dust and Particulate Matter:** Respirators may be required when workers are exposed to high levels of dust, such as during activities like cutting, grinding, sanding, or demolishing materials like concrete, drywall, or asbestos-containing materials.
- **Chemical Fumes and Vapors:** When construction work involves the use of chemicals, paints, solvents, or adhesives that release fumes or vapors into the air, respirators may be necessary to protect against inhalation of these harmful substances.
- **Welding and Soldering:** Welders and those involved in soldering operations should use respirators to protect against the fumes and gases produced during these processes.

When is a respirator needed?

Slide 2 of 2



- Confined Spaces: In confined spaces, the air quality may be compromised due to the presence of toxic gases or insufficient oxygen. Workers entering confined spaces, such as tanks, tunnels, or manholes, may require respirators.
- Biological Hazards: In situations where there is a risk of exposure to biological contaminants, such as mold spores or bacteria, respirators may be needed to prevent inhalation of these hazardous agents.
- Asbestos and Lead Removal: When construction work involves the removal of asbestos-containing materials or lead-based paints, specialized respirators, often with HEPA filters, are typically required to protect workers from inhaling these toxic substances.
- Airborne Infectious Diseases: During outbreaks of airborne infectious diseases, such as COVID-19 or tuberculosis, construction workers may need to wear respirators to reduce the risk of exposure.

Personal Training

Employers must provide formal training to all **employees** who may be exposed to **ergonomic hazards** to inform them of the hazards associated with their work and of the tools, machinery, and equipment they use.

Information that must be included in the training includes **specific risk factors**, their **causes**, recognizing and reporting **symptoms**, and the **prevention** of these occurrences.





Job-Specific Training

All **new** employees and those assigned **new tasks** must be made aware of the **specific risks** associated with a particular job before they start their work. A practical demonstration should be arranged in order to show the employees how to **use** all the **tools** and **equipment properly** and how to **carry out** all **procedures** efficiently.

Training for Supervisors



In addition to training received by employees, supervisors should be provided with additional training to help them **recognize early signs** and **symptoms** of **risk**, **hazardous work practices**, how to correct such practices, and how to reinforce the ergonomic program.

TCM 2430 – Construction Safety

Week 7 – Protection against Falls and Struck-by-Objects



Dr. Tommy Tafazzoli

What do we mean by construction fatal fours?

- Falling
- Electrocution
- Hit-by-object
- Caught-in/between



The above fatal four are, according to OSHA, the leading causes of worker deaths at construction sites.

These **Fatal Fours** are responsible for **more than half** of the construction **deaths**.

Job site accident terminology

Accident

- An accident is an unplanned event that has **inconvenient or undesirable consequences**, other times being inconsequential.

Incident

- An incident denotes an unintended event that possibly **doesn't result in a loss**.



Hazard

- Anything that can **potentially hurt** or **harm** you through contact.

Exposure

- How **susceptible** you are to an injury or illness because of being **near** a hazardous substance or material.

When do accidents happen?

For an accident to happen, two factors should be present:

1. **hazard**
2. **exposure** to the hazard.

Accidents may result from:

1. an **unsafe act** by a worker or
2. from **unsafe** working **conditions**, or both.



What are the main four theories about the occurrence of accidents?

Theory	Explanation
Single Factor Theory	One event is solely responsible for an accident, akin to the “pilot error syndrome”
Domino Theory	Change of sequential events trigger each other to cause an accident, removing a factor prevents the chain reaction
Multiple Factor Theory	Analyzes 3 phases, precontact, contact, post contact, and influencers like management, machines, and workers
Human Factor Theory	Analyzes factors that lead to human error such as overload and inappropriate activities and responses
Swiss Cheese Theory	Breakdown of components of a complete system creates holes that line up creating an accident condition



Are most accidents caused by unsafe conditions or unsafe behavior?

Research into why construction accidents occur has shown that about **90% of accidents** on construction sites are due to **unsafe behavior**, and about 10% are due to unsafe worksite conditions.

What are the 11 causes of unsafe behavior on the job site?

- Lack of Training
- Inadequate Supervision or Vague Guidance
- Poor condition of physical environment
- Rushed Work and mental stress
- Fatigue or Overtime work
- Multi-Tasking or Overnight work
- Inadequate Communication
- Peer Pressure, interruptions and distractions
- Inadequate Risk Assessment
- Overconfidence
- Lack of Safety Culture or Ignoring it



What do we mean by direct and indirect costs of accidents?

- Direct costs of accidents are those costs covered by insurance.

- Indirect cost is not paid by insurance and thus is unrecoverable.

What are some examples of direct costs of accidents?

- Physical therapy
- Medical expenses
- Repair fees for damaged equipment
- Continuation of pay
- Compensatory damages
- Workers' compensation insurance premium cost
- Liability insurance premium cost
- Equipment liability insurance premium cost
- Legal expenses associated with claim resolution





What are some examples of indirect costs of accidents?

- First-aid expenses
- Damage or destruction of materials
- Cleanup and repair cost
- Idle construction machinery cost
- Unproductive labor time
- Construction schedule delays
- Loss of trained manpower
- Work slowdown
- Administrative and legal expenses
- Lowered employee morale
- Third-party lawsuits
- Cleanup, preparation, and replacement cost of damaged materials, machinery, and property
- Wages paid to injured workers for absences not covered by workers' compensation
- Lost wages and work stoppage associated with the worker injury
- Overtime due to the accident
- Administrative costs and time spent by safety personnel, clerical workers, and other employees after the injury
- Training for replacement workers
- Lost productivity due to the work unit separation from the injury
- Accommodation of the injured employee within the organization



Fatal Fours: FALLS

Physics of fall



- There are more than 100,000 injuries and deaths per year due to work-related falls.

- A body in free fall can travel 4 feet in 0.5 seconds.
- A body in free fall can travel 16 feet in 1 second.
- A body in free fall can travel 64 feet in 2 seconds.

How can I prevent falls on a job site?

Install Guardrails and Barriers	Use Safety Nets	Require Personal Fall Arrest Systems (PFAS)	Erect and Inspect Scaffolds Properly	Train Workers on Ladder Use
Cover or Guard Floor Openings	Implement Roof Fall Protection	Regularly Inspect Equipment	Provide Comprehensive Training	Develop a Fall Protection Plan
Prioritize Fall Prevention	Ensure Adequate Lighting	Promote Safe Work Practices	Foster a Safety Culture	Conduct Regular Safety Meetings
		Establish Emergency Response Procedures	Ensure Regulatory Compliance	

What areas are required to have fall protection?

Unprotected sides and edges	Leading edges	Hoist areas	Holes	Formwork and reinforcing steel
Ramps, runways, and other walkways	Excavations	Dangerous equipment	Overhand bricklaying and related work	Roofing work on low-slope roofs
Roofs	Precast concrete erection	Residential construction	Wall openings	Walking/working surfaces not otherwise addressed

Professionals' advice on fall protection

- Fall protection is generally required when one or more employees have exposure to falls of 6 feet or greater to the lower level.
- Surfaces must be inspected before the work begins.
- Employees are only permitted to be on surfaces that are strong enough to support them.
- Employers are expected to assess the workplace in order to decide if the walking/working surfaces on which employees are to work have the strength and structural integrity to safely support workers.
- Employees are not allowed to work on these surfaces until it has been determined that the surfaces have the necessary strength and structural integrity to support workers.

What are the main tools to protect against falls on a construction jobsite? *(Slide 1of 4)*

- **Personal Fall Arrest Systems (PFAS):** These systems typically consist of a full-body harness, lanyard, and anchor point. Workers wear the harness, and the lanyard is attached to the harness and secured to a suitable anchor point. In the event of a fall, the PFAS prevents the worker from hitting the ground.

- **Guardrails:** Guardrails are physical barriers placed around open edges of elevated work areas, such as scaffolds, platforms, and roofs. They prevent workers from accidentally falling.

- **Safety Nets:** Safety nets are installed beneath elevated work areas to catch falling workers or objects, reducing the risk of injury or damage.

Personal Fall Arrest Systems (PFAS)

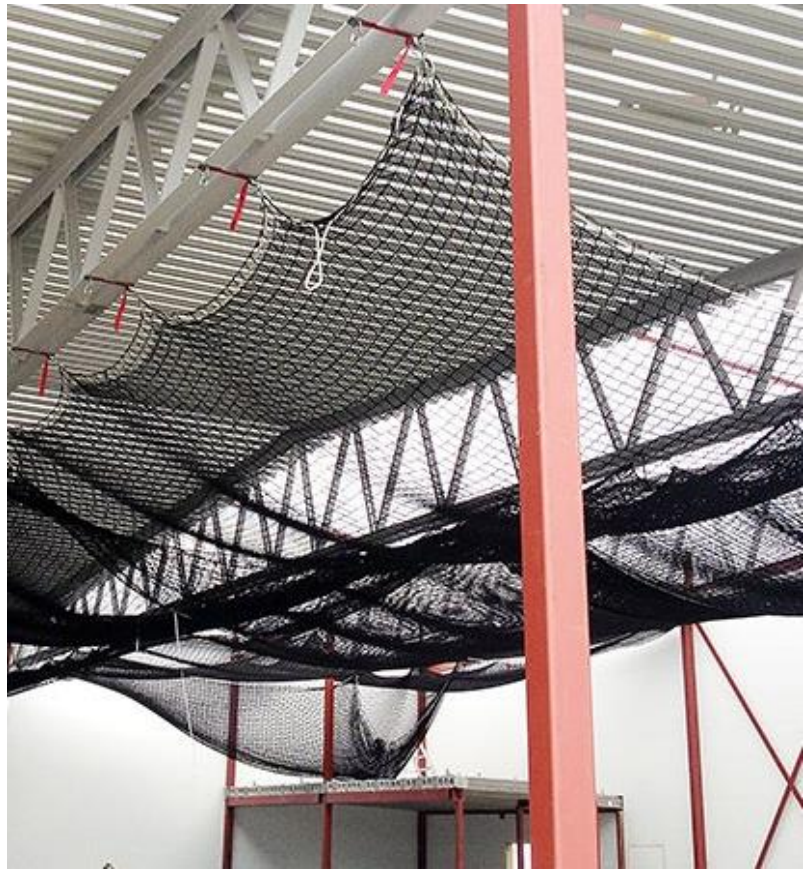


Guardrails





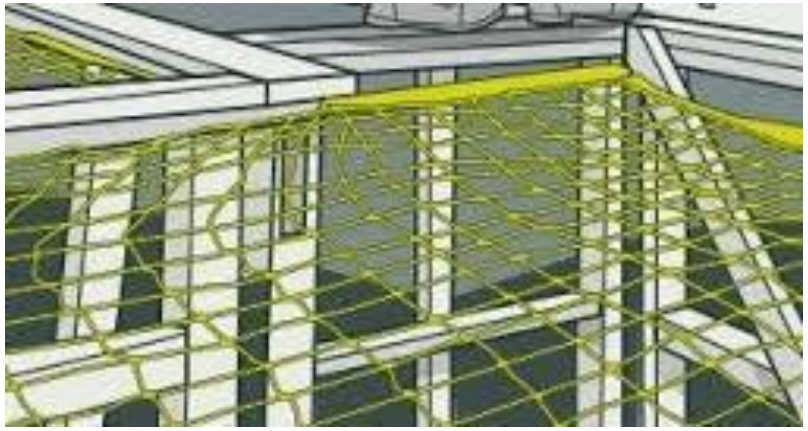












Safety Nets

What are the main tools to protect against falls on a construction jobsite? *(Slide 2of 4)*

- **Safety Harnesses:** Workers wear safety harnesses as part of a personal fall arrest system. These harnesses distribute the force of a fall across the body, reducing the risk of injury.
- **Lanyards and Lifelines:** Lanyards are used to connect a worker's harness to an anchor point, while lifelines are used for horizontal movement on elevated surfaces. They are crucial components of personal fall arrest systems.
- **Anchorage Points:** Anchorage points are secure attachment points for lanyards and lifelines. They can be fixed, such as anchor bolts, or temporary, like anchor straps.



Safety Harnesses



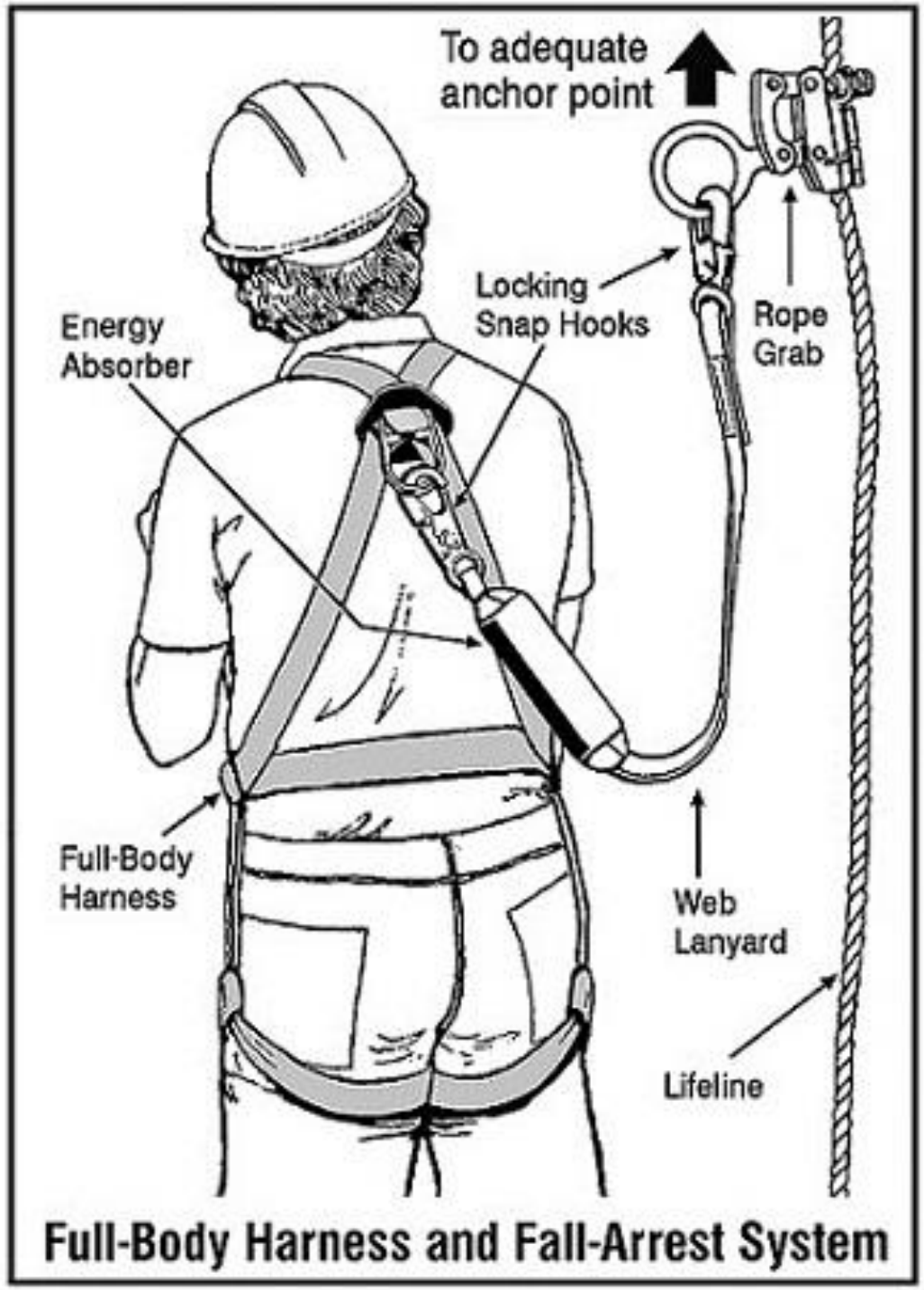
FALL PROTECTION SAFETY GEAR GUIDE

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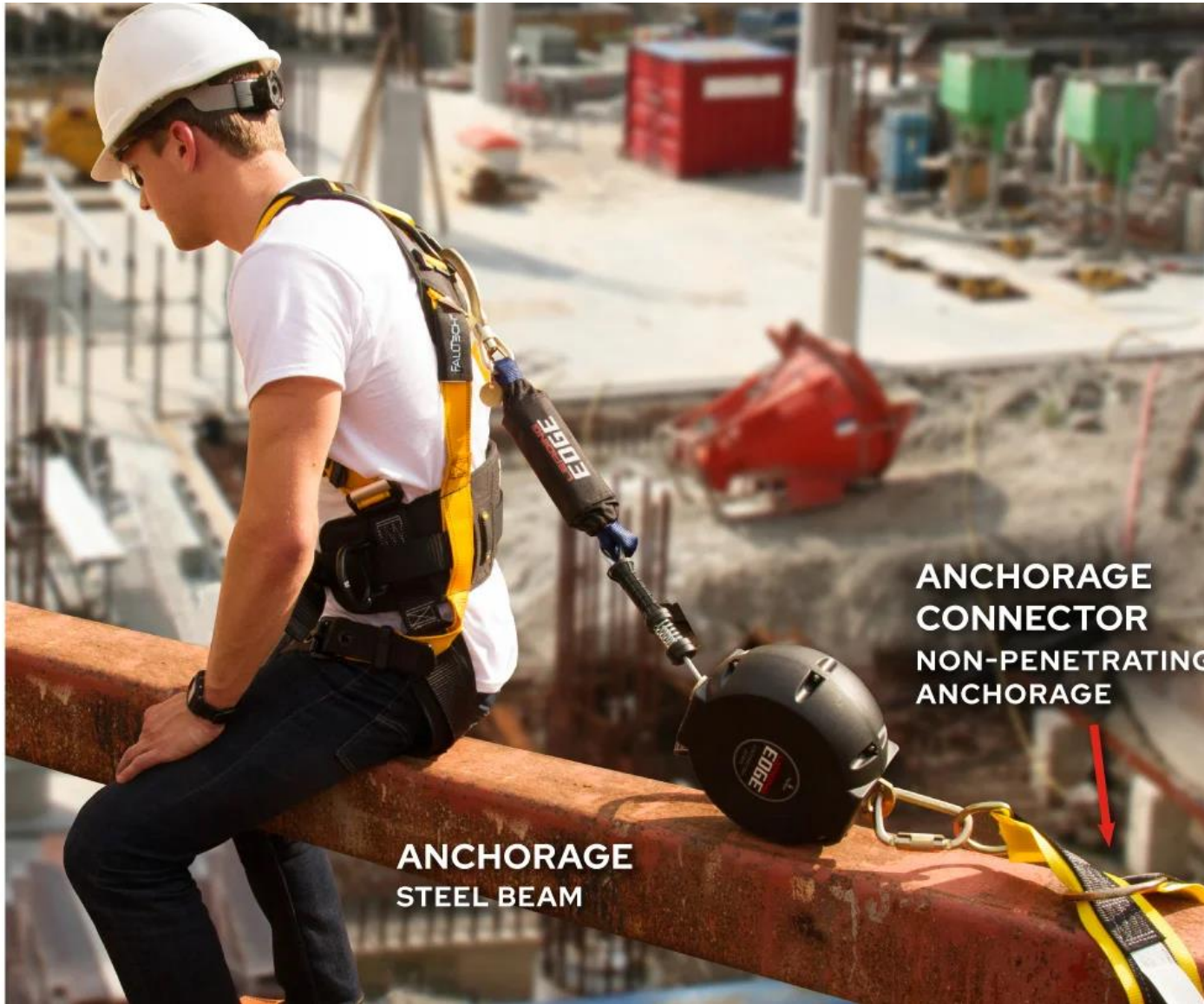
Lanyards and Lifelines





Anchorage Points





What are the main tools to protect against falls on a construction jobsite? *(Slide 3 of 4)*

- **Scaffolding:** Properly constructed scaffolding with guardrails and toe boards provides a safe working platform at elevated heights.

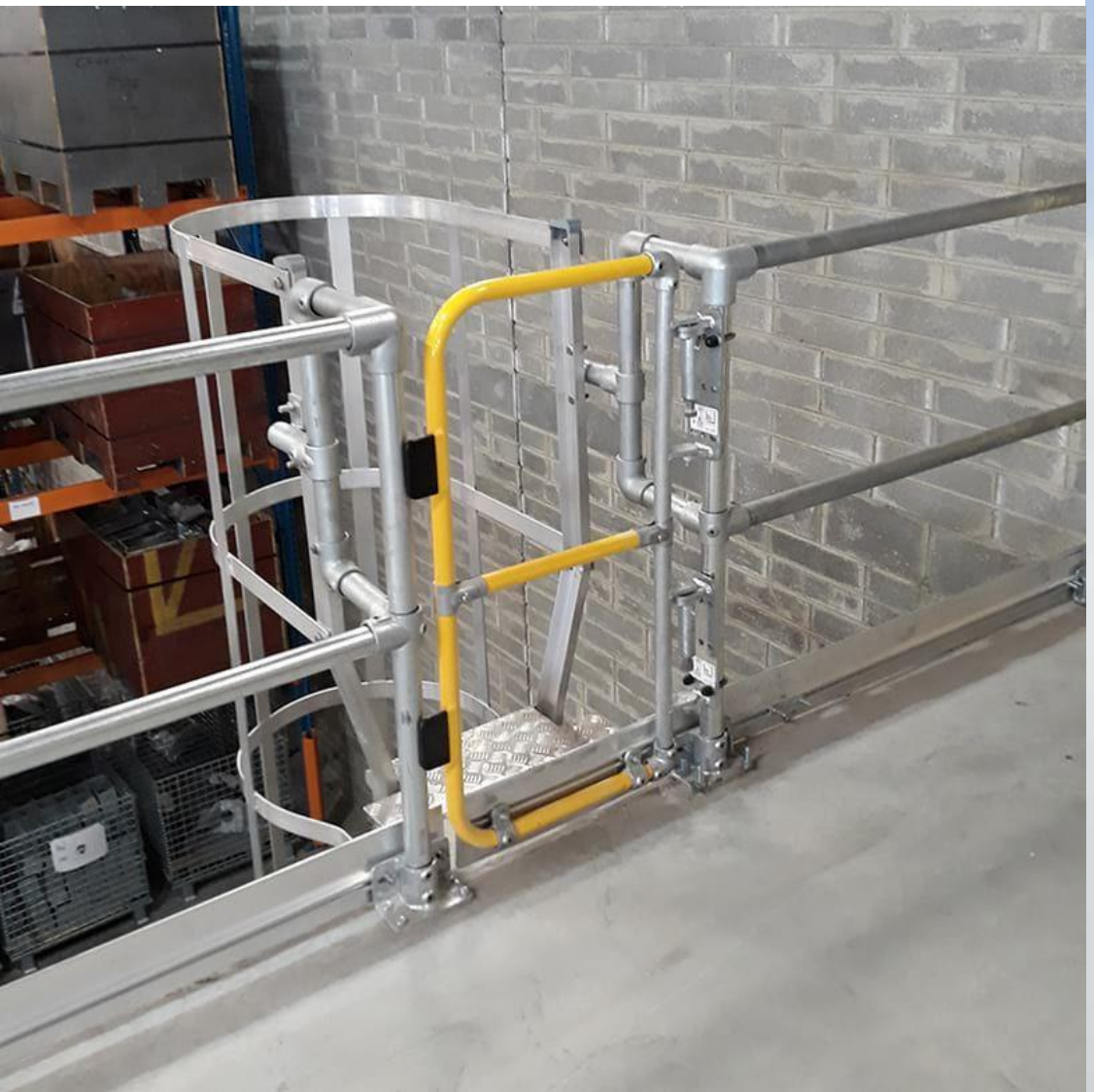
- **Ladder Safety Devices:** These devices, such as ladder cages or ladder safety gates, enhance ladder safety and prevent falls.

- **Safety Barricades:** Temporary barricades are used to create exclusion zones and keep unauthorized personnel away from potential falling object hazards.

Scaffolding



Ladder Safety Devices

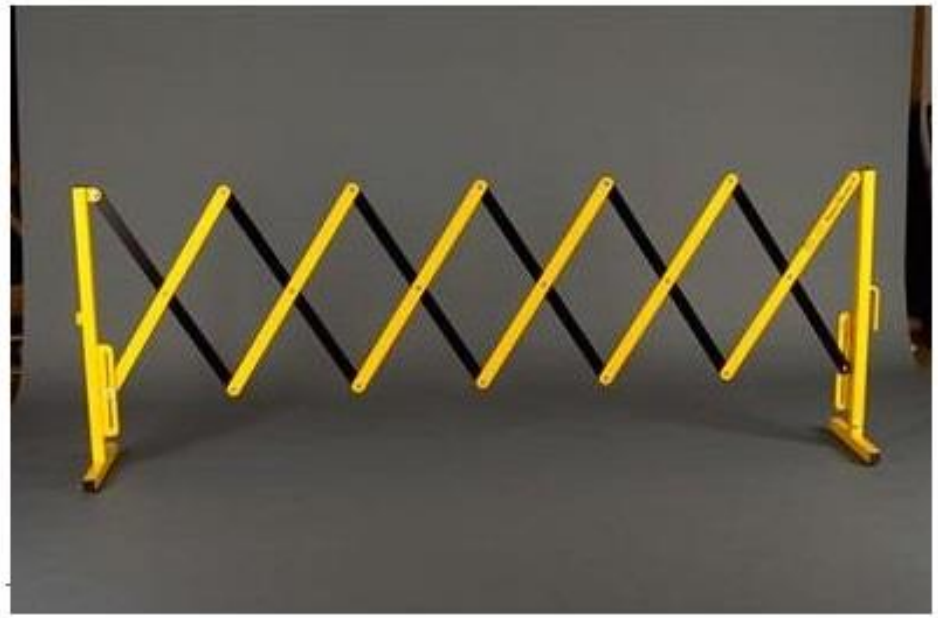




Safety Barricades









What are the main tools to protect against falls on a construction jobsite? *(Slide 4 of 4)*

- **Safety Warning Signs:** Signs indicating potential fall hazards and safety rules are essential for communication and hazard awareness.
- **Safety Training and Education:** Training programs and educational materials help workers understand the importance of fall protection and how to use safety equipment properly.
- **Regular Equipment Inspection:** Inspections of all fall protection equipment, including harnesses, lanyards, and anchors, are necessary to ensure they are in good condition and safe to use.
- **Rescue Equipment:** Having rescue equipment readily available, such as fall arrest retrieval systems or rope access gear, is essential for quickly rescuing a worker in the event of a fall.
- **Fall Protection Plan:** A well-defined fall protection plan specific to the job site ensures that all necessary precautions are taken to prevent falls and respond to incidents effectively.

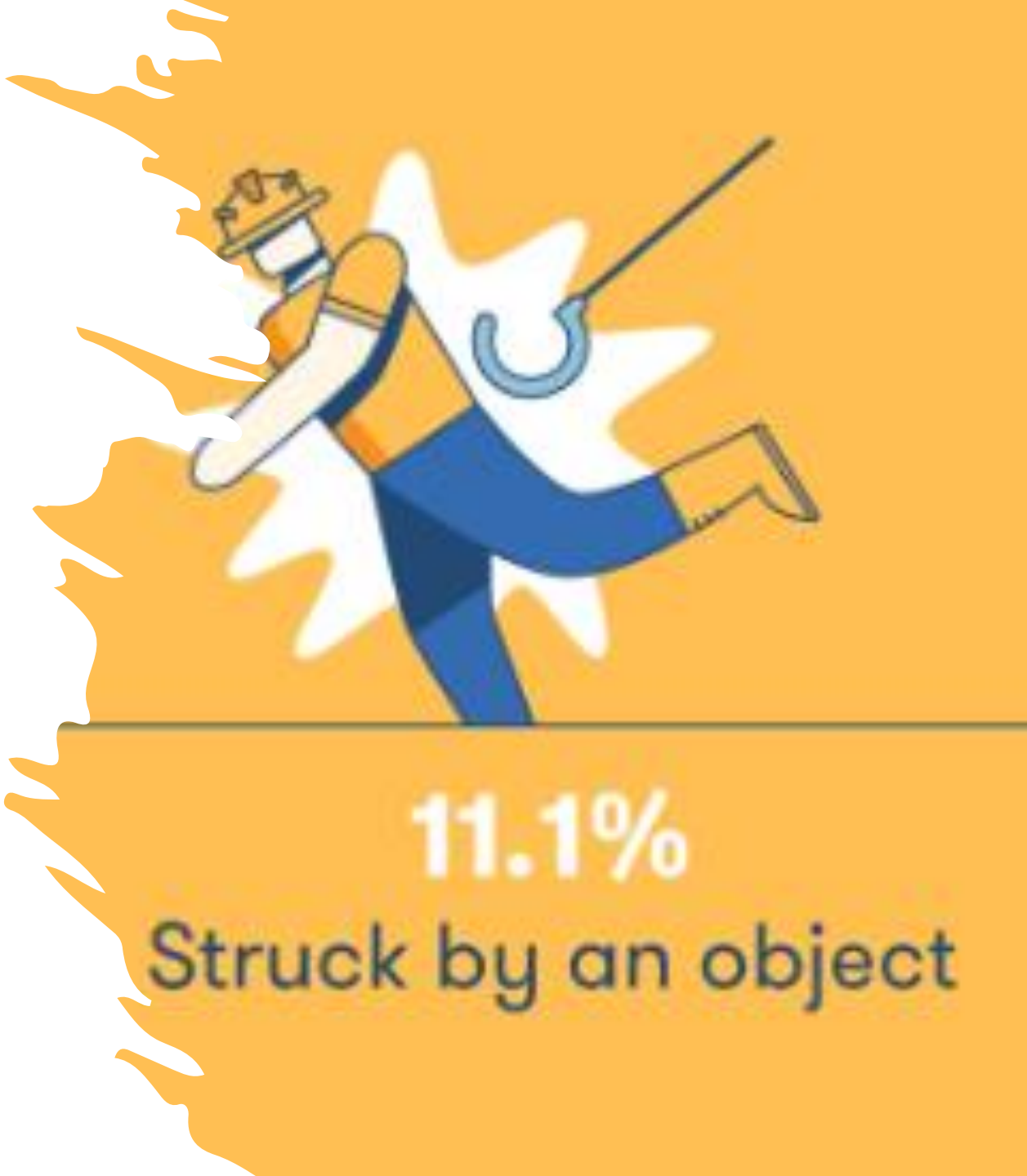
These tools and equipment, along with proper training and adherence to safety procedures, are critical for safeguarding workers and minimizing the risk of falls on construction job sites.



Fatal Fours: Struck (Hit)-by-Objects

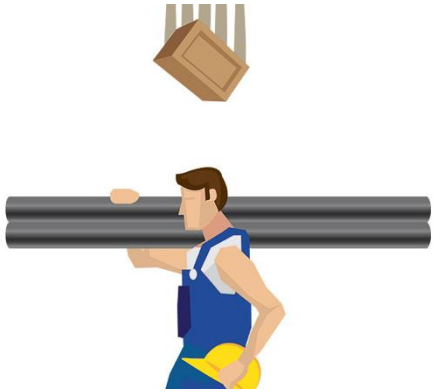
What do we mean by struck-by-object accidents?

- These accidents include objects that are falling (suspended load coming loose), flying (thrown tools or debris), swinging (load swaying), or rolling (vehicle or heavy equipment in motion).
- In these scenarios, employees are sometimes caught off guard and don't have enough time to respond and move out of the way.
- Only falls rank higher and is the number one cause of death in the construction industry.
- OSHA estimates that 75% of struck-by fatalities involve heavy equipment like trucks or cranes.



How Do we prepare against being struck by objects?

1. **Hard Hat Usage**: Require all workers to wear hard hats at all times to protect their heads from falling objects.
2. **Exclusion Zones**: Establish exclusion zones around overhead work areas where there's a risk of falling objects. Ensure that only authorized personnel enter these zones.
3. **Tool Tethering**: Use tool tethering systems to secure tools and equipment at heights. This prevents them from falling.
4. **Barricades and Warning Signs**: Use barricades, cones, and warning signs to mark off hazardous areas and inform workers and visitors of potential risks.
5. **Safety Netting**: Install safety netting or toe boards on scaffolds and elevated work area to catch falling objects.
6. **Debris Nets**: Use debris nets or screens to contain and prevent construction debris from falling to lower levels.
7. **Secure Materials**: Ensure that construction materials are properly stored and secured to prevent them from rolling or falling.
8. **PPE**: In addition to hard hats, provide appropriate personal protective equipment (PPE) such as safety glasses, high-visibility vests, and steel-toed boots to reduce injury risk.
9. **Equipment Inspection**: Regularly inspect heavy equipment, cranes, and lifting devices to ensure they are in good working condition and won't drop loads unexpectedly.
10. **Worker Training**: Train workers on safe work practices and the importance of staying alert and aware of their surroundings to avoid potential hazards.



Mote Safety tips to prevent struck-by-object accidents *(slide 1 of 2):*

- Always install, use, and maintain vehicle backup alarms.
- Station flaggers behind vehicles that have obstructed rear views.
- Keep nonessential workers away from areas of vehicle use.
- Keep workers away from temporary overhead activities.
- Place barriers and warning signs around hazardous operations and public roadways.
- Never put yourself between moving or fixed objects.
- Always wear bright, highly visible clothing when working near equipment and vehicles.



Mote Safety tips to prevent struck-by-object accidents *(slide 2 of 2):*

- Use manufacturer-approved safety restraints unless the vehicle is not designed for them.
- Never allow workers to drive equipment in reverse without an alarm or flagger.
- Enforce a limited access zone before dumping or lowering buckets.
- Properly turn off and block all equipment, including accessories.
- Set parking brakes and use chock wheels if parked on an incline.
- Install cab shields on hauling vehicles to protect against struck-by and rollover injuries.
- Never exceed the vehicle's rated lift capacity or carry unauthorized personnel.
- Use signs, barricades, and flaggers to protect workers near roadways.
- Use proper lighting and reflective clothing/vests at night.



When do we need to get prepared for struck-by-object incidents ?

- Protection from struck-by-object incidents should be an ongoing priority on construction sites.
- It is relevant at all stages of a construction project, from planning and pre-construction to active construction and even during demolition and site cleanup.





What are examples of falling objects?

Falling objects can include:

tools,

materials,

debris,

equipment,

and they pose a significant hazard due to the force and potential for serious harm.



Why is protection against falling objects a must?

1. **Safety**: Falling objects can cause severe injuries, including head trauma, fractures, and even fatalities. Protecting against falling objects is a fundamental aspect of ensuring construction site safety.

2. **Legal Requirements**: Many occupational safety regulations mandate protection against falling objects on construction sites. Failure to comply can result in fines and legal consequences.

3. **Productivity**: A safer work environment contributes to higher worker morale and productivity, as workers can focus on their tasks without the fear of falling objects.





When is protection against falling objects needed:

- **During All Construction Phases:** Protection against falling objects is necessary throughout all construction phases, from initial site preparation to demolition and cleanup.

- **Whenever Work is Conducted Above Ground:** Any work performed at elevations where objects can fall, such as scaffolding, elevated platforms, or work on upper levels of structures, requires protection against falling objects.

- **When There's Activity Above or Below:** Even when workers are not directly above the ground, objects can fall from heights or be dislodged from work areas above or below.

How can I protect my workers against falling objects?

- Make Them Wear Appropriate PPE
- Install Safety Nets and Catch Platforms
- Use Toe Boards and Guardrails
- Secure Tools and Equipment
- Establish Barricades and Exclusion Zones
- Conduct Regular Inspections
- Store Materials and Tools Securely
- Ensure Clear Communication
- Provide Training
- Supervise and Enforce Safety Measures
- Establish Emergency Response Procedures



Selection of fall protection systems based on site conditions

Site Conditions	Selection
There is a hoisting area without guardrails	Personal fall arrest system
Workers are working 4 feet above paving equipment	Equipment guards
An 8-foot deep hole is hidden by overgrown grasses	Fences
Roofers are working on low-slope roofs with unprotected sides	Warning line and safety monitoring systems
Workers may be hit by falling tools and materials	Hardhats and barricades
Falling tools and materials	Toe boards
Work on a roof with an unprotected edge	Warning line system
Workers working on a 12-foot high wall	Positioning device system
Workers on a roof with large holes	Covers



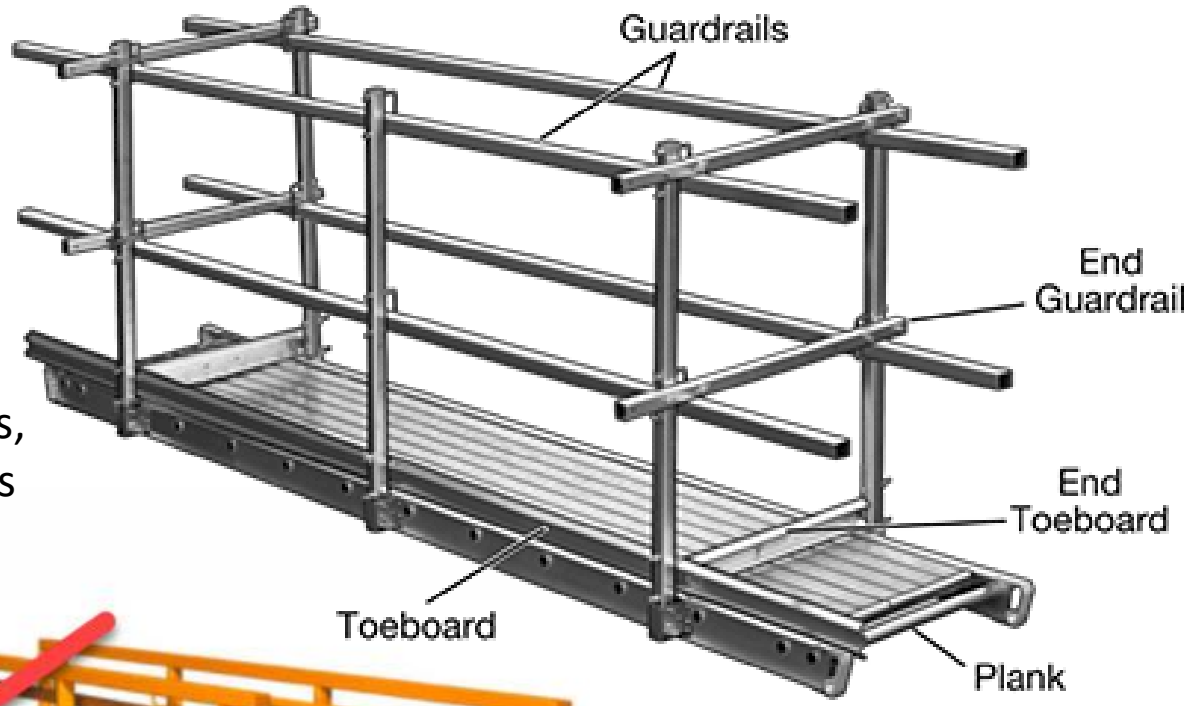
Tool Tethers and Lanyards

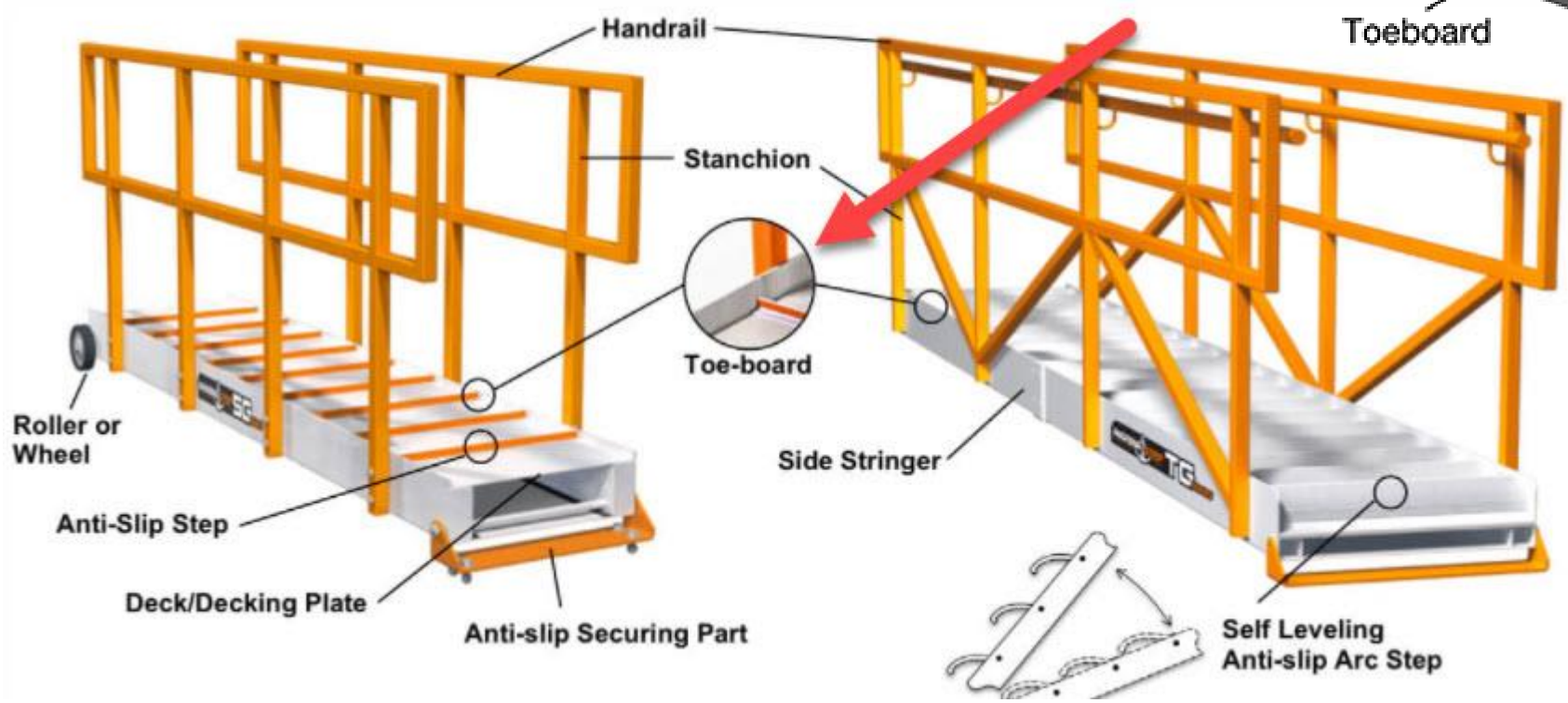
These are used to secure tools and equipment to prevent them from falling when workers are at heights. Tool lanyards can be attached to a worker's belt or harness.



Toe Boards

Toe Boards: Toe boards are used along the edges of scaffolds, elevated platforms, and other open edges to prevent objects from falling over the side.





Hard Hats: Workers should wear hard hats to protect against head injuries from falling objects.





What are the steps to create a fall protection plan?

Step 1. Develop a written fall protection plan and train employees in fall protection.

Step 2. Assess potential fall hazards prior to each project.

Step 3. Use administrative controls to eliminate hazards by changing or rescheduling tasks.

Step 4. Inspect fall protection equipment to ensure its condition and appropriateness.

Step 5. Before starting work, remind employees of specific fall hazards that are present on the jobsite.

Step 6. Once work has begun, observe workers to ensure that fall protection is being used properly.

TCM 2430 – Construction Safety

Week 8 – Protection against Electrocution & Caught-in/between



Dr. Tommy Tafazzoli

Reminder: Fatal Four

OSHA FATAL FOUR HAZARDS

4,674 private sector worker fatalities occurred in 2017

971 or **20.7%** were in construction

The Fatal Four were responsible for **59.9%** of the construction worker deaths in 2017

That means **1 out of every 5** worker deaths was construction-related

Eliminating the Fatal Four would save **582** workers' lives every year.



Falls 39.2%

The leading cause of death among construction workers

- Ladders
- Ledges
- Cranes
- Scaffolding
- Roofing
- Wall opening
- Floor holes may contribute to a worker's fatal fall.



Struck-by Object 8.2%

Struck-by injuries occur when a worker is hit or injured by an object, tool, equipment, or material. They are categorized by:

- Flying object
- Falling object
- Swinging object
- Rolling object





Electrocutions 7.3%

Electrocution can result from contact with overhead power lines, contact with energized sources such as damaged wires, and improper use of extension cords.

Caught-In/Between 5.1%

Ladders, ledges, cranes, scaffolding, roofing, wall opening, & floor holes may contribute to a worker's fatal fall.

Caught-in or a caught-between occur when a worker is caught, crushed, squeezed, pinched, or compressed between two or more objects.



Pietras Saracino Smith & Meeks LLP
Attorneys at Law



Fatal Fours: Electrocution

What do professionals say about electrocution?

Almost every week we face an accident of electrician.

It takes very little current flow to cause harm to a person who comes in direct contact with an electrical circuit.

There is a significant risk of fires due to electrical malfunctions.

Unserious electrocution can cause a worker to fall/ slip and lead to serious injuries.

It's essential for everyone on the job site to be vigilant and cautious when working near electrical systems or equipment.

Relying on your experience when dealing with electricity can be misleading.



Who can be exposed to electrocution on a construction job site?
(slide 1 of 2)



Electricians	Electricians are highly trained professionals responsible for installing, maintaining, and repairing electrical systems on construction sites. They are particularly at risk due to their close proximity to live electrical circuits.
Construction workers	Many construction workers may come into contact with electrical systems or equipment as part of their job, especially if they are involved in activities like wiring, drilling, or digging near buried electrical lines.
Equipment operators	Operators of heavy machinery and construction equipment, such as cranes, backhoes, and excavators, can be exposed to electrocution hazards if their equipment accidentally makes contact with overhead power lines or buried electrical cables.
Plumbers and pipefitters	These tradespeople may need to work in areas where electrical systems are present, such as when installing water heaters, pumps, or other equipment that interacts with electricity.
HVAC technicians	Heating, ventilation, and air conditioning technicians often work with electrical components in HVAC systems, which can pose a risk if proper safety precautions are not taken.

Who can be exposed to electrocution on a construction job site?
(slide2 of 2)



Inspectors and supervisors	Construction site inspectors and supervisors may need to be present near electrical work to ensure that safety procedures are followed. They should also be aware of the risks associated with electrical hazards.
General laborers	Even general laborers on construction sites can be exposed to electrocution hazards if they are working in areas where electrical systems are present or if they come into contact with electrical tools and equipment.
Engineers and designers	Engineers and designers involved in the planning and layout of electrical systems on construction projects need to be aware of potential electrocution hazards and ensure that safety measures are integrated into the design.
Visitors and bystanders	Visitors, including clients, family members, and other non-construction personnel, can also be at risk if they enter construction zones without proper awareness of electrical hazards and safety precautions.

Is low voltage safe?

Low voltage does not mean that there is a low hazard of electrical shock. The severity of the shock depends on:

- The path of current through the body
- The amount of current flowing through the body (Ampere)
- The duration of the shocking current through the body



What are the examples of direct electrical injuries?

- Electrocution (death due to electrical shock)
- Electrical shock and related symptoms resulting from the shock (e.g., tissue damage, neurological disorders, muscle contractions which can cause falls and injuries, etc.)
- Burns
- Arc flash/blast (usually resulting in burns, concussion injuries, etc.)



What are the examples of indirect electrical injuries?

- Electric shocks may also cause indirect injuries. Workers on ladders and in elevated areas that encounter shocks can slip, resulting in severe injury or death.

The following are considered to be indirect electrical injuries:

- Falls
- Back injuries
- Cuts to the hands



What are some examples of electrical hazards?

(Slide 1 of 2)

Contact with live electrical wires	• Accidental contact with live electrical wires, such as overhead power lines or exposed wiring, can lead to electrocution.
Overhead power lines	• Construction equipment, like cranes and scaffolding, can come into contact with overhead power lines, posing a risk of electrocution if not properly managed.
Inadequate grounding	• Electrical equipment and tools should be properly grounded to prevent electrical shocks. Failure to do so can result in electrical hazards.
Wet or damp conditions	• Water can conduct electricity, so working with electrical equipment in wet or damp conditions increases the risk of electrical shock.
Damaged or frayed cables and cords	• Worn or damaged electrical cables and extension cords can expose live wires, leading to electrical shocks or fires.
Inadequate electrical insulation	• Electrical equipment and wiring should be adequately insulated to prevent contact with live parts.
Lack of lockout/tagout procedures	• Failure to de-energize and lockout/tagout electrical systems before maintenance or repairs can lead to unexpected energization and electrical accidents.
Unsafe use of extension cords	• Overloading extension cords, using damaged cords, or using cords not rated for the intended purpose can result in electrical hazards.

Overhead power lines in construction



What are some examples of electrical hazards?

(Slide 2 of 2)

Poorly maintained electrical equipment	• Neglected or poorly maintained electrical tools and equipment may develop faults that increase the risk of electrical accidents.
Confined spaces	• Electrical hazards can be amplified when working in confined spaces where it's challenging to avoid contact with live wires or electrical components.
Inadequate training and supervision	• Workers who are not properly trained or supervised may not be aware of electrical hazards or how to safely work with electrical equipment.
Lack of personal protective equipment (PPE)	• Failure to use appropriate PPE, such as insulated gloves, safety goggles, and non-conductive footwear, can increase the risk of electrical injury.
Overloading circuits	• Plugging too many devices or tools into a single circuit can overload it, leading to overheating and potentially causing electrical fires.
Inadequate signage and warnings	• Failing to mark electrical hazards and provide clear warnings can lead to unsuspecting individuals entering hazardous areas.
Improper use of power tools	• Using power tools near water sources or without proper grounding can create electrical hazards.



What should be controlled to avoid electrical hazards?

(What are the root causes of electrical hazard)

- Unsafe equipment and/or installation
- Unsafe workplace environments
- Unsafe work practices



Fatal Fours: Caught-in/between

What are caught-in/between accidents on a construction site?

- Accidents that involve workers or objects getting caught, crushed, or trapped between two or more objects or surfaces.

Some examples include:

Trench or excavation collapses	Machinery accidents	Equipment rollovers
Collapsing materials or structures	Pinned or squeezed between objects	Confined spaces





How can I prevent Trench or excavation collapses? *(slide 1 of 2)*

Assign a Competent Person

Designate a competent person on-site with training and experience in trenching and excavation safety. Empower them to assess the work area, make safety decisions, and enforce safety measures.

Utilize Trench Protective Systems

Implement appropriate trench protective systems to buttress the sides of the excavation and thwart collapses. Employ three primary types of trench protective systems:

1. **Slope the Trench:** Angle the trench walls away from the excavation at a safe slope ratio, adjusting it based on soil conditions.
2. **Shore the Trench:** Use engineered shoring systems, such as hydraulic or mechanical shoring, designed to withstand soil pressure and provide trench wall support.
3. **Shield the Trench:** Install trench boxes or shields, creating a protective barrier between workers and the trench walls.

Conduct Soil Analysis

Arrange for a soil analysis by a geotechnical engineer to ascertain soil type and stability. This analysis guides the selection of the appropriate protective system and sloping angles.

Establish Safe Access and Egress

Ensure safe means of entry and exit from the trench, such as ladders or ramps, placed no more than 25 feet apart.

How can I prevent trench or excavation collapses? *(slide 2 of 2)*

Implement Benching

If benching is chosen instead of sloping, construct horizontal steps within the trench walls to reduce collapse risk.

Manage Water

Address groundwater and surface water issues that might weaken trench walls. Employ well-point systems, sump pumps, or dewatering techniques as necessary.

Keep Spoil Piles Clear

Maintain spoil piles and equipment at least 2 feet away from the trench edge to avoid additional pressure on the walls.

Perform Inspections

Conduct daily trench inspections before work commencement and after significant weather events or soil condition changes. Vigilantly look for signs of instability, including cracking, bulging, or sloughing.

Equip Workers

Ensure workers within the trench wear proper protective gear, including hard hats, high-visibility vests, and appropriate footwear.

Establish Safety Barriers

Erect barriers or barricades around the excavation site to prevent unauthorized entry and to deter non-essential personnel from approaching the hazard area.

What are some safety guidelines in trenching?





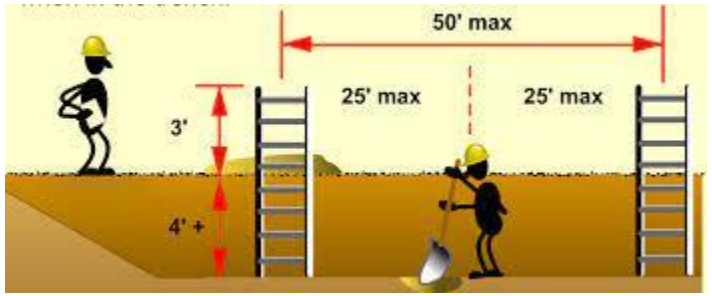
Trench shielding



Trench shoring

Trench Safe Access and Egress for safety



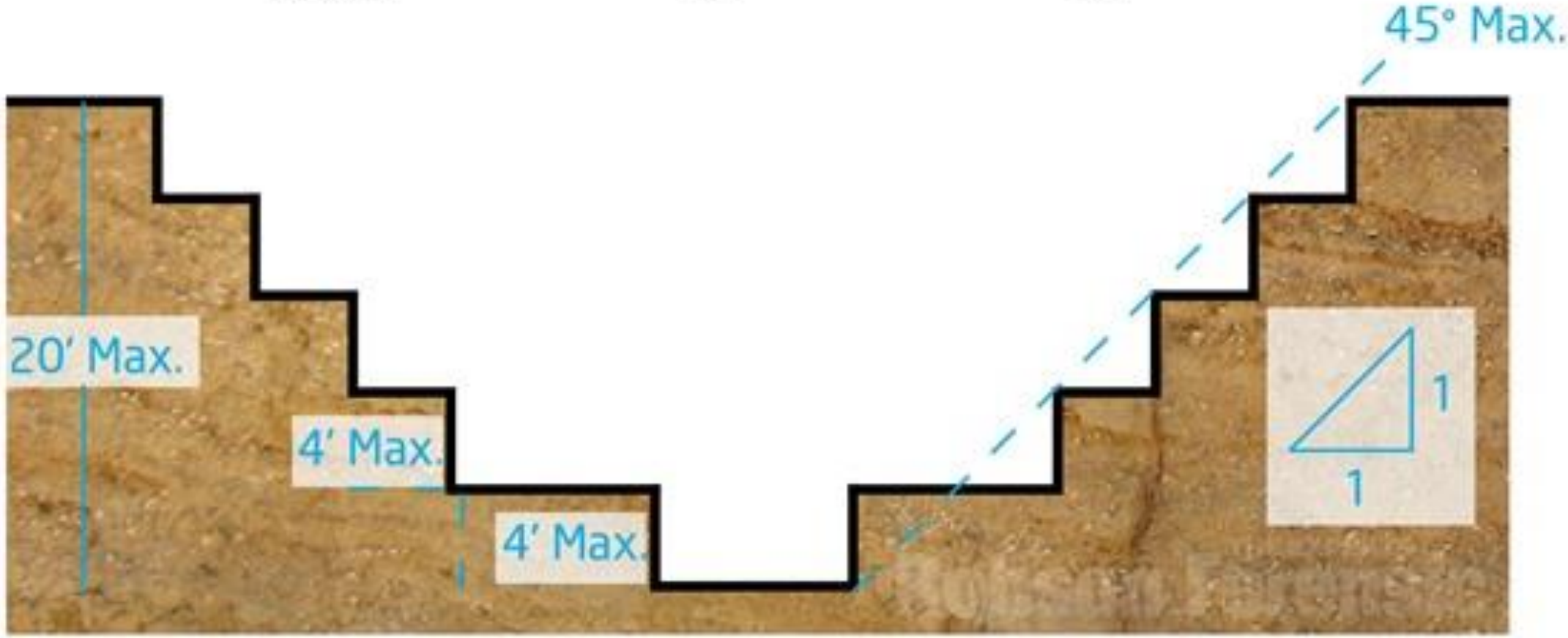




Depiction of Benching

Benching Slope Varies by Soil Type

Soil Type	Max. Slope (H:V)	Slope Angle (degrees)
Type A	3/4 :1	53
Type B	1:1	45



How can I prevent machinery accidents? *(slide 1 of 2)*

Inspect Machinery Regularly

- Schedule routine machinery inspections to detect and address potential faults or defects promptly.

Train Operators

- Provide comprehensive training for machinery operators, ensuring they are proficient in safe operation and maintenance procedures.

Use Safety Guards

- Install and maintain appropriate safety guards and shields on machinery to prevent contact with moving parts.

Conduct Pre-Operational Checks

- Prior to use, require operators to conduct pre-operational checks to confirm that machinery functions correctly.

Follow Lockout/Tagout Procedures

- Implement lockout/tagout procedures when performing maintenance or repairs to prevent unexpected energization of machinery.

Maintain Clear Visibility

- Ensure machinery operators have unobstructed visibility, and use backup alarms and spotter personnel when necessary.

Establish No-Go Zones

- Define and enforce designated no-go zones to keep workers at a safe distance from operating machinery.

How can I prevent machinery accidents? *(slide 2 of 2)*

Provide Adequate Lighting

- Ensure proper lighting in and around machinery areas to enhance visibility and safety.

Avoid Overloading

- Adhere to load limits and avoid overloading machinery to maintain stability and prevent accidents.

Secure Loads

- Safely secure loads on equipment like cranes and forklifts to prevent shifting or falling during transport.

Control Speed

- Implement speed limits and safe operating speeds for machinery to reduce the risk of collisions or rollovers.

Stay Clear of Moving Parts

- Instruct workers to stay clear of machinery while it's in operation and never reach into moving equipment.

Properly Park and Secure Equipment

- Ensure machinery is properly parked and securely immobilized when not in use to prevent unintended movement.

How can I prevent equipment rollovers?



1. **Train Operators:** Provide comprehensive training for equipment operators, ensuring they are skilled in safe equipment operation techniques.
2. **Check Load Limits:** Verify that loads are within the specified weight limits for equipment to maintain stability.
3. **Use Load Charts:** Refer to load charts and equipment manufacturer guidelines to determine safe load capacities.
4. **Monitor Ground Conditions:** Continuously assess ground conditions to identify potential hazards like soft or uneven terrain.
5. **Avoid Overloading:** Prevent overloading equipment by adhering to load limits and distributing loads evenly.
6. **Secure Loads:** Properly secure loads with straps, chains, or other suitable restraints to prevent shifting during transport or operation.
7. **Inspect Tires:** Regularly inspect tires for proper inflation, tread wear, and damage, addressing any issues immediately.
8. **Operate on Level Ground:** Use equipment on level and stable surfaces whenever possible to maintain balance.
9. **Slow Down on Slopes:** Reduce speed and exercise caution when operating equipment on slopes or uneven terrain.
10. **Implement Rollover Protection:** Equip equipment with rollover protection systems (ROPS) and seat belts to safeguard operators in the event of a rollover.

How can I prevent hazards due to working in confined spaces (other than tranches)? *(Slide 2 of 2)*

Identify Confined Spaces	Clearly define what constitutes a confined space at your construction site. Confined spaces can include tanks, sewers, manholes, silos, vaults, tunnels, and more.
Conduct a Risk Assessment	Before any work begins, conduct a thorough risk assessment to identify potential hazards specific to the confined space. This assessment should consider factors such as atmospheric conditions, potential for engulfment, and hazardous substances.
Train Workers	Ensure that all workers involved in confined space work receive appropriate training on confined space hazards, safe work practices, and emergency procedures. Workers should know how to use safety equipment and be trained in first aid and CPR.
Use Proper Entry Permits	Implement a confined space entry permit system. Workers should obtain a permit before entering a confined space, and permits should only be issued after a thorough evaluation of safety conditions.
Ventilation	Ensure adequate ventilation within the confined space to control atmospheric hazards. This may involve using fans, blowers, or natural ventilation methods.
Atmospheric Testing	Regularly test and monitor the atmosphere inside the confined space for oxygen levels, flammable gases, and toxic substances. Ensure that workers have access to gas detectors and that they are trained to interpret the readings.
Isolation and Lockout/Tagout	Isolate and lockout/tagout all energy sources associated with the confined space to prevent accidental activation of equipment or machinery.
Proper Equipment	Provide workers with appropriate personal protective equipment (PPE), including respiratory protection, fall protection, and gas detectors. Ensure that PPE is in good working condition and used correctly.

How can I prevent hazards due to working in confined spaces (other than tranches)? *(Slide 1 of 2)*

Emergency Procedures	Establish and communicate clear emergency procedures, including rescue plans. Have rescue equipment on hand, and train a designated rescue team in confined space rescue techniques.
Communication	Maintain constant communication with workers inside the confined space using two-way radios or other reliable communication devices.
Safe Entry and Exit	Ensure safe means of entry and exit from the confined space, such as properly positioned ladders, stairs, or hoists. These should be regularly inspected for safety.
Supervision	Assign a competent person to supervise confined space work. This person should have knowledge of confined space hazards and emergency procedures.
Regular Inspections	Conduct regular inspections of confined spaces, including before and after entry, to ensure safety conditions are maintained.
Record Keeping	Maintain records of confined space entry permits, atmospheric testing results, training records, and any incidents or near misses. These records can help identify trends and areas for improvement.
Continuous Training and Evaluation	Regularly update and reinforce safety training, procedures, and equipment. Conduct debriefings after confined space work to evaluate what went well and identify areas for improvement.
Review and Revise Procedures	Periodically review and update confined space procedures based on lessons learned and changes in regulations or technology.

TCM 2430 – Construction Safety

Week 09 – Demolition, Noise + Dust Control, and Excavation Safety



Dr. Tommy Tafazzoli



Demolition Safety



Primary safety considerations when planning a demolition project

1. Conduct a Thorough Site Assessment

- Conduct a thorough site assessment to identify potential hazards, including unstable structures, utilities, environmental contaminants, and nearby structures or properties. Understanding the site's condition is crucial for proper planning.



Primary safety considerations when planning a demolition project

2. Select the Appropriate Demolition Method

- Choose the most appropriate demolition method based on the site's conditions, the type of structure, and its proximity to other structures. Methods can include implosion, mechanical demolition, or manual demolition.

Primary safety considerations when planning a demolition project

3. Identify and Manage Hazardous Materials

- Identify and assess the presence of hazardous materials such as asbestos, lead-based paint, and chemicals. Develop safe procedures for handling, removal, and disposal of these materials in compliance with regulations.



Primary safety considerations when planning a demolition project

4. Securely Disconnect Utilities

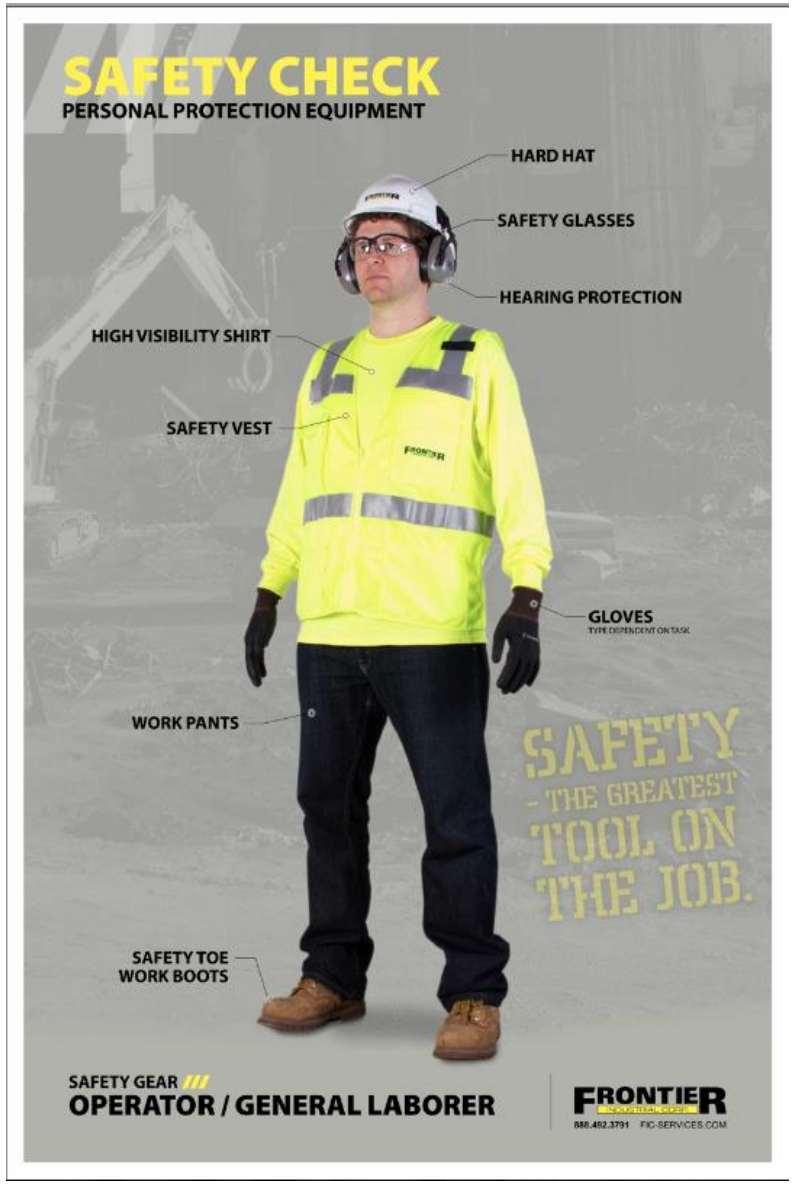
- Ensure that all utilities, including gas, water, electricity, and telecommunications, are safely disconnected or relocated before demolition begins to prevent accidents.



Primary safety considerations when planning a demolition project

5. Provide Adequate Personal Protective Equipment (PPE)

- Outfit all workers on the site with appropriate PPE, including hard hats, safety glasses, hearing protection, respiratory gear, and high-visibility attire.



Primary safety considerations when planning a demolition project

6. Assess Structural Stability

- Assess the structural stability of the building or structure and implement shoring or bracing if necessary to prevent collapse during demolition.



Primary safety considerations when planning a demolition project

7. Control Dust and Debris

- Implement measures to control dust and debris generated during demolition, including the use of water sprays, dust curtains, and barriers to protect workers and the surrounding environment.



Primary safety considerations when planning a demolition project

8. Mitigate Noise and Vibration

- Develop strategies to mitigate noise and vibration to prevent adverse effects on workers and nearby residents. This may involve sound barriers, dampening materials, or scheduling work during less disruptive times.



Primary safety considerations when planning a demolition project

9. Maintain Equipment Safety

- Ensure that all demolition equipment is properly maintained, inspected, and operated by trained personnel. Establish safety procedures for equipment operation.





Primary safety considerations when planning a demolition project

10. Craft an emergency response plan

- Formulate a comprehensive emergency response plan that outlines procedures for evacuating the site, rendering medical assistance, and addressing accidents, fires, or unforeseen incidents.

Primary safety considerations when planning a demolition project

11. Establish Clear Communication Protocols

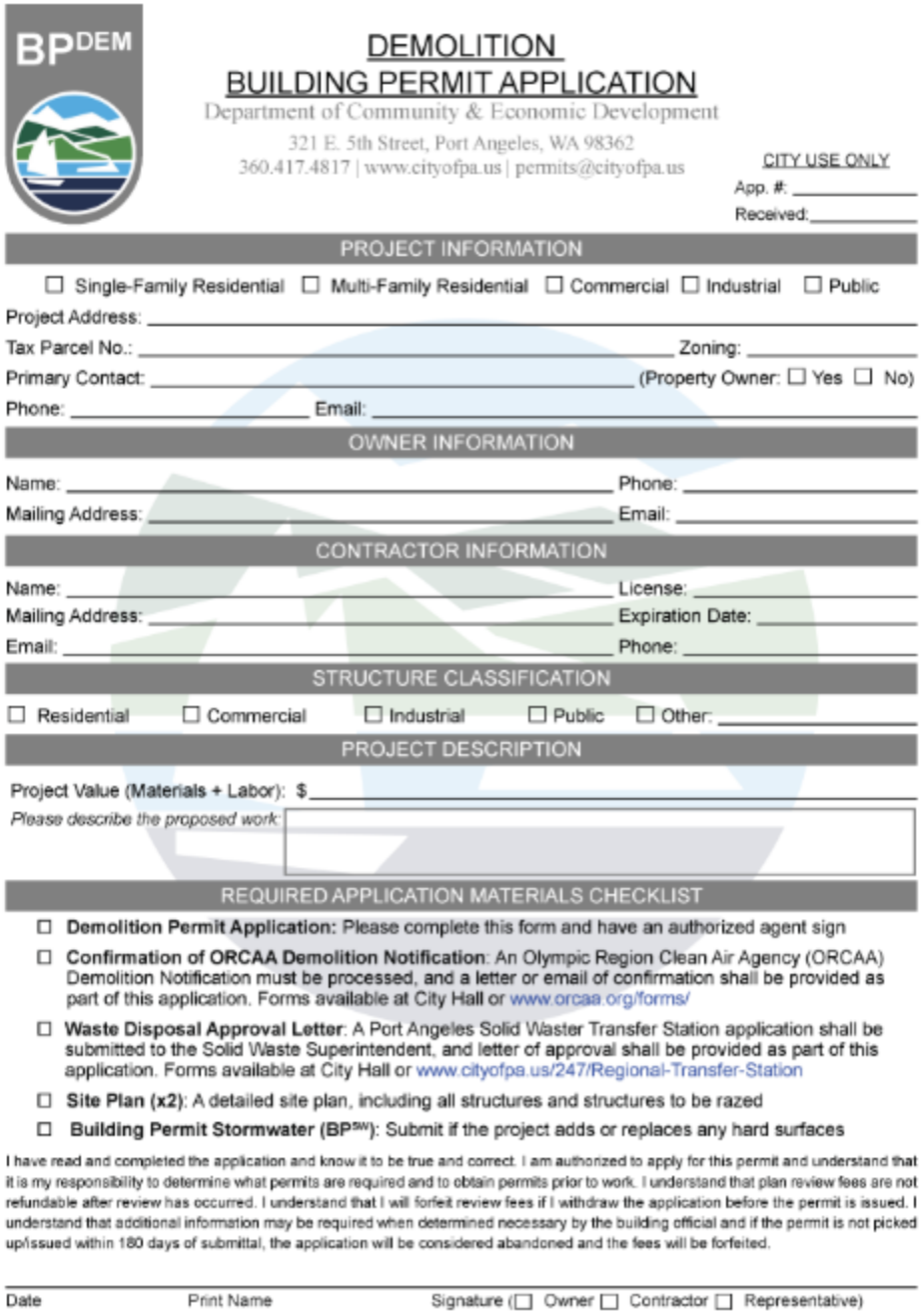
- Foster transparent communication among workers and the public, utilizing signage and barricades to denote restricted areas and potential dangers.



Primary safety considerations when planning a demolition project

12. Comply with Permits and Regulations

- Assure that all necessary permits and regulatory requirements are scrupulously adhered to, including full compliance with local, state, and federal regulations governing demolition activities.



BP DEM

DEMOLITION
BUILDING PERMIT APPLICATION
Department of Community & Economic Development
321 E. 5th Street, Port Angeles, WA 98362
360.417.4817 | www.cityofpa.us | permits@cityofpa.us

CITY USE ONLY
App. #: _____
Received: _____

PROJECT INFORMATION

☐ Single-Family Residential ☐ Multi-Family Residential ☐ Commercial ☐ Industrial ☐ Public

Project Address: _____
Tax Parcel No.: _____ Zoning: _____
Primary Contact: _____ (Property Owner: ☐ Yes ☐ No)
Phone: _____ Email: _____

OWNER INFORMATION

Name: _____ Phone: _____
Mailing Address: _____ Email: _____

CONTRACTOR INFORMATION

Name: _____ License: _____
Mailing Address: _____ Expiration Date: _____
Email: _____ Phone: _____

STRUCTURE CLASSIFICATION

☐ Residential ☐ Commercial ☐ Industrial ☐ Public ☐ Other: _____

PROJECT DESCRIPTION

Project Value (Materials + Labor): $_____
Please describe the proposed work:

REQUIRED APPLICATION MATERIALS CHECKLIST

☐ **Demolition Permit Application:** Please complete this form and have an authorized agent sign
☐ **Confirmation of ORCAA Demolition Notification**: An Olympic Region Clean Air Agency (ORCAA) Demolition Notification must be processed, and a letter or email of confirmation shall be provided as part of this application. Forms available at City Hall or www.orcaa.org/forms/
☐ **Waste Disposal Approval Letter**: A Port Angeles Solid Waster Transfer Station application shall be submitted to the Solid Waste Superintendent, and letter of approval shall be provided as part of this application. Forms available at City Hall or www.cityofpa.us/247/Regional-Transfer-Station
☐ **Site Plan (x2)**: A detailed site plan, including all structures and structures to be razed
☐ **Building Permit Stormwater (BP^{SW})**: Submit if the project adds or replaces any hard surfaces

I have read and completed the application and know it to be true and correct. I am authorized to apply for this permit and understand that it is my responsibility to determine what permits are required and to obtain permits prior to work. I understand that plan review fees are not refundable after review has occurred. I understand that I will forfeit review fees if I withdraw the application before the permit is issued. I understand that additional information may be required when determined necessary by the building official and if the permit is not picked up/issued within 180 days of submittal, the application will be considered abandoned and the fees will be forfeited.

Date Print Name Signature (☐ Owner ☐ Contractor ☐ Representative)



Primary safety considerations when planning a demolition project

13. Champion Environmental Protection

- Enact measures to shield the environment, including proper disposal of hazardous waste, erosion control, and effective stormwater management.

Primary safety considerations when planning a demolition project

14. Provide Comprehensive Training

- Equip all workers participating in the demolition project with comprehensive training, encompassing hazard recognition, safe work practices, and emergency response procedures.

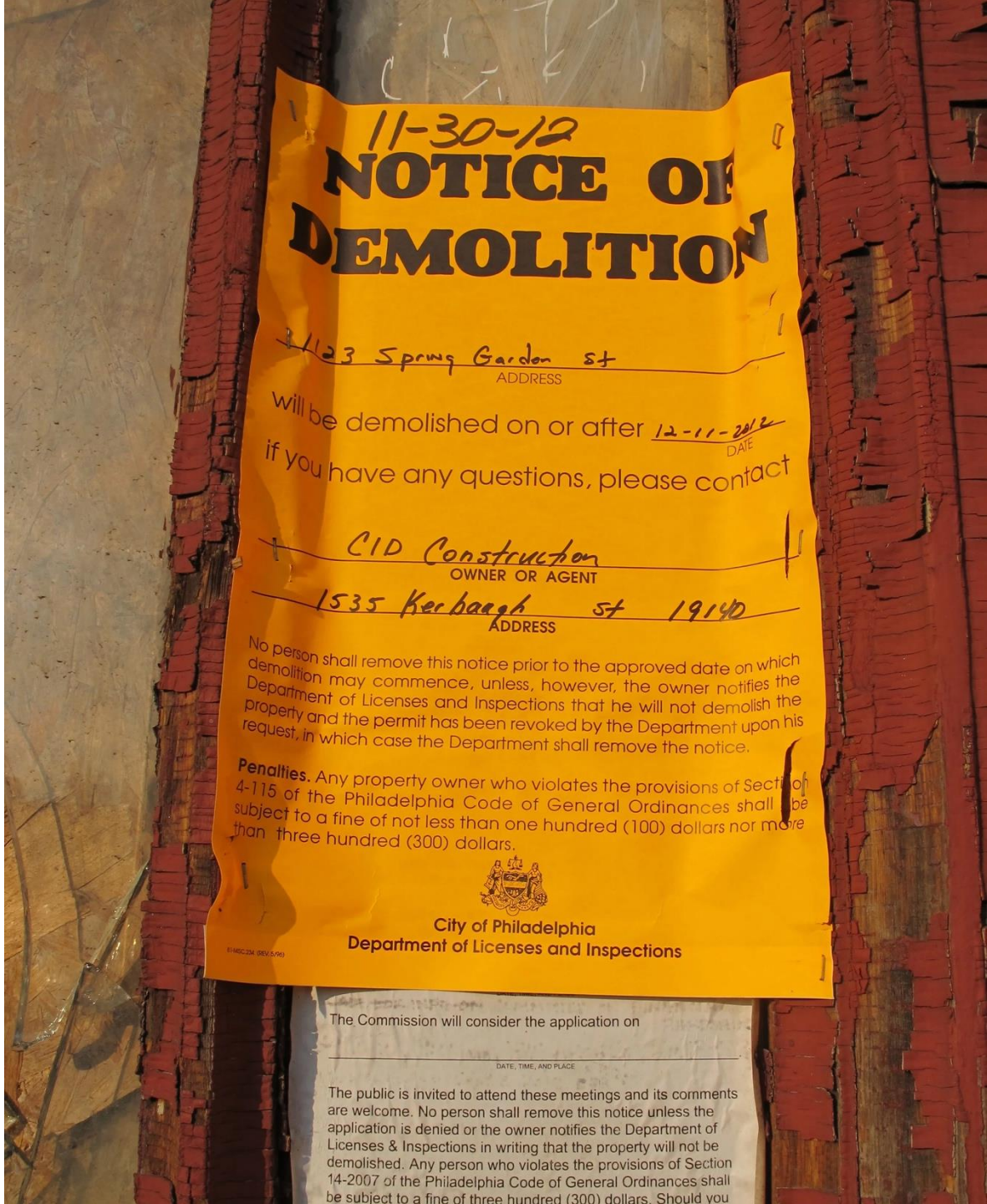


Primary safety considerations when planning a demolition project

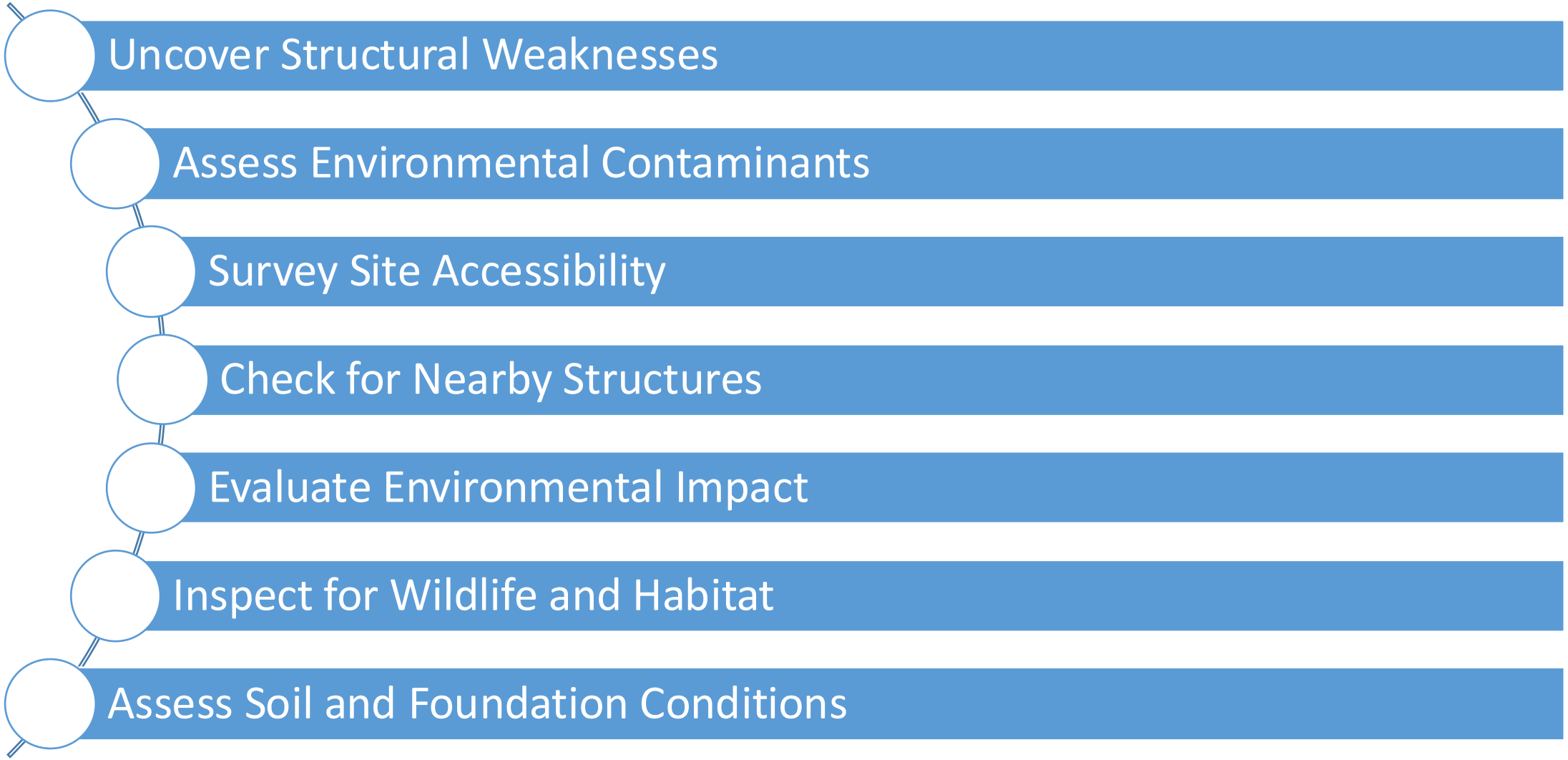
15. Implement Site Security Measures

- Apply security measures to thwart unauthorized access to the demolition site, thereby reducing the risks of accidents and vandalism.





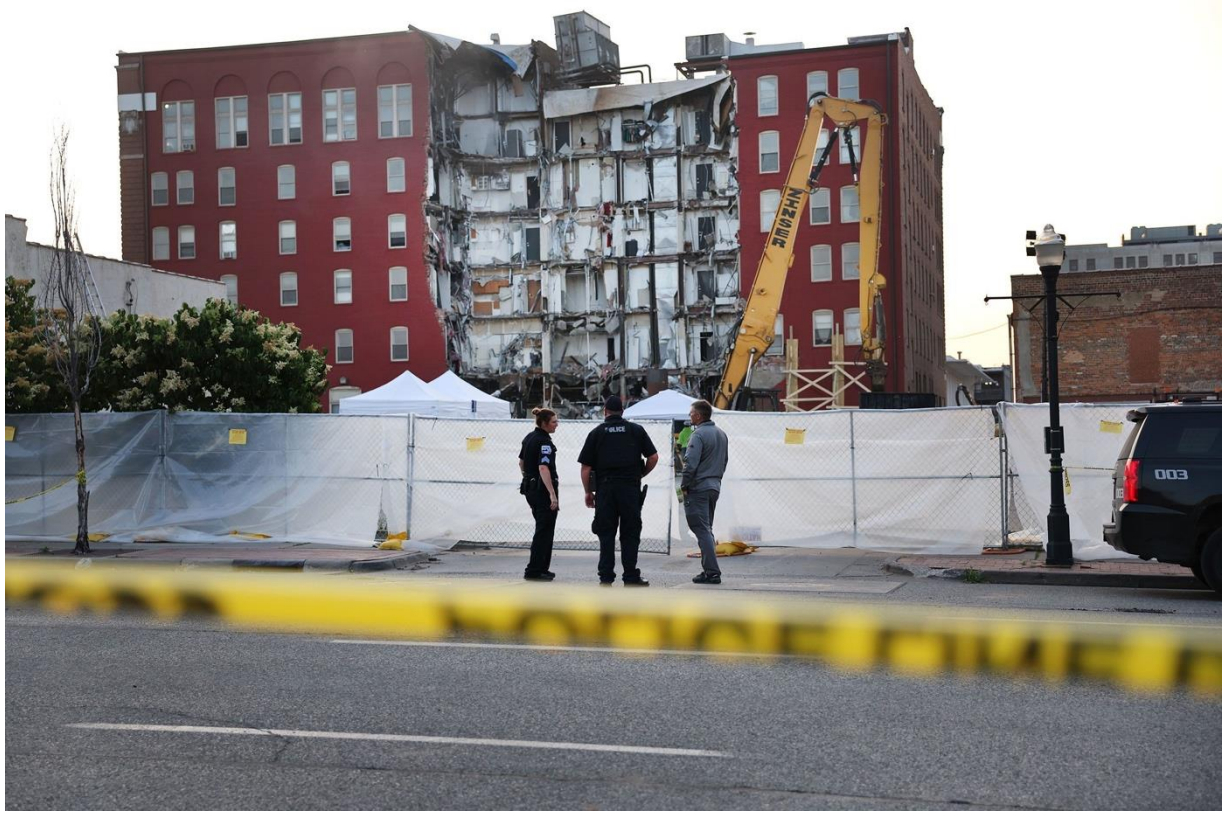
How should we conduct a thorough site assessment before starting demolition work, and what hazards should be identified during this assessment?



Conducting site assessment before starting demolition work

1. Uncover Structural Weaknesses

- To uncover structural weaknesses, various methods such as structural inspections, engineering assessments, non-destructive testing, and materials analysis can be employed. These methods help ensure that the construction or demolition project proceeds safely, efficiently, and with the highest quality standards.



Conducting site assessment before starting demolition work

2. Assess Environmental Contaminants

- Assessing environmental contaminants before demolition and construction is a proactive and responsible approach that benefits human health, protects the environment, ensures legal compliance, manages costs, and fosters positive relationships with stakeholders.
- It is an essential step in sustainable and responsible construction and demolition practices.



Conducting site assessment before starting demolition work

3. Survey Site Accessibility

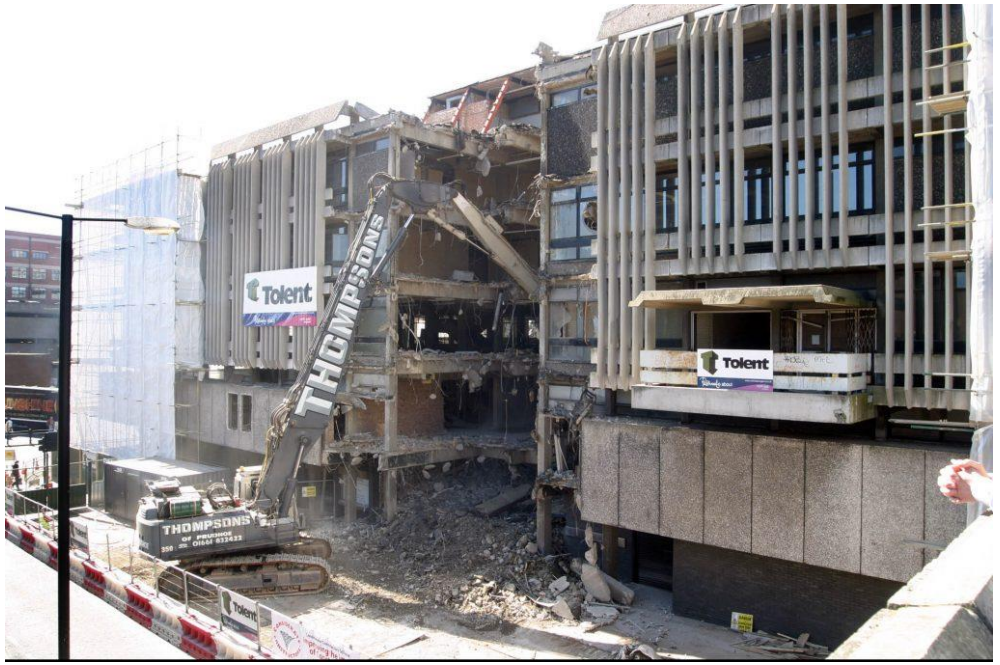
- This is essential for safety, legal compliance, cost control, efficiency, environmental responsibility, stakeholder communication, and overall project success.
- It helps identify potential issues early, allowing for effective planning and risk mitigation.



Conducting site assessment before starting demolition work

4. Check for Nearby Structures

- This is essential for ensuring safety, complying with regulations, protecting the environment, avoiding legal issues, and maintaining positive relationships with the community.
- It helps ensure that construction and demolition projects proceed smoothly and responsibly.



Conducting site assessment before starting demolition work

5. Evaluate Environmental Impact

- It is essential to protect the environment, comply with regulations, promote sustainability, address community concerns, and ensure long-term cost-effectiveness and safety. It is a crucial step in responsible and ethical development practices.



Conducting site assessment before starting demolition work

6. Inspect for Wildlife and Habitat

- inspecting for wildlife and habitat before demolition and construction is essential for environmental conservation, legal compliance, ethical responsibility, and long-term sustainability.
- It helps identify and mitigate potential negative impacts on wildlife and their ecosystems, ultimately contributing to a more responsible and sustainable approach to development.



Conducting site assessment before starting demolition work

7. Assess Soil and Foundation Conditions

- assessing soil and foundation conditions before demolition and construction is a crucial step that ensures the safety, stability, and success of the project while complying with legal and regulatory requirements.



What hazards should be identified during site assessment before starting demolition work?

Structural Instability	Hazardous Materials	Utilities	Environmental Contaminants
Accessibility and Egress	Proximity to Other Structures	Environmental Impact	Wildlife and Habitat
Soil and Foundation Conditions	Weather and Climate	Security Risks	Historical Records

Dust Control



What safety measures should be in place to protect workers and the surrounding environment from dust and debris during demolition? *(Slide 1 of 3)*

Dust Control Plan

Develop a comprehensive dust control plan that outlines specific strategies and measures to minimize dust generation and dispersion.

Water Sprays

Utilize water sprays or misting systems to suppress dust at the source. This helps weigh down particles and prevents them from becoming airborne.

Dust Curtains and Barriers

Erect dust curtains or barriers around the demolition site to contain dust and prevent it from spreading beyond the work area.

Wet Demolition

Consider wet demolition methods where feasible, such as soaking materials before removal, to reduce dust creation.

Demolition Timing

Schedule demolition work during periods of lower wind speeds to minimize the spread of dust.

High-Efficiency Dust Collectors

Employ high-efficiency dust collection systems on equipment like saws and crushers to capture and contain airborne particles.

What safety measures should be in place to protect workers and the surrounding environment from dust and debris during demolition? *(Slide 2 of 3)*

Personal Protective Equipment (PPE)

Provide workers with appropriate PPE, including respiratory protection (such as N95 respirators), safety glasses, and full-body coveralls, to reduce exposure to dust.

Ventilation

Implement proper ventilation systems to maintain air quality within enclosed workspaces, reducing the concentration of airborne dust.

Debris Containment

Use debris chutes, nets, or catchment systems to collect falling debris and prevent it from scattering.

Waste Removal

Establish procedures for the safe and controlled removal of demolition waste, ensuring it is securely contained during transport to disposal sites.

Roadway Cleaning

Regularly clean adjacent roadways and public areas to minimize dust tracking onto streets and into neighboring properties.

Monitoring and Air Quality Testing

Conduct regular monitoring of dust levels using air quality sensors and perform air quality testing to ensure compliance with safety standards.

What safety measures should be in place to protect workers and the surrounding environment from dust and debris during demolition? *(Slide 3 of 3)*

Public Notifications

Inform neighboring residents and businesses about demolition activities and the potential for dust and debris, along with measures being taken to mitigate these issues.

Regulatory Compliance

Adhere to local, state, and federal regulations regarding dust control and environmental protection, obtaining any required permits or approvals.

Environmental Impact Assessment

Assess the potential environmental impact of dust and debris, including any impact on nearby water bodies, vegetation, or wildlife, and take measures to prevent harm.

Worker Training

Train workers on the hazards of dust exposure and proper safety procedures, emphasizing the importance of PPE usage and following the dust control plan.

Emergency Response

Develop an emergency response plan for addressing unexpected releases of dust or debris, including procedures for evacuation and containment.







Dust Curtains and Barriers







Water Sprays for dust control







Wet Demolition



Noise Control

What are some common methods for controlling noise and vibration during demolition to minimize potential harm to workers and neighboring properties? (slide 1 of 2)

Isolate Machinery	Isolate demolition machinery and equipment by placing them on vibration-dampening materials or mounts to reduce the transmission of vibrations to the ground.
Install Acoustic Barriers	Erect acoustic barriers or sound walls around the demolition site to contain noise and prevent its propagation to neighboring properties.
Schedule Work Hours	Carefully schedule demolition work during specified hours to minimize disruption to nearby residents and businesses, particularly during quieter periods.
Adjust Impact Energy	Modify equipment settings to limit the impact energy applied during demolition, thereby reducing both noise and vibrations.
Opt for Quieter Techniques	Choose demolition techniques that generate less noise and vibration, such as precision dismantling or mechanical methods, when feasible.
Equip Silenced Machinery	Employ silenced or muffler-equipped equipment to diminish noise emissions during operation.
Utilize Dampened Pile Drivers	When applicable, use pile drivers equipped with dampening mechanisms to minimize vibration transmission into the ground.

What are some common methods for controlling noise and vibration during demolition to minimize potential harm to workers and neighboring properties? (slide 2 of 2)

Install Shock Absorbers	Fit heavy machinery and equipment with shock absorbers or isolators to minimize the transfer of vibrations.
Maintain Equipment Regularly	Perform routine maintenance on equipment and machinery to prevent noise and vibration issues caused by mechanical problems.
Monitor and Measure	Continuously monitor noise and vibration levels using appropriate instruments to ensure they remain within acceptable limits.
Notify the Public	Inform nearby residents and businesses about demolition schedules and potential noise and vibration impacts, as well as the measures being taken to mitigate these effects.
Comply with Regulations	Ensure compliance with local noise ordinances and regulations, obtaining any necessary permits or approvals.
Assess Environmental Impact	Conduct an assessment of potential environmental impacts caused by noise and vibrations, particularly on nearby water bodies, wildlife, and vegetation, and implement mitigation measures.
Train Workers	Train workers on noise and vibration hazards, emphasizing the proper use of equipment and techniques to minimize their effects.
Develop Emergency Response Plan	Create an emergency response plan to address unexpected increases in noise or vibration, including procedures for assessing and mitigating risks.





Isolating Machinery





Acoustic Barriers

How should utilities such as electricity, gas, and water be safely disconnected or managed before demolition begins? (slide 1 of 2)

Coordinate with Utility Companies	Perform Utility Locating	Notify Utility Providers	Shut Off Power Sources	Gas Line Isolation	Water Supply Termination	Label Utility Locations
• Initiate coordination with local utility companies to schedule the safe disconnection or shut-off of electricity, gas, and water services to the demolition site.	• Execute utility locating services to accurately pinpoint the location of underground utilities, such as gas and water lines.	• Inform utility providers promptly about the demolition project and request temporary service interruptions or relocation of utility lines, if necessary.	• De-energize electrical systems decisively by shutting off circuit breakers, disconnecting power sources, and implementing lockout procedures to prevent accidental reactivation.	• Isolate gas lines efficiently by promptly shutting off the main gas valve and ensuring that gas meters are securely locked or removed in accordance with local gas utility protocols.	• Cease the water supply with precision at the main shut-off valve or meter, and systematically drain the water lines to prevent accidental flooding during demolition.	• Clearly label utility shut-off points, and meticulously document their locations to ensure swift and unobstructed access for emergency responders and demolition crews.

How should utilities such as electricity, gas, and water be safely disconnected or managed before demolition begins? (slide 1 of 2)

Lockout/Tagout Procedures	Inspect for Leaks	Pressure Release	Document Disconnect Process	Utility Verification	Develop an Emergency Response Pla	Plan Utility Reconnection
• Implement lockout/tagout procedures for electrical and gas systems with diligence to obstruct unauthorized or accidental reactivation.	• Conscientiously inspect gas lines for leaks post-shut-off, and promptly address any identified issues to eliminate safety risks.	• If required, safely release pressure from gas lines using established protocols to mitigate the potential for unexpected bursts during demolition.	• Rigorously document the disconnection process, including specific dates, times, and responsible personnel, ensuring comprehensive records for future reference and safety documentation.	• Thoroughly verify the successful completion of all utility disconnections, and maintain meticulous documentation before proceeding with any demolition activities.	• Formulate a comprehensive emergency response plan encompassing procedures for effectively addressing utility-related incidents or emergencies that may arise during the demolition	• Strategically plan for the safe reconnection of utilities post-demolition, adhering to regulatory compliance and safety protocols.



What is the importance of creating a demolition plan and establishing a clear chain of command for communication and decision-making on the worksite?

- Safety is paramount in demolition work.
- A well-structured demolition plan outlines safety procedures, hazard assessments, and emergency protocols.
- Establishing a clear chain of command ensures that safety decisions are made promptly and effectively to protect workers and the public.

How can I ensure safety for equipment operators involved in demolition?

Training and Certification	Training should cover equipment operation, safety procedures, emergency response, and hazard recognition.
Conduct thorough Pre-Operation Inspection	Identify any potential mechanical issues or safety hazards. Verify that all safety features, such as emergency shut-off switches and alarms, are functioning correctly.
Conduct a comprehensive Site Evaluation	Identify potential hazards, such as underground utilities, unstable structures, or hazardous materials.
Safe Distance	Ensure that all workers and bystanders are at a safe distance from the demolition area and equipment during operation. 1. Establish barricades and warning signs to restrict access to hazardous zones.
Determine Load Limits	Be aware of the equipment's load limits and do not exceed them. Overloading equipment can lead to instability and accidents.
Controlled Demolition	Practice controlled demolition techniques, which involve systematically dismantling structures in a planned and orderly manner, rather than using brute force. Avoid swinging wrecking balls uncontrollably or using excessive force.



Excavation Safety

What is excavation, and why is it a crucial aspect of construction projects?

- Excavation is the process of digging, removing, and shaping the earth's surface to create cavities or depressions in the ground.
- It is a crucial aspect of construction projects because it provides the foundation for various construction activities, such as building foundations, underground utilities, basements, and road construction.
- Proper excavation ensures a stable and safe environment for the construction of structures and the installation of utilities, making it a fundamental step in the construction process.



What are the common hazards associated with excavation work, and how can they be mitigated?



Trench Collapses

- Excavation walls can collapse, burying workers. To mitigate this hazard, use protective systems like shoring, sloping, or trench boxes.

Falls

- Workers can fall into excavations. Guard the edges with barriers, ensure workers use fall protection equipment, and maintain safe access and egress.

Engulfment

- Soil or materials can engulf workers. Use protective systems, remove materials from the edge, and have a rescue plan in place.

Struck-By Incidents

- Workers can be struck by equipment or falling objects. Maintain safe distances, use spotters, and wear high-visibility clothing.

Utility Strikes

- Hitting underground utilities can lead to gas leaks or electrical hazards. Identify utility locations beforehand and use proper excavation techniques.

Hazardous Atmosphere

- Confined spaces in excavations can contain hazardous gases. Test the atmosphere, provide proper ventilation, and have rescue procedures in place.

Drowning

- Water can accumulate in excavations, posing a drowning risk. Pump out water and implement proper drainage measures.

Falling Loads

- Loads being lifted by equipment can fall into excavations. Ensure proper rigging and signaling during lifting operations.

What steps can be taken to identify and locate underground utilities before excavation to prevent accidents?



1. **Contact Utility Companies:**
    1. Reach out to local utility companies, such as gas, water, electric, telephone, and cable providers, well in advance of excavation.
    2. Request utility line location services, commonly known as "utility marking" or "utility locating."
2. **Review Utility Records:**
    1. Review existing utility records and as-built drawings to gather information about underground infrastructure on the site.
3. **Use One-Call Services:**
    1. Utilize one-call or "811" services, which are available in many countries, to notify all utility companies about the planned excavation.
    2. One-call services will coordinate with utility providers to mark the locations of their underground lines.
4. **Meet with Utility Representatives:**
    1. Schedule a pre-excavation meeting with utility company representatives to discuss the excavation plan and identify any specific safety precautions or requirements.
5. **Mark Utility Lines:**
    5. After notification, utility companies will send personnel to mark the ground with color-coded flags or paint to indicate the location of their respective underground lines.
    6. Each utility type is typically assigned a specific color code (e.g., yellow for gas, blue for water).
6. **Verify Marks:**
    1. Verify the accuracy of the marks and their alignment with the excavation plan. If discrepancies are found, contact the utility company for clarification.
7. **Use Non-Destructive Testing:**
    1. Employ non-destructive testing methods, such as ground-penetrating radar (GPR) or electromagnetic locators, to further verify the presence and depth of underground utilities.
8. **Hand Digging:**
    1. When working near marked utility lines, use hand digging techniques or vacuum excavation equipment to expose the lines gradually and avoid damaging them.
9. **Safe Work Distances:**
    1. Establish safe work distances from marked utility lines, taking into account the type of equipment being used and the depth of the utilities.



TCM 2430 – Construction Safety

Week 10 – Mobilization, Foundation, Scaffolding, Steelwork & Forklift Safety

Dr. Tommy Tafazzoli



Mobilization Safety

Construction Mobilization Hazards and Prevention Techniques

Traffic Accidents



1. Traffic Control Plans (TCPs): Develop and implement comprehensive traffic control plans that clearly define traffic flow patterns, safe zones, and speed limits in and around the construction site. This should include proper signage, barricades, and delineators to guide both construction vehicles and regular traffic safely.

2. Flagging and Spotters: Employ trained flaggers or spotters to direct traffic, especially at critical points where construction vehicles enter or exit the site or when working near public roadways. Ensure that they are easily identifiable with high-visibility clothing.

3. Separate Entry/Exit Points: Establish separate entry and exit points for construction vehicles whenever possible to reduce congestion and the likelihood of accidents. Ensure that these points are well-marked and well-lit, especially during low visibility conditions.

4. Driver Training and Vehicle Maintenance: Ensure that all construction vehicle operators are trained and qualified to operate their equipment safely. Regularly inspect and maintain construction vehicles to address potential mechanical issues that could lead to accidents.

Construction Mobilization Hazards and Prevention Techniques

Material Handling

Proper Planning and Organization:

- Before mobilizing for a construction project, create a detailed plan for material handling. This plan should include an inventory of materials and equipment needed, their location on-site, and the sequence of their delivery or use.
- Organize materials in a logical and accessible manner to minimize the need for excessive movement or rehandling.



Utilize Mechanical Equipment:

- Use mechanical equipment such as forklifts, cranes, and conveyor belts to lift, heavy materials and equipment.
- Ensure that all equipment is well-maintained and operated by trained personnel.

Implement Proper Lifting Techniques:

- Train workers on proper lifting techniques to prevent strains and injuries. Encourage the use of proper lifting belts, gloves, and other personal protective equipment.
- Promote team lifting when handling heavy or bulky items, and emphasize communication and coordination among workers.

Establish Clear Pathways and Signage:

- Create designated pathways and clear signage for the movement of materials and equipment to avoid congestion and collisions.
- Mark loading and unloading zones and establish safe zones for pedestrian traffic.

Construction Mobilization Hazards and Prevention Techniques

Heavy Equipment Operation

1. Pre-Operational Inspections and Maintenance:

1. Conduct thorough pre-operational inspections of heavy equipment to check for any defects, malfunctions, or damage that could jeopardize safety during operation.
2. Implement a robust maintenance schedule to ensure all equipment is in good working condition and promptly address any identified issues.

2. Clear Communication and Signals:

1. Establish clear communication protocols and hand signals between ground personnel and heavy equipment operators to facilitate safe and efficient movements on the construction site.
2. Emphasize the importance of maintaining constant communication and vigilance to avoid accidents, especially in busy or congested work areas.

3. Safe Operating Procedures:

1. Implement strict adherence to safe operating procedures for each type of heavy equipment, including proper startup and shutdown protocols, safe loading and unloading practices, and guidelines for navigating various terrains.
2. Emphasize the use of seat belts, harnesses, and other safety restraints while operating heavy equipment to minimize the risk of injury during unexpected events.

4. Awareness of Surroundings and Blind Spots:

1. Train operators to be acutely aware of their surroundings, especially blind spots where they may not have clear visibility.
2. Encourage the use of spotters and mirrors to mitigate blind spots and ensure a 360-degree view of the working area, especially when moving equipment or reversing.



Foundation Construction Safety


What are the main hazards during building the foundation?
Excavation Hazards
Falls
Heavy Equipment
Confined Spaces
Material Handling
Fire Hazards
Noise and Vibration

Hazards during building the foundation

Excavation Hazards

- Workers can be at risk of cave-ins, collapses, or slides when excavating for foundation trenches or pits.
- Proper shoring, sloping, or trench box systems must be used to prevent these hazards. ***(discussed in previous weeks)***

- Video: Most Excavation Fatalities Are Caused By Cave-ins

  https://www.youtube.com/watch?v=mV9xqKHf5K0&ab_channel=Cat%C2%AEProducts







Safe and unsafe sites for cave ins



Hazards during building the foundation

Falls into the excavated area

- Working at height during formwork installation, reinforcing bar placement, or concrete pouring can lead to falls if proper fall protection measures are not in place. ***(discussed in previous weeks)***





Hazards during building the foundation

Heavy Equipment causing cave-ins



The operation of heavy machinery like excavators, cranes, or concrete trucks can pose hazards to both equipment operators and workers on the ground.



Heavy equipment are at risk of falls and falling objects



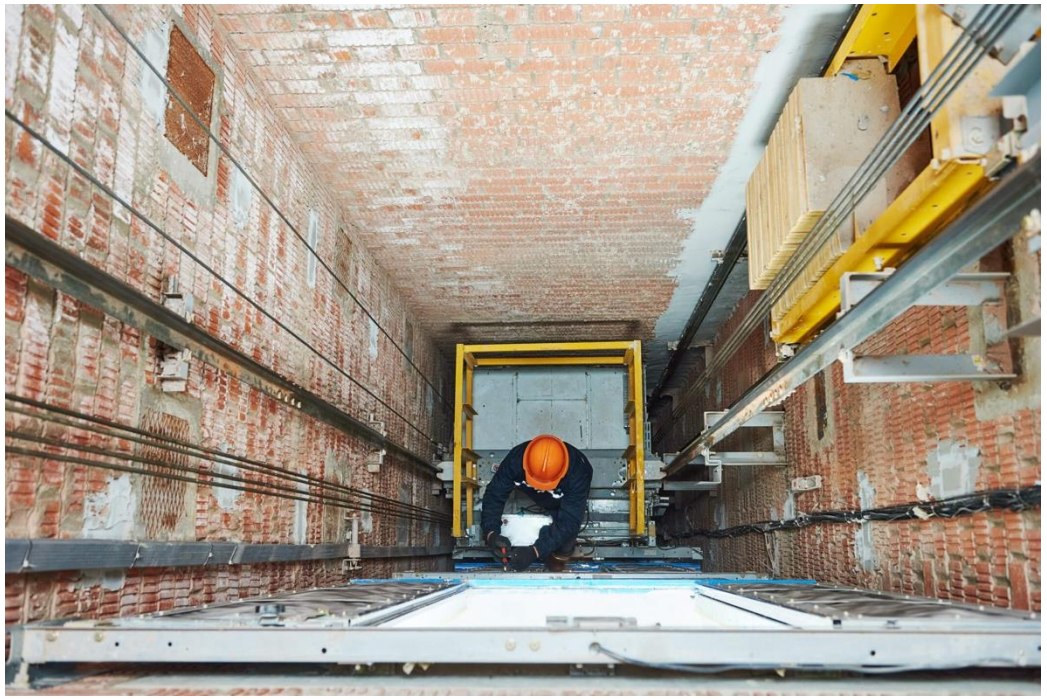
Heavy equipment passing by trenches can cause cave-ins for the workers who are busy in the trench.

Hazards during building the foundation

Working in Confined Spaces

- Foundation pits or trenches may qualify as confined spaces, and workers may face risks related to atmospheric conditions, lack of oxygen, or other confined space hazards.





Hazards during building the foundation

Material Handling

- Handling and transporting heavy construction materials like concrete, steel rebar, or forms can lead to musculoskeletal injuries if proper lifting techniques and equipment are not used.







Reinforcement safety caps



Hazards during building the foundation

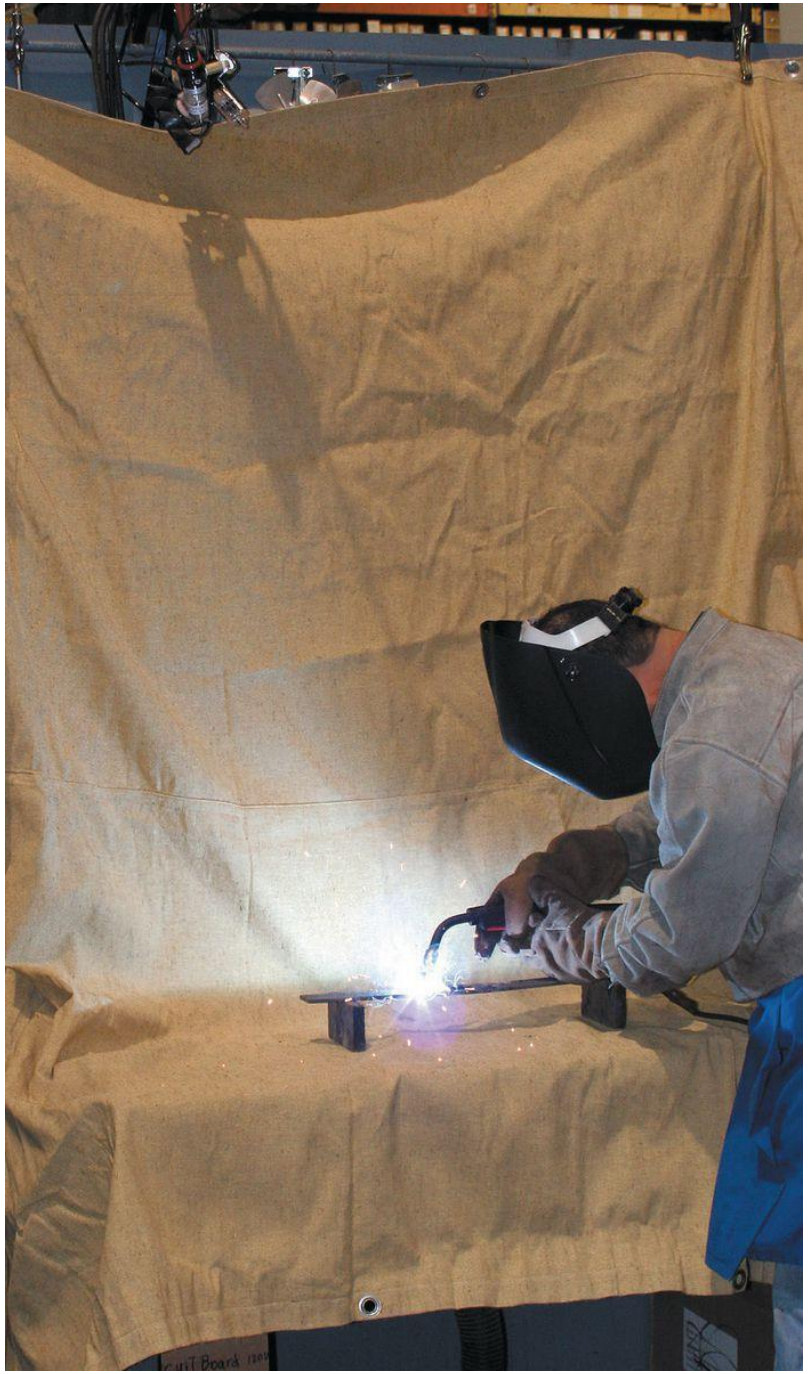
Fire Hazards



- Welding, cutting, and other hot work activities may create sparks or open flames, which can pose fire hazards, especially in confined areas.









Welding Blankets



Hazards during building the foundation

Noise and Vibration

Construction activities can generate high levels of noise and vibration, which can have long-term health effects if not controlled.





Drilling & Pile Driving



Scaffolding Safety

Hazards in scaffolding

Workers' Falls

- Workers can fall from platforms, leading to injuries or fatalities. Lack of proper fall protection measures, like guardrails or personal fall arrest systems, is a primary cause of such accidents.





Hazards in scaffolding

Scaffolding Collapse or Overloading

- Scaffolds can collapse if they are not assembled correctly or if they are overloaded with too much weight, including workers, tools, materials, and equipment. Poorly erected scaffolds may also tip over.



Collapse of scaffolding at the Amerock building



Scaffolding collapse in downtown San Antonio

Hazards in scaffolding

Unsafe Access and Egress

- Missing or unstable ladders or stairs, can lead to slips, trips, or falls during entry or exit.





Hazards in scaffolding

Structural weakness

- Scaffolding components, such as braces, frames, or platforms, can weaken over time due to wear and tear or exposure to the elements. This can compromise the structural integrity of the scaffold.



2 killed, 6 wounded in construction site scaffolding collapse in Ramat Gan | The Times of Israel



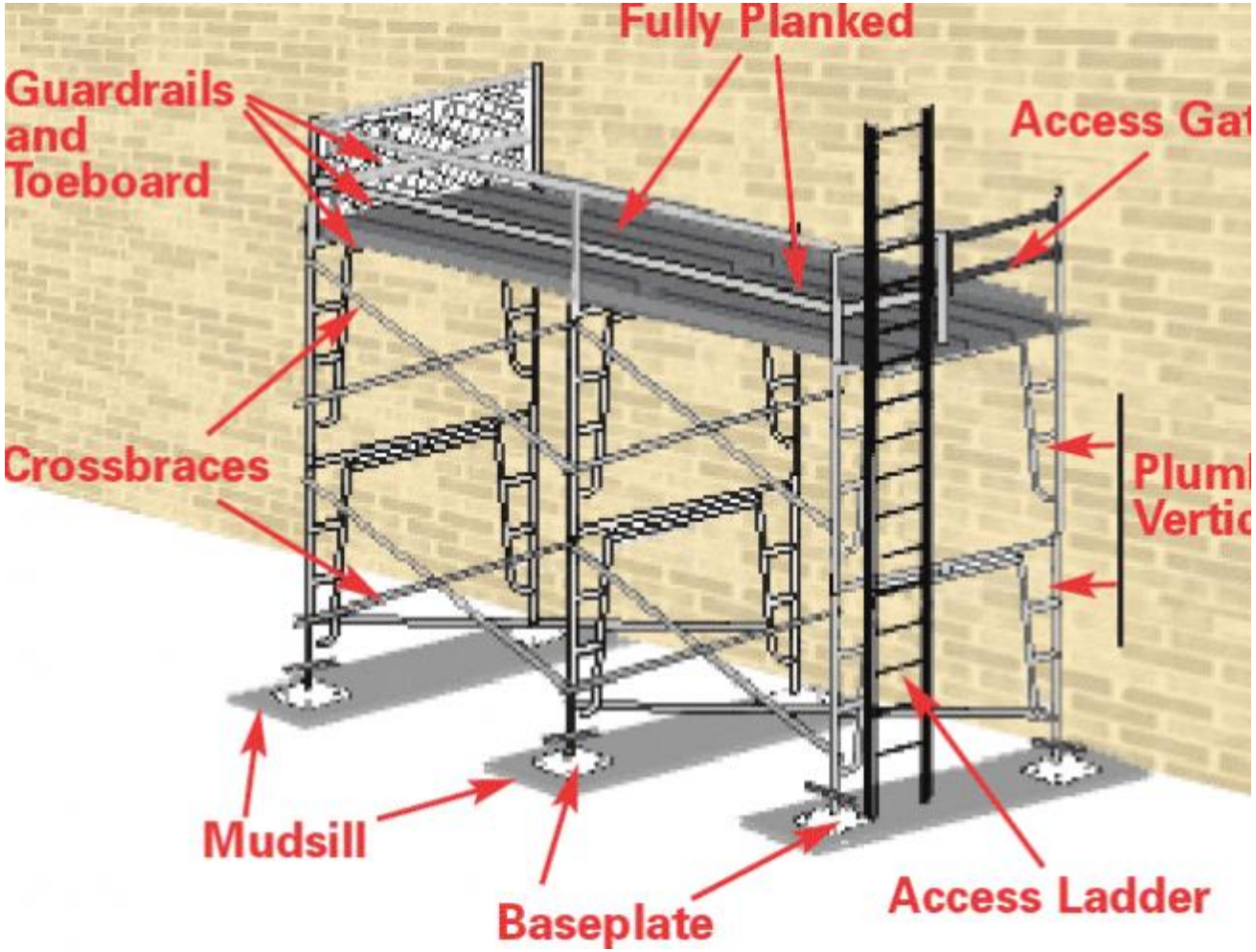
Massive scaffolding collapse at Houston building injures six workers

Hazards in scaffolding

Guardrail and Toe Board Deficiencies

- Missing or damaged guardrails and toe boards can result in workers accidentally falling from scaffold platforms or materials falling to lower levels.





Hazards in scaffolding

Uneven, slippery, or cluttered scaffold platforms

- They can cause workers to trip or lose balance, leading to falls or other accidents.





Hazards in scaffolding

High winds, rain, ice, or snow

- Adverse weather conditions, such as high winds, rain, ice, or snow, can affect scaffold stability and create slippery surfaces.

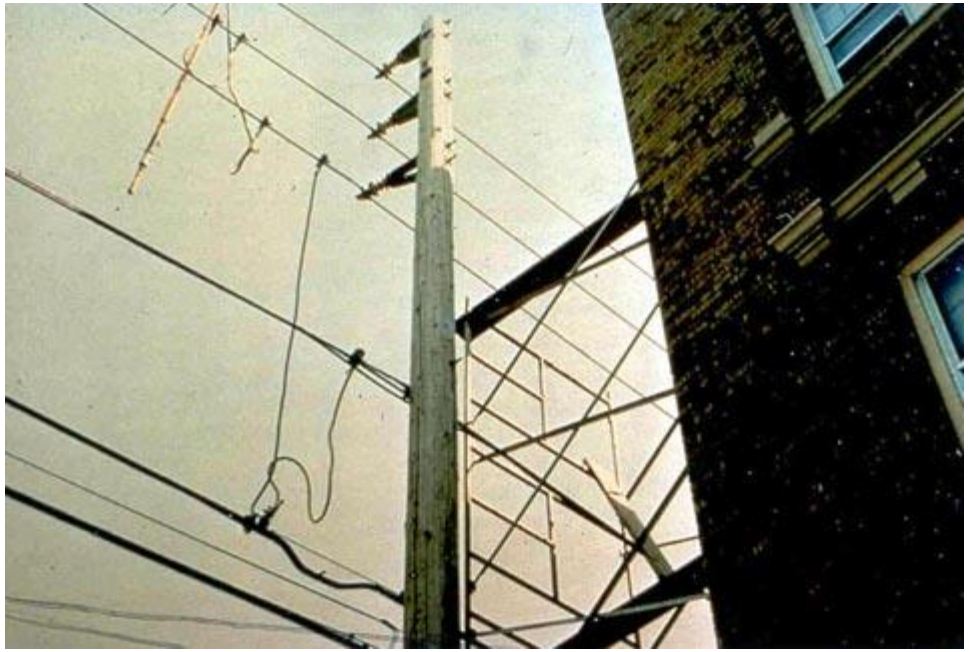




Hazards in scaffolding

Working near power lines or electrical equipment

- Scaffolds near power lines or electrical equipment can pose electrocution risks if not properly managed and isolated.



Hazards in scaffolding

Falling of tools, equipment, or materials

- They can accidentally fall from scaffold platforms, endangering workers or bystanders below.





Best practices to ensure safety during scaffolding operations *Slide 1 of 2*

- **Proper Training:** Ensure that all workers who will be using or working on scaffolding are trained in scaffold safety, including the correct procedures for assembly, use, and dismantling.
- **Competent Personnel:** Only allow trained and competent personnel to erect, modify, or dismantle scaffolding. Qualified supervisors should oversee scaffold work.
- **Scaffold Design:** Use scaffolding systems that are designed, engineered, and manufactured to meet safety standards and the specific requirements of the job.
- **Inspection:** Conduct thorough inspections of scaffolds before each use. Check for damaged or missing components, loose connections, and stability. Record and address any issues promptly.
- **Fall Protection:** Implement fall protection measures such as guardrails, safety nets, or personal fall arrest systems, depending on the height and type of work being performed on the scaffold.
- **Access:** Provide safe access to and from the scaffold, typically using ladder access points and scaffold stairs. Ensure that access points are secure and equipped with handrails.
- **Weight Capacity:** Adhere to the scaffold's weight capacity and load limits, considering not only the workers but also tools, materials, and equipment being used.
- **Platform Integrity:** Keep scaffold platforms free of debris, tools, and materials. Platforms should be fully planked and maintained to prevent tripping hazards.

Best practices to ensure safety during scaffolding operations *Slide 2 of 2*

- **Stability:** Ensure that the scaffold is stable and properly supported. Use base plates, mud sills, or adjustable leveling jacks as needed to maintain stability on uneven surfaces.
- **Weather Conditions:** Monitor and address weather conditions that can affect scaffold stability, such as high winds, ice, or rain. Scaffolds should be secured in adverse weather.
- **Overhead Hazards:** Protect workers from overhead hazards, such as falling objects, by installing debris nets, toe boards, or canopy systems.
- Electrical Hazards: Keep scaffolds a safe distance away from power lines and other electrical sources to prevent electrocution.
- **Communication:** Maintain clear communication among workers on the scaffold and with ground personnel. Use signals and radios if necessary.
- **Daily Safety Checks:** Encourage workers to perform daily safety checks on their scaffold and report any issues immediately.
- **Proper Use of PPE:** Ensure that workers on scaffolds wear appropriate personal protective equipment (PPE), such as hard hats, high-visibility vests, and fall protection gear.
- Training Records: Maintain records of scaffold training, inspections, and maintenance for auditing and compliance purposes.
- **Documentation:** Keep records of scaffold assembly, modification, and dismantling processes, as well as incident reports and near-miss incidents.
- **Emergency Response:** Establish emergency response procedures for scaffold-related incidents, including rescue plans for workers who may be suspended in personal fall arrest systems.
- **Legal Compliance:** Comply with local regulations, codes, and industry standards related to scaffolding safety.



Steelwork Safety

What are the four main tasks in steel erection?

1. Establishing that the foundations are suitable and safe for an erection to commence.

2. Lifting and placing components into position, generally using cranes but sometimes by jacking. To secure components in place, bolted connections will be made, but will not yet be fully tightened. Bracings may similarly not be fully secured.

3. Aligning the structure, principally by checking that column bases are lined, and level and columns are plumb. Packing in beam-to-column connections may need to be changed to allow column plumb to be adjusted.

4. Bolting-up, which means completing all the bolted connections to secure and impart rigidity to the frame.

What are the Hazards in Steel Erections?

Hazards related to housekeeping

- Injuries like cut, fall, slip, and strain, sprain of the body due to handling, arranging, lifting, or shifting of scaffold components
- Injury due to fall and trip, equipment failure
- Exposure to hazardous chemicals, materials, fumes gases, etc.



General safety measures in steel erections

Safety measures for hazards related to housekeeping

1. Provide adequate manpower for loading/unloading. Adequate supervision is must.
2. Provide required tools, tackles, and lifting equipment.
3. Use hosting facilities by crane or hydra.
4. Prepare small size of each structural member for safe handling/lifting.
5. Provide hardhats and safety glasses, work boots, full-length work pants, and shirts.
6. The training for erection of steel structures should address some important hazards and control measures.
7. Keep work areas clean and organized.
8. Be aware of changes in elevations in and around jobsite, including pot holes.
9. MSDS sheets for all materials shall be maintained on site. All chemicals shall be kept in the original container or marked appropriately.

What are the Hazards in Steel Erections?
Hazards related to materials handling/movement



- Injury caused by falls or being struck by steel structures
- Electric shock or electrocution caused by coming in contact with live electricity wire or touching steel structural materials
- Injury due to overload, drop, trap, trike, or fall of structural members
- Injuries caused by being crushed by swing loads or struck by extended parts of steel structures; injuries such as sprains, back damage, and back strain due to fall of steel structures unexpected trip overs while moving or climbing on the outside of steel structures
- Injury caused by damaged lifting tools tackles, defective rigging, or equipment failure
- Injury due to inadequate visibility and no communication between crane operator and signaler

General safety measures in steel erections

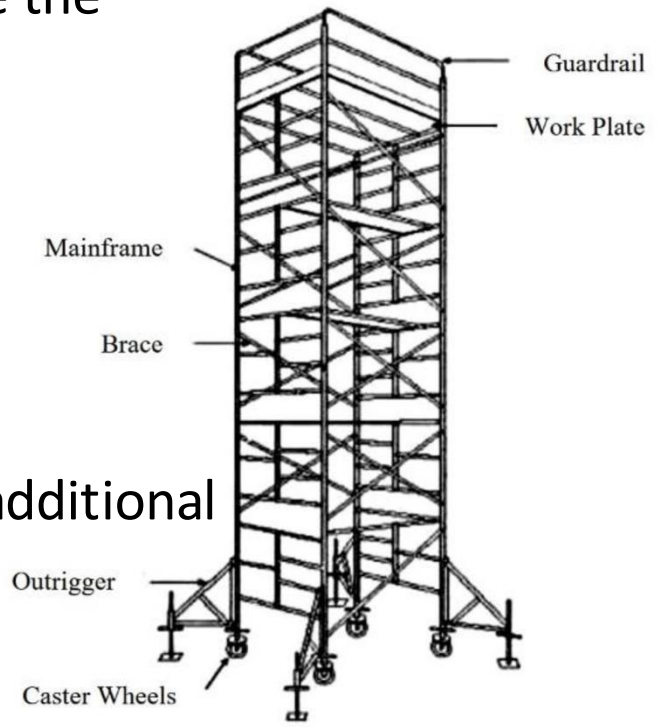
Safety measures for hazards related to material handling

1. Use designated trucking routes and a designated person to assist the trucks in entering and exiting the jobsite as required.
2. Keep eye out for people or pedestrians on jobsite.
3. Trailer carrying steel structures to be located on stable ground where it is to be unloaded prior to removing chains.
4. Inspect load prior to removing chains.
5. Use spotter to help guide forks to material.
6. Use only trained forklift/crane operators with certification.
7. Do not store steel unsafely.
8. Barricade the area covering radius of crane under the load being lifted.
9. Use tag line to control loads while load may swing.
10. Only one person to give signals and ensure that all personnel are out of barricade area.
11. Rigger to be free and away from rigging of steel structures prior to crane lifting each

General safety measures in steel erections

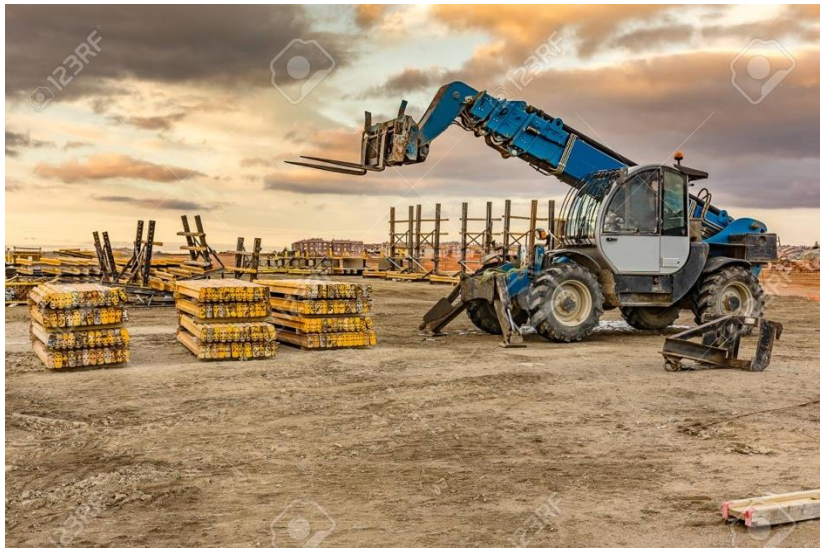
Safety measures for cutting, grinding, and welding

1. Use inspected and certified scaffold platform while working at height.
2. Keep access ladders that are secured and extended 1.0 meter above the deck being accessed.
3. While climbing on ladder, maintain tree point contact.
4. Ensure that structural materials are clamped and secured firmly.
5. Use required personal protective equipment.
6. Keep unauthorized person out of area.
7. Keep fuel container out of away from welding area.
8. Keep fire extinguishers nearby to all welding operations, as well as additional fire extinguishers should be available.
9. All workers must tie/anchor safety hook of safety belt.
10. Transfer all loose materials like bolts, nuts, etc., by rope and bucket.
11. Hardhats are required by all crew members always. Welders may wear brim backward during times of welding only.



What are the Hazards in Steel Erections?
Hazards for forklift or crane operations

- Fall or strike injury due to faulty operation of fork lift, hydra, or crane
- Injury to the workmen due to load shifting or load bouncing; prevent overturning or overloading of forklift, hydra, or crane Body injury due to fall or overturn of crane, and crane striking or hitting people



General safety measures in steel erections

Safety measures for forklift/crane operations

1. Any employee operating the forklift shall be certified and have proof of certification on forklift operation.
2. No employee shall ride on the forks, on a load on the forks, or anywhere on the forklift or its load.
3. Forklift operator must travel at a safe speed with loads on the lift to ensure that bouncing due to road condition/elevation (potholes, ruts, etc.) around the jobsite do not pose any hazard.
4. Unbalanced loads with tendency to roll, etc., needs to be secured back to the mast of the forklift.
5. All workmen are to stay clear of the sides and front of the forklift a distance equal to the full width of the load, in case the load shifts.
6. The operator shall not pick objects exceeding the weight limits of the lift.
7. The swing radius of the crane, including counterweights, shall be flagged off to prevent any employee from entering a zone where they could be struck by the crane
8. Ensure that the crane and all rigging materials are identified with their load capacity and possess a valid load test certificate and a thorough examination certificate issued by a competent person authorized by the government.
9. Experienced signalman appointed for the task.
10. In case of a heavy lift or if there is low headroom for the operation, it is treated as a critical lift and a lift plan is to be prepared.



TCM 2430 – Construction Safety

Week 11 – Masonry, Concrete, Stairways & Ladders, Cranes and Derricks Safety,

Dr. Tommy Tafazzoli



Masonry Construction Safety

What do we mean by masonry construction

- Masonry construction refers to the building of structures using individual units, often made of materials like brick, stone, concrete blocks, or clay tiles, that are bound together by mortar.

When is masonry construction used?

- It is commonly used in the construction of houses, commercial buildings, bridges, retaining walls, and other structures.

What is the history behind masonry construction?

- Masonry is one of the oldest and most enduring construction methods and has been used for various types of buildings and structures throughout history.

What are the advantages of masonry construction?

- Masonry construction has several advantages, including durability, fire resistance, and thermal mass properties that contribute to energy efficiency.



What are the hazards in masonry work?

Handling and Lifting Masonry Units

- Masonry units, such as bricks or concrete blocks, can be heavy, leading to strains, sprains, and musculoskeletal injuries if not lifted properly.
- Workers should be trained in safe lifting techniques, and mechanical aids like forklifts or cranes should be used to reduce the risk.



What are some safety guidelines when handling masonry units?



- **Assess the Load:** Before lifting any masonry unit, assess its weight and size. If it is too heavy or awkward to lift by yourself, seek assistance from another worker or use mechanical lifting equipment.

- **Warm-Up:** Stretch and warm up your muscles before lifting. A few minutes of light stretching can help prepare your body for the task.

- **Proper Footing:** Stand with your feet shoulder-width apart to maintain balance. Your body should be aligned with the load.

- **Get a Good Grip:** Use both hands to grip the masonry unit securely. If the unit has handles or openings, use them to get a better grip.

- **Use Your Legs:** Bend at the knees and hips, not at the waist, to get closer to the masonry unit. This allows you to use your leg muscles, which are stronger, to lift the load.

- **Keep the Load Close:** Keep the masonry unit as close to your body as possible to minimize strain on your back. Hug the load to your chest or abdomen.

What are some safety guidelines when handling masonry units?



- **Lift Slowly:** Lift the load smoothly and steadily, using your leg muscles to do most of the work. Avoid jerky or sudden movements.
- **Avoid Twisting:** When turning with the load, pivot your feet and your whole body rather than twisting your torso. Twisting can strain your back.
- **Team Lifting:** If the load is too heavy or awkward for one person, use a team lifting approach. Coordinate your movements with your partner and communicate clearly to ensure a safe lift.
- **Set Down Carefully:** To set the load down, use the same principles as lifting but in reverse. Bend at the knees and hips, keep the load close, and lower it slowly and carefully.
- **Maintain a Neutral Spine:** Keep your back in a neutral, straight position while lifting. Do not round your back or arch it excessively.
- **Rest Regularly:** If you have to perform repetitive lifting tasks, take regular breaks to avoid overexertion and muscle fatigue.
- **Use Mechanical Aids:** Whenever possible, use mechanical lifting aids like forklifts, hoists, or wheelbarrows to move heavy masonry units. These tools can significantly reduce the risk of injury.

What are OSHA's regulations about Masonry construction?

- A limited access zone shall be established whenever a masonry wall is being constructed. The limited access zone shall conform to the following.
  - The limited access zone shall be established prior to the start of construction of the wall.
  - The limited access zone shall be equal to the height of the wall to be constructed plus four feet, and shall run the entire length of the wall.
  - The limited access zone shall be established on the side of the wall which will be unscaffolded.
  - The limited access zone shall be restricted to entry by employees actively engaged in constructing the wall. No other employees shall be permitted to enter the zone.
  - The limited access zone shall remain in place until the wall is adequately supported to prevent overturning and to prevent collapse unless the height of wall is over eight feet, in which case, the limited access zone shall remain in place until the requirements of paragraph (b) of this section have been met.
- All masonry walls over eight feet in height shall be adequately braced to prevent overturning and to prevent collapse unless the wall is adequately supported so that it will not overturn or collapse. The bracing shall remain in place until permanent supporting elements of the structure are in place.



Concrete Manufacturing Safety

Potential hazard while working with concrete and its solution

Cement Dust





- **Hazard:** Exposure to cement dust can irritate eyes, nose, throat and the upper respiratory system. Skin contact may result in moderate irritation to thickening/cracking of skin to severe skin damage from chemical burns. Silica exposure can lead to lung injuries including silicosis and lung cancer.
- **Solutions:**
- Rinse eyes with water if they come into contact with cement dust and consult a physician.
- Use soap and water to wash off dust to avoid skin damage.
- Wear a P-, N- or R-95 respirator to minimize inhalation of cement dust.
- Eat and drink only in dust-free areas to avoid ingesting cement dust.

Potential hazard while working with concrete and its solution

Wet Concrete 

- **Hazard:** Exposure to wet concrete can result in skin irritation or even first-, second- or third-degree chemical burns. Compounds such as hexavalent chromium may also be harmful.
- **Solutions:**
- Wear alkali-resistant gloves, coveralls with long sleeves and full-length pants, waterproof boots and eye protection.
- Wash contaminated skin areas with cold, running water as soon as possible.
- Rinse eyes splashed with wet concrete with water for at least 15 minutes and then go to the hospital for further treatment.

Potential hazard while working with concrete and its solution

Poor Ergonomics



- **Hazard:** Improper lifting, awkward postures and repetitive motions can lead to sprains, strains and other musculoskeletal disorders.
- **Solutions:**
- Use hand trucks or forklifts when possible.
- Lift properly and get a coworker to help if a product is too heavy.
- Avoid twisting while carrying a load. Shift your feet and take small steps in the direction you want to turn.
- Keep floors clear to avoid slipping and tripping hazards.
- Avoid working in awkward postures.

Potential hazard while working with concrete and its solution

Other Hazards

- Welding operations can lead to flash burns.
- Makeshift ladders, platforms and stairs with improper or no guardrails make falls more likely.
- Workers can also be injured by falling concrete forms if the forms are improperly chocked, braced or cribbed.

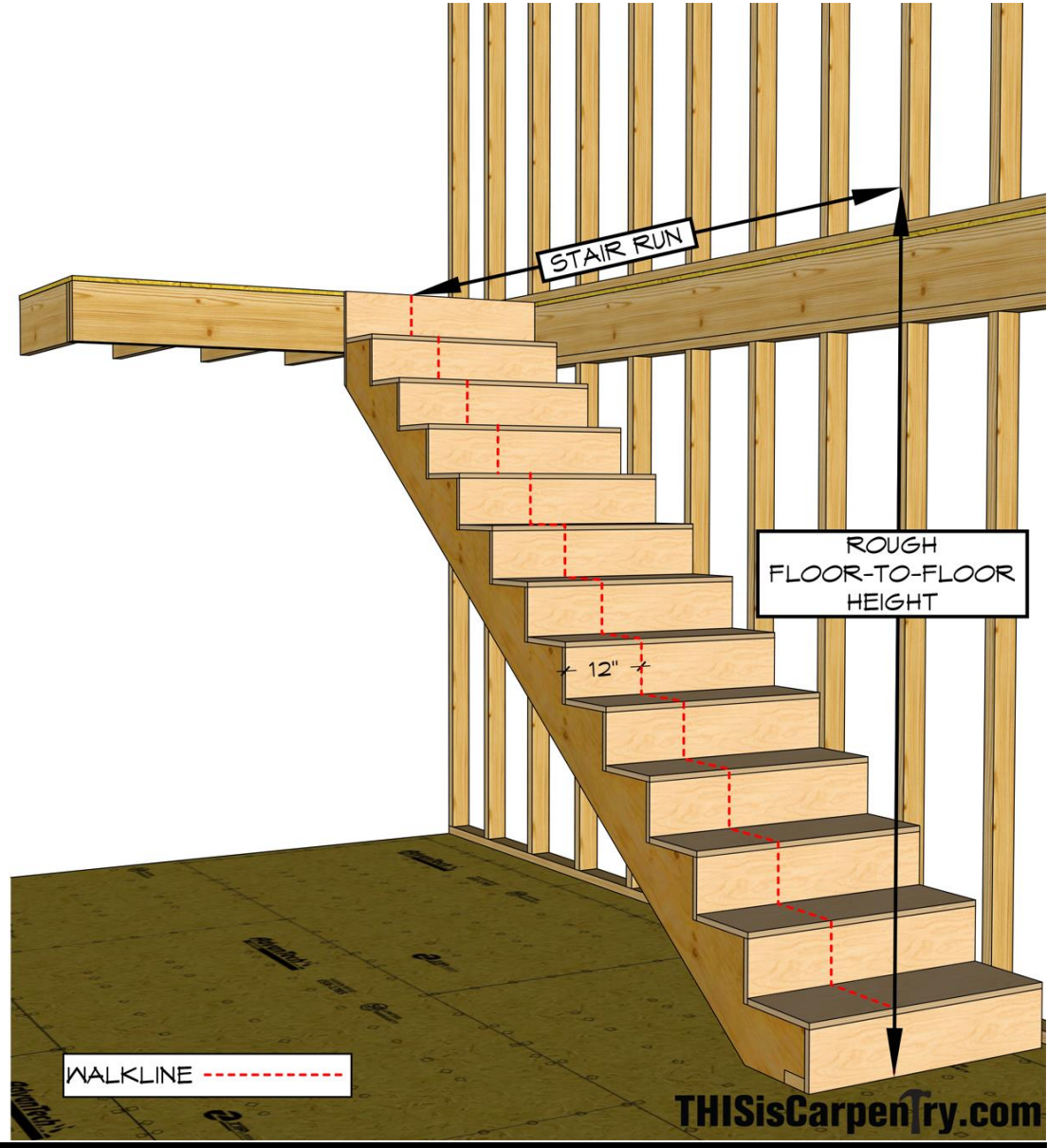










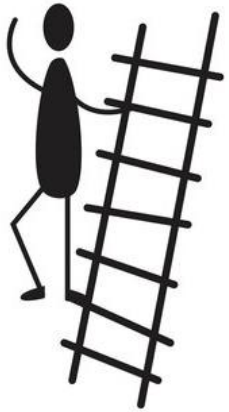


Stairways & Ladders

What safety regulations does OSHA consider for stair rail and handrails?

- Handrails be on stairways with four or more risers, or over 30 inches
- If there is a fall hazard over six feet, a stairrail system must be installed
- Handrails and top rails withhold a load/force of 200 pounds
- Stair rails and handrails be smooth to prevent, punctures, cuts, etc.
- Handrails be 30 to 37 inches from rail top to surface of tread
- After 1991, stairwell handrails to be 36-37 inches from rail surface to tread; before 1991, stair rails can be 30-34 inches from rail surface to tread

What safety regulations does OSHA consider for ladders ?



- Avoid slippery conditions and secure ladders especially in traffic areas.
- Rungs to be 10-14 inches apart; cleats and steps to be uniformly spaced.
- Use ladders only for designed use; never use the top step of a stepladder.
- Competent persons must inspect ladders; if defective, tag “Do Not Use.”
- Never allow anyone to climb on cross-bracing unless the design allows it
- Never move, shift, or extend a ladder while in use.
- Ladder surfaces must be free of puncture or laceration hazards.
- Ladders with a pitch over 90 degrees from horizontal are prohibited.
- The step-across space from step centerline or rungs of fixed ladders to the nearest structural edge worked on, must be under 12 inches

Ladders near Energized Electrical Equipment

- Ladders must have nonconductive side rails if they are used in places where workers or ladders could contact exposed energized electrical equipment.

Climbing a Ladder Safely

- Always face a ladder when using it. Grab it with at least one hand when mounting or dismounting. Never carry anything that could cause loss of balance. Use ladders only on stable, level surfaces unless secured properly

Double-Cleated Ladders

- Use double-cleated ladders when ladders are the only way to enter or exit areas with 25 or more workers and when used for two-way simultaneous traffic

Ladder Angles

- Non-self-supporting ladders must be placed or positioned at an angle where the horizontal distance from the top support to the foot of the ladder is 1/4 the ladder's working length (the distance between the foot and top support).



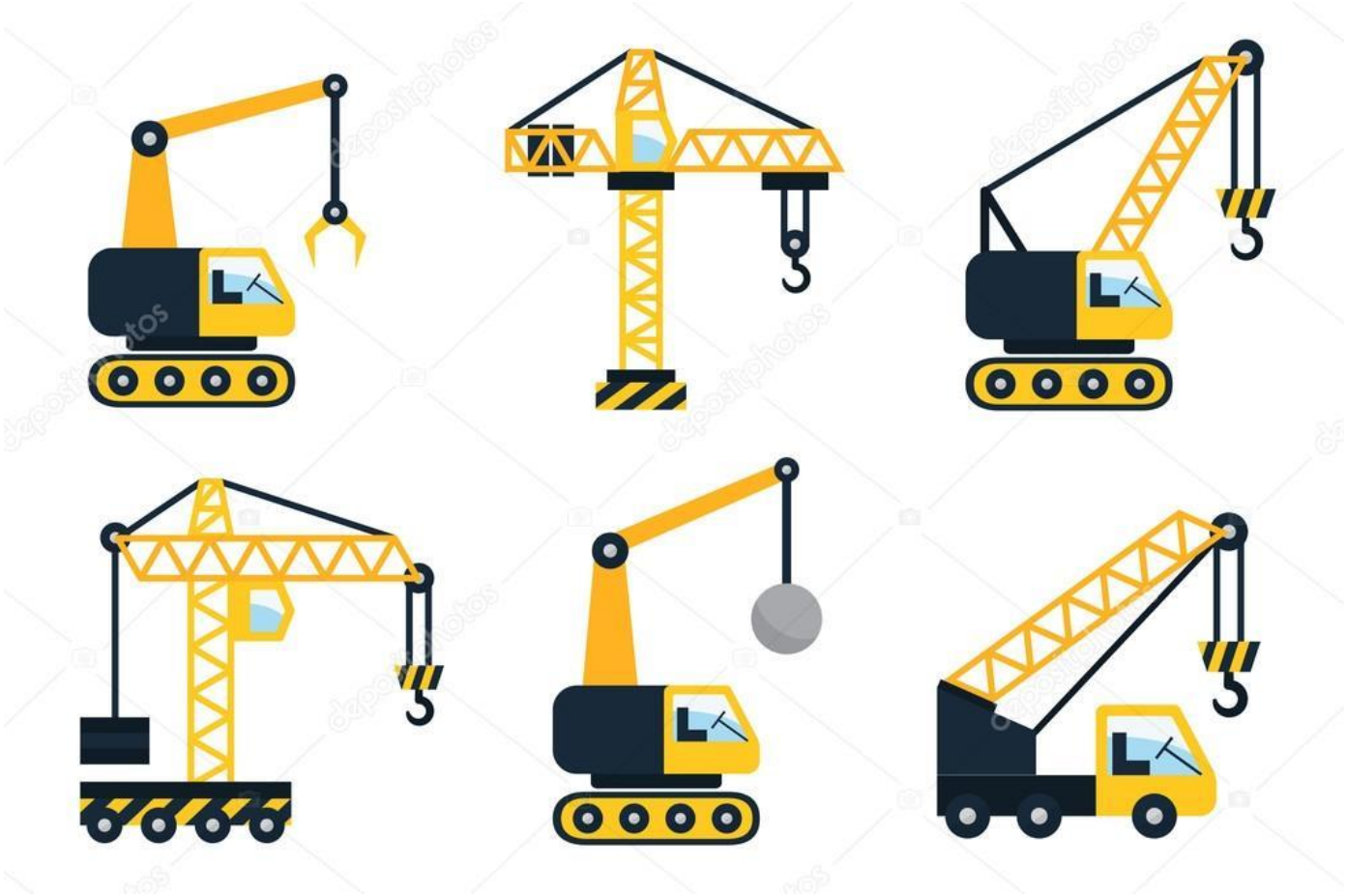
What safety regulations does OSHA consider for tall ladders

All fixed ladders 24 feet or more must be equipped with:

- A ladder safety device
- Self-retracting lifelines with rest platforms every 150 feet or less
- Cage or well, and multiple ladder sections each less than 50 feet
- Strength to hold at least two loads of 250 pounds each, concentrated between any two consecutive attachments

The climb on a fixed ladder equipped only with a cage or well must not exceed 50 feet. If ladder safety devices are also present, the climb can exceed 50 feet





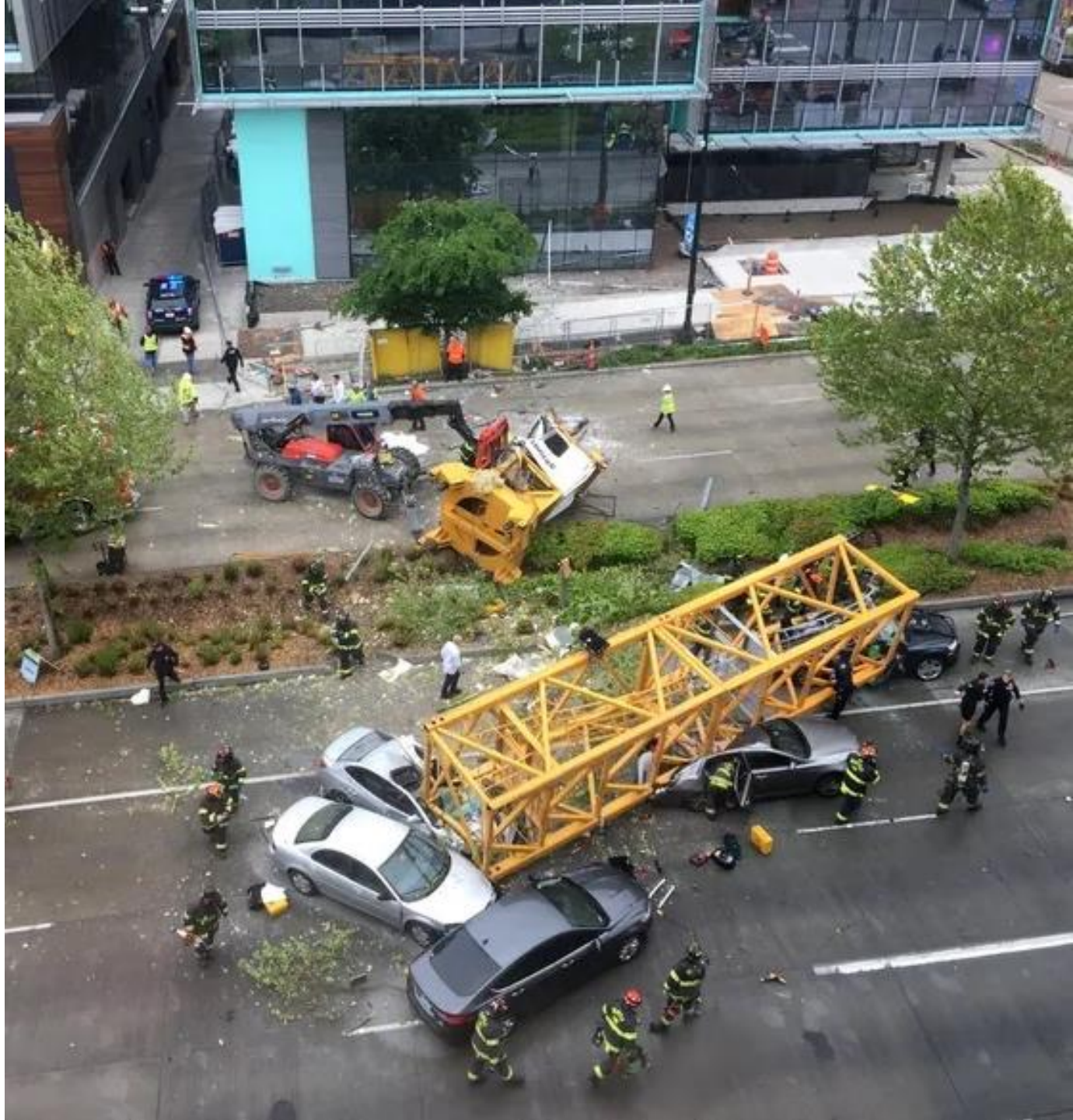
Cranes and Derricks Safety

Major hazards when using cranes in construction

Overturning

Cranes can tip over primarily for three reasons:

1. the load is too heavy,
2. the ground is unstable,
3. the crane is not properly set up and level



Major hazards when using cranes in construction

Contact with overhead power lines

Coming into contact with electrical lines can result in electrocution and severe injuries.

See the next slides for prevention strategies



How to prevent crane's contact with overhead power lines? *(slide 1 of 2)*



- **Identify Power Lines:** Before starting any construction project, identify the location of overhead power lines in the work area. Contact the local utility company to provide this information if necessary.
- **Maintain Safe Distances:** Ensure that all equipment and materials are kept at a safe distance from power lines. This distance can vary depending on the voltage of the lines, so it's crucial to follow local regulations and safety guidelines. A common guideline is to maintain a minimum distance of 10 feet (3 meters) from power lines for voltages up to 50 kV.
- **Use a Spotter:** Appoint a trained spotter to monitor the equipment and materials when operating in close proximity to power lines. Their role is to maintain awareness and communicate with equipment operators to ensure safe distances are maintained.
- **Insulate Equipment:** For equipment that must work near power lines, use insulating materials like rubber tires or insulating links on equipment such as cranes. These can reduce the risk of electrical conductivity.
- **Plan Your Work:** When developing a construction plan, consider the location of power lines and the sequence of operations. Try to schedule work that requires heavy equipment near power lines at times when the lines are not energized, if possible.
- **Conduct Safety Meetings:** Prior to starting any construction project, conduct safety meetings to inform workers about the risks associated with overhead power lines and the safety measures in place.

How to prevent crane's contact with overhead power lines? *(slide 2 of 2)*



- **Mark Hazard Zones:** Clearly mark the areas near power lines with warning signs and tape to ensure that workers and equipment operators are aware of the danger.
- **Training and Awareness:** Provide comprehensive training to all construction workers regarding the hazards of overhead power lines and how to prevent contact. Workers should be able to recognize the potential dangers and respond appropriately.
- **Emergency Response Plan:** Develop an emergency response plan that includes procedures for dealing with accidents involving power lines. Ensure that all workers are aware of these procedures and how to contact emergency services.
- **Comply with Regulations:** Familiarize yourself with local, state, and federal regulations regarding overhead power lines. Compliance with these regulations is essential to avoid legal issues and ensure safety.
- **Regular Inspections:** Regularly inspect equipment and machinery to ensure they are in good working condition. This includes checking for damaged insulation and electrical components.
- **Monitor Weather Conditions:** Weather conditions can affect the safety of working near power lines. High winds, storms, or other adverse weather may increase the risk of accidents. Consider weather conditions in your safety planning.
- **Communication:** Establish clear communication protocols among workers, equipment operators, and spotters. Ensure everyone can communicate effectively to avoid accidents.
- **Continuous Supervision:** Supervise construction activities near power lines continuously to ensure that safety measures are being followed.

How to prevent crane's dropped loads? *(slide 1 of 2)*



1. **Train Thoroughly:** Ensure that all crane operators and riggers receive comprehensive training and proper certification.
2. **Maintain Regularly:** Keep the crane and its components well-maintained with routine inspections and maintenance.
3. **Calculate Load Weight:** Accurately calculate the load weight and never exceed the crane's rated capacity.
4. **Consult Load Charts:** Always refer to the crane's load chart to determine its capacity for various configurations and angles.
5. **Conduct Pre-Lift Meeting:** Before initiating any lift, hold a pre-lift meeting to discuss the lift plan, load weight, and potential hazards.
6. **Communicate Clearly:** Maintain clear communication between the crane operator and the signal person or crew members using radios or hand signals.
7. **Rig Properly:** Ensure that rigging equipment, such as slings, shackles, and hooks, is in good condition and appropriately rated for the load.
8. **Inspect the Load:** Prior to lifting, inspect the load for defects or loose items, and secure it properly.
9. **Monitor Wind Conditions:** Be vigilant about wind conditions, as high winds can affect crane stability and load handling.

How to prevent crane's dropped loads? *(slide 2 of 2)*



10. **Avoid Overloading:** Never overload the crane, even briefly, to prevent structural failure.
11. **Ensure Safe Zones:** Keep workers and the public at a safe distance from the crane and the load, using barriers and signage.
12. **Watch for Obstacles:** Be alert to overhead obstacles like power lines and maintain a safe clearance.
13. **Establish Emergency Procedures:** Develop and communicate emergency procedures in case of a load drop.
14. **Monitor Continuously:** The crane operator should continuously monitor the load and conditions and stop if anything appears unsafe.
15. **Maintain Records:** Keep records of inspections, maintenance, and training to demonstrate compliance with safety regulations.
16. **Comply with Regulations:** Ensure full compliance with local, state, and national safety regulations, such as OSHA standards.
17. **Promote a Safety Culture:** Foster a safety-conscious culture on the construction site and encourage workers to report concerns or violations.

Name other hazards during crane operations and their solutions

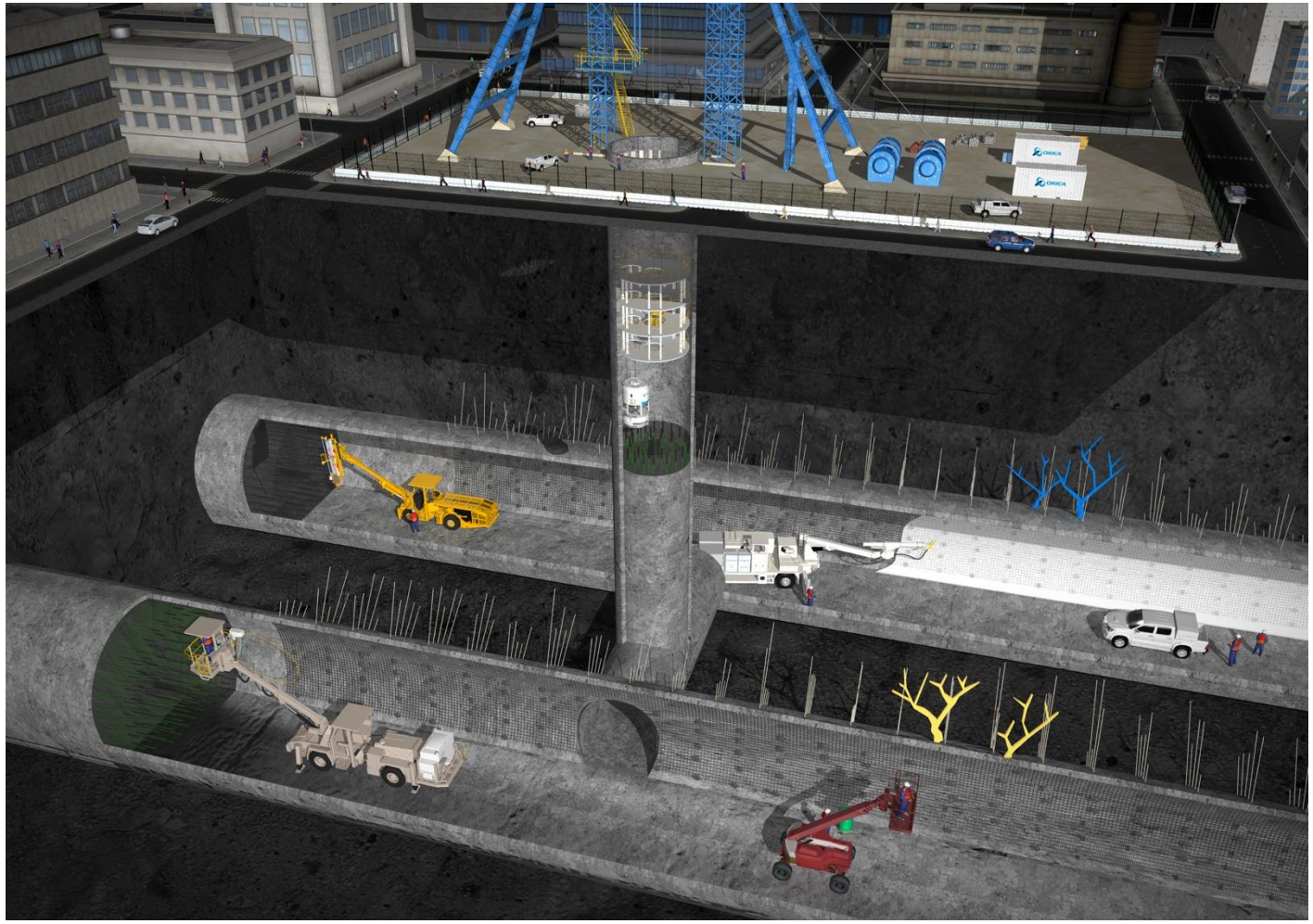
- **Boom collapse** ➡ Avoid overloading and adhere to regulated maintenance to prevent mechanical failure.
- **Structural failure** ➡ Check for defects in components.
- **Operator errors** ➡ Train operators and teach them ways to informed judgment of loads as well as effective communication with assistance and other employees.
- **Weather conditions** ➡ Stop and postpone work in adverse weather, such as strong winds, can affect the crane's stability and safety.
- **Crush and pinch points** ➡ Teach the workers to avoid work zone of cranes, establish on ground safety strategies before starting crane work
- **Work area hazards** ➡ Avoid congested or cluttered work areas
- **Inadequate rigging** ➡ Ensure balance and security of rigging before loading



TCM 2430 – Construction Safety

Week 12 – Underground Construction + Caissons, & Cofferdams + Blasting and the Use of Explosives

Dr. Tommy Tafazzoli





Underground Construction

Hazards in Underground Construction

Ground Instability

- **Collapse:** Excavations and tunnels can collapse if the surrounding soil or rock is not stable. This risk is heightened in areas with loose or fractured geological formations.

- **Subsidence:** Construction activities can lead to ground subsidence, causing settlement and potential damage to structures on the surface.



Hazards in Underground Construction

Gas and Dust Accumulation

- **Gas Buildup:** Underground spaces may contain naturally occurring gases or gases released during construction. Accumulation of gases like methane poses explosion risks.

- **Dust:** Drilling, blasting, and excavation can generate dust, which may cause respiratory issues and reduce visibility.



Hazards in Underground Construction

Water Ingress

- **Flooding:** Water can infiltrate underground spaces, leading to flooding. This poses risks to workers and can damage equipment and structures.



Hazards in Underground Construction

Confined Spaces

- **Air Quality:** Limited ventilation in underground spaces can result in poor air quality, leading to respiratory problems.

- **Restricted Movement:** Working in confined spaces poses risks of injury due to limited mobility and escape routes.



Hazards in Underground Construction

Mechanical and Electrical Hazards

- **Equipment Risks:** Operation of heavy machinery and equipment in confined spaces can lead to accidents.

- **Electrical Hazards:** Wiring and electrical systems can pose a risk of electrocution, especially in damp conditions.



Hazards in Underground Construction

Fire Hazards

- **Combustible Materials:** Construction materials, as well as the presence of flammable gases, can create fire hazards in underground environments.



Hazards in Underground Construction

Communication and Navigation Challenges

- **Limited Communication:** Underground spaces may hinder radio and electronic communication, making it challenging to coordinate activities and respond to emergencies.

- **Navigation Issues:** Lack of natural light and confined spaces can make it difficult for workers to navigate safely.



Hazards in Underground Construction

Health Risks

- **Exposure to Hazardous Materials:** Workers may be exposed to hazardous materials, such as asbestos or toxic chemicals, during excavation and tunneling activities.

- **Stress and Fatigue:** Working in confined spaces with challenging conditions can lead to stress and fatigue, impacting workers' overall health and safety.



Hazards in Underground Construction

Geotechnical Challenges

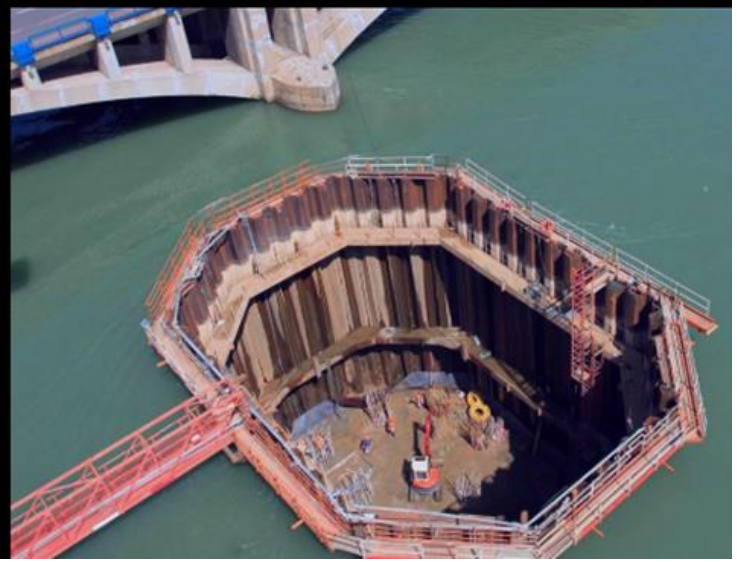
- **Rockfalls:** In rock tunneling, the risk of rockfalls and collapses is significant, especially in areas with unstable geological formations.



CAISSON



COFFERDAM



Caissons & Cofferdams Safety

What are caissons?

- Caisson construction involves the use of a caisson, a watertight structure, typically made of wood, steel, or concrete, that is used to create a dry working environment underwater.

- Caissons are commonly employed in civil engineering projects, particularly for the construction of bridge piers, harbor structures, and other underwater foundations.



What are cofferdams?

- A cofferdam is a temporary structure designed to exclude water from a specific area, typically to facilitate construction or repair work below the water level.
- It creates a dry work environment, allowing construction activities to take place in areas that would otherwise be submerged.
- Cofferdams are commonly used in various civil engineering and construction projects, such as bridge construction, dam construction, and pipeline installation.
- There are different types of cofferdams, and their selection depends on the specific requirements of the project.



How are caissons and cofferdams different?

Permanent vs. Temporary:

- Caissons: Caissons are often permanent structures that become part of the foundation.
- Cofferdams: Cofferdams are temporary structures used during construction and are typically removed once the project is complete.

Working Environment:

- Caissons: Workers in pneumatic caissons may work in pressurized conditions during the sinking process.
- Cofferdams: Workers in cofferdams do not work in pressurized conditions.

Application:

- Caissons: Primarily used for creating foundations underwater.
- Cofferdams: Used for creating dry spaces in water for various construction activities.

Hazards in caisson & cofferdam construction

High Pressure and Decompression Sickness

- **Pressurized Environment:** Workers inside pneumatic (open) caissons operate in a pressurized environment. Rapid decompression can lead to decompression sickness or "the bends," a condition caused by the formation of nitrogen bubbles in the bloodstream.

- **Safety Precautions:** Strict safety protocols, including gradual decompression and monitoring of workers' health, are essential to prevent decompression-related health issues.



Hazards in caisson & cofferdam construction

Air Quality and Contaminants

- **Limited Ventilation:** The confined space of a caisson can result in limited air circulation and potential air quality issues.

- **Contaminants:** The excavation process may release contaminants, such as gases and dust, which can pose respiratory hazards to workers.





Hazards in caisson & cofferdam construction

Confined Space Risks

- **Limited Mobility:** Working in the confined space of a caisson can restrict the movement of workers, increasing the risk of injuries.
- **Emergency Evacuation:** Limited access and egress routes can hinder quick evacuation in case of emergencies.

Hazards in caisson & cofferdam construction

Falling Materials and Objects

- **Construction Debris:** Excavated materials and debris can pose a risk of falling onto workers inside the caisson.

- **Tools and Equipment:** Tools and equipment used in the construction process may also pose a hazard if not properly secured.



Hazards in caisson & cofferdam construction

Structural Failures

- **Collapse:** There is a risk of the caisson collapsing or failing during the construction process, especially if it encounters unstable soil conditions or excessive external pressures.

- **Instability:** The structural stability of the caisson and its ability to withstand external forces must be carefully monitored.



Hazards in caisson & cofferdam construction

Water Ingress

- **Flooding:** The caisson must remain watertight to prevent flooding. Any failure in the watertight seal can lead to flooding inside the caisson, posing a drowning risk for workers.





Blasting and the Use of Explosives

Hazards of Blasting and the Use of Explosives in construction

Flying Debris

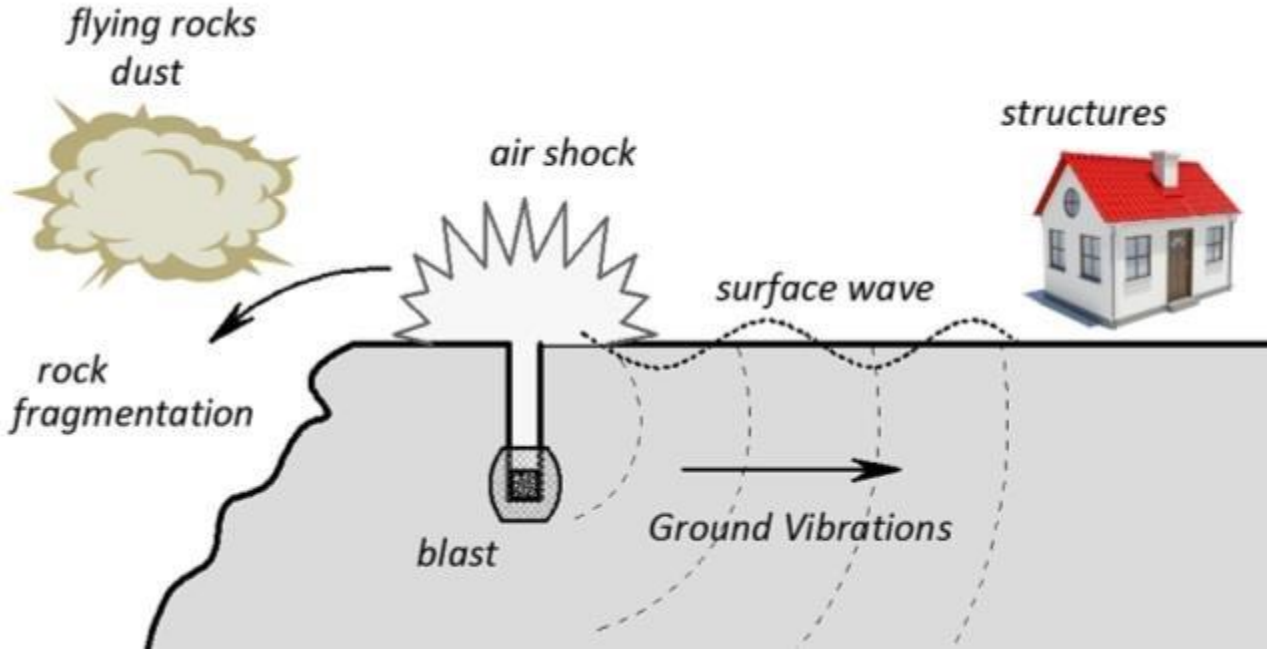
- **Projectile Hazard:** The detonation of explosives can propel rock fragments, soil, and other debris at high velocities, posing a risk to workers and nearby structures.



Hazards of Blasting and the Use of Explosives in Construction

Ground Vibration

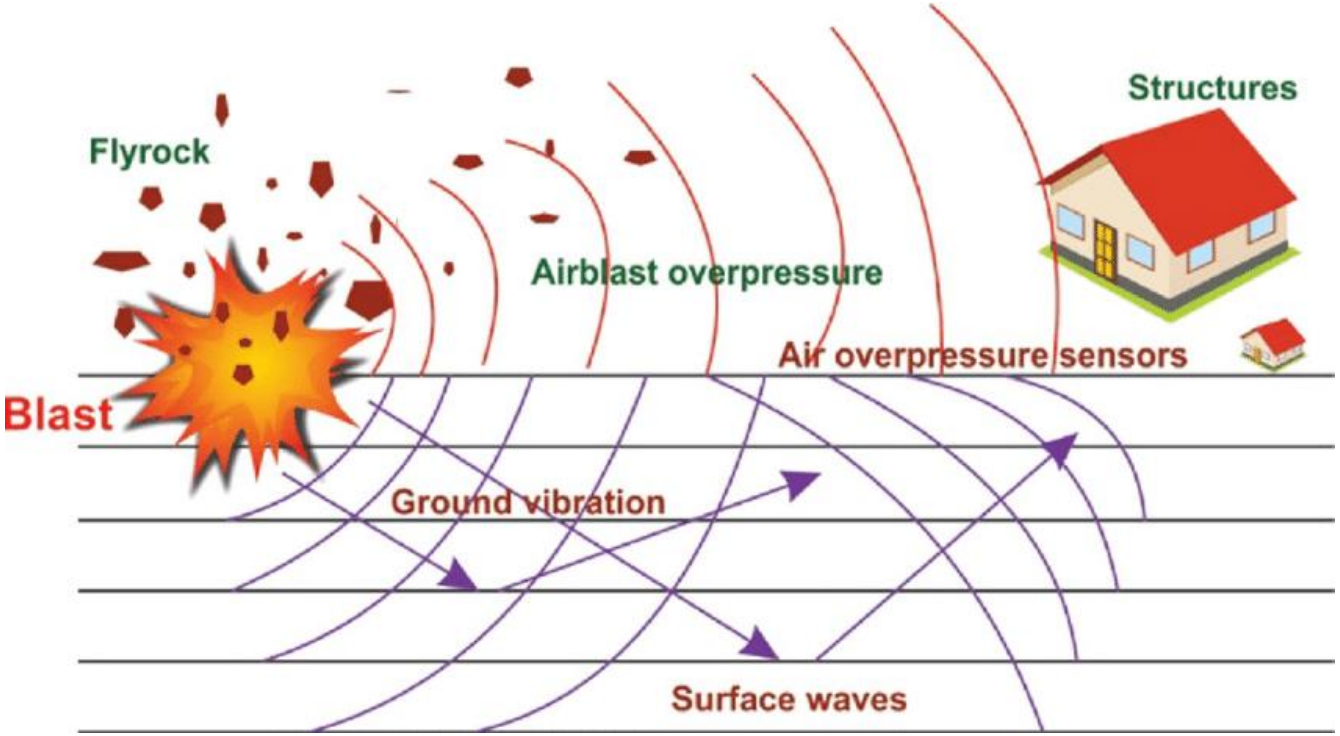
- **Structural Damage:** The shockwaves generated by blasting can cause ground vibrations that may lead to structural damage in nearby buildings, bridges, and infrastructure.



Hazards of Blasting and the Use of Explosives in Construction

Air Blast

- **Pressure Waves:** The release of energy during a blast produces pressure waves that can cause damage to structures, especially windows and fragile components, within the vicinity of the blast site.



Hazards of Blasting and the Use of Explosives in Construction

Toxic Fumes and Dust

- **Gas Emissions:** Blasting can release toxic gases and fumes, depending on the types of explosives used and the materials being blasted.

- **Dust Generation:** The process can generate dust, which may contain harmful particles, contributing to respiratory issues for workers and nearby residents.



Hazards of Blasting and the Use of Explosives in Construction
Initiation Failures

- **Misfires:** The initiation system of explosives may fail, resulting in misfires. Misfires pose a risk of delayed detonation, leading to unpredictable and potentially hazardous situations



Hazards of Blasting and the Use of Explosives in Construction

Overcharging

- **Excessive Explosives:** Using too much explosive material for a given blast can lead to larger-than-intended explosions, causing more significant safety risks and potential damage.



Hazards of Blasting and the Use of Explosives in construction

Flyrock

- **Uncontrolled Fragments:** Flyrock refers to fragments that are propelled away from the blast site. It can travel long distances, posing a serious hazard to people, structures, and equipment.



Hazards of Blasting and the Use of Explosives in construction

Poor Blasting Design

- **Inadequate Planning:** Improper design of the blast pattern, including hole placement, stemming, and timing, can result in uneven fragmentation, excessive ground vibration, and other safety hazards.



Hazards of Blasting and the Use of Explosives in construction

Electrical Hazards

- **Detonation Systems:** Electrical initiation systems used in blasting introduce the risk of electrical hazards, especially in the presence of water or other conductive materials.



Hazards of Blasting and the Use of Explosives in construction
Inadequate Warning Systems

- **Insufficient Notifications:** Inadequate warning systems and communication with nearby residents and workers can lead to unexpected exposure to blasts.

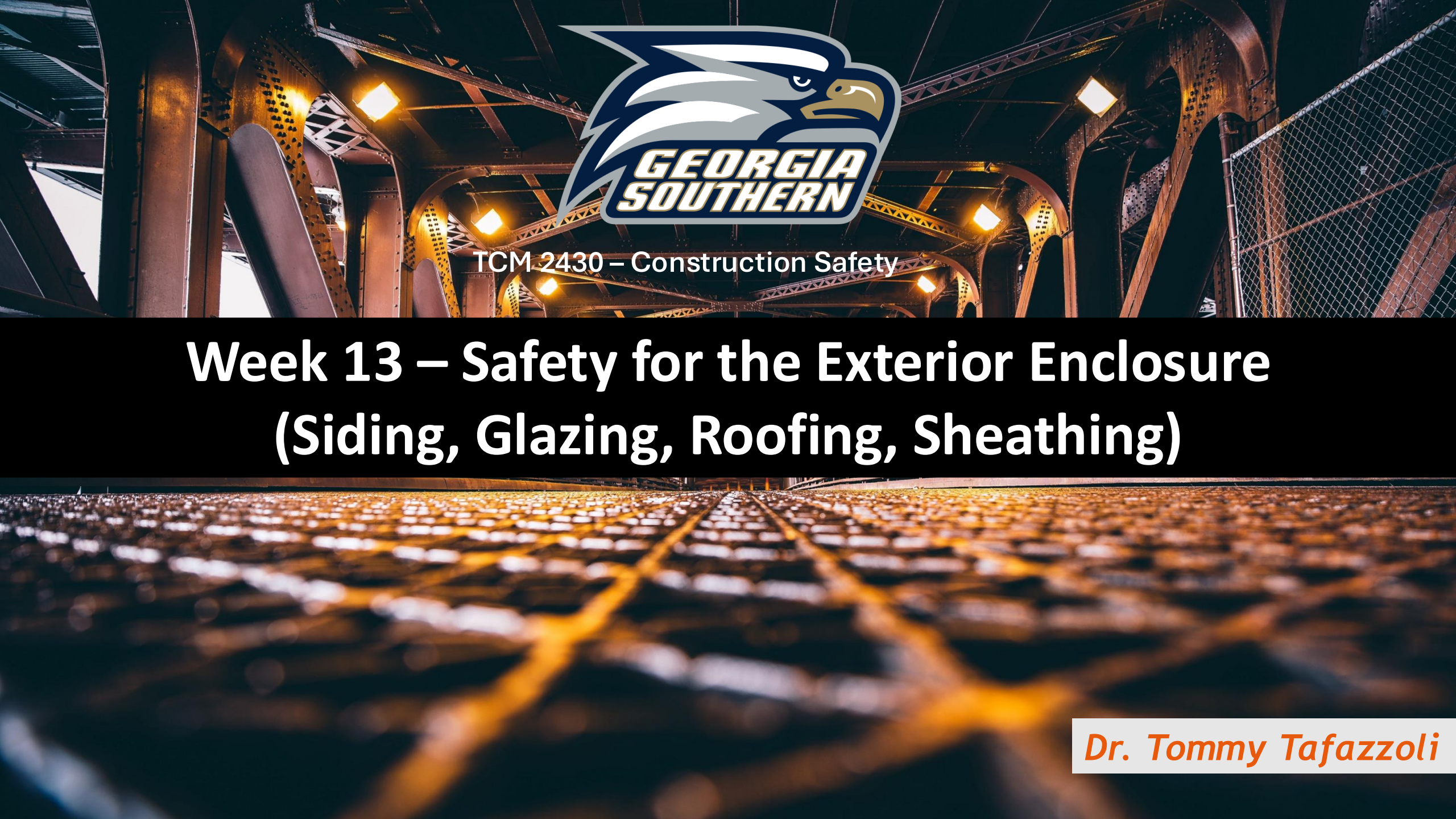


Hazards of Blasting and the Use of Explosives in construction
Unsafe Storage and Handling

- **Explosive Storage:** Improper storage of explosives can lead to accidental detonation or theft, posing serious safety risks.

- **Handling Procedures:** Incorrect handling procedures during transportation and loading of explosives increase the risk of accidents.

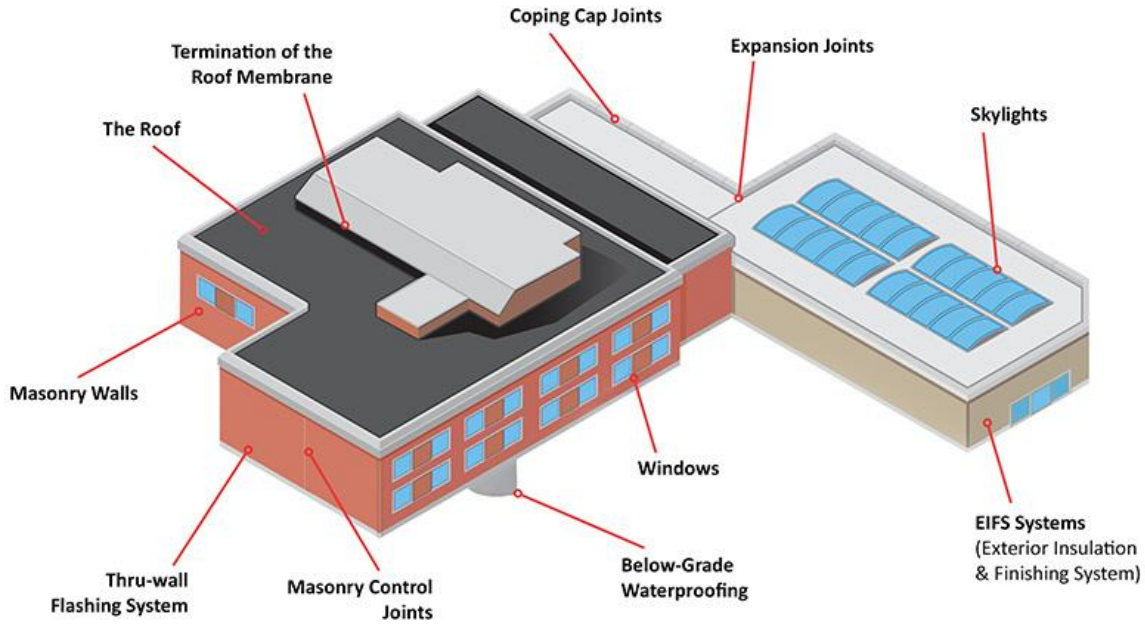


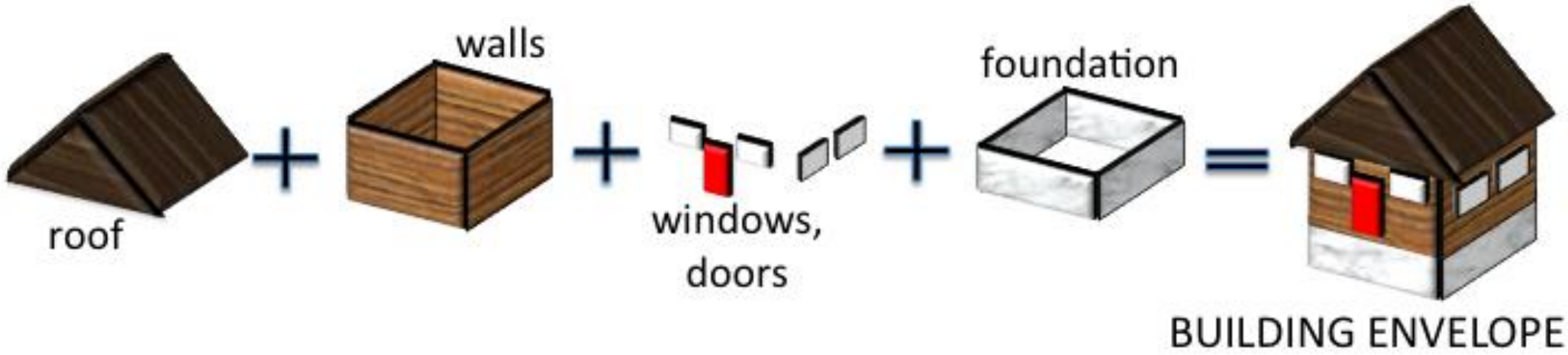


TCM 2430 – Construction Safety

Week 13 – Safety for the Exterior Enclosure (Siding, Glazing, Roofing, Sheathing)

Dr. Tommy Tafazzoli





Elements of Building Envelope

What is construction of exterior enclosure?

- The construction of an exterior enclosure, also known as the **building envelope** or **building enclosure**, refers to the assembly of materials and components that work together to form the outer shell of a building.
- This enclosure is designed to protect the interior of the building from various environmental elements, such as weather, wind, water, and temperature fluctuations, while also providing thermal insulation and maintaining structural integrity.

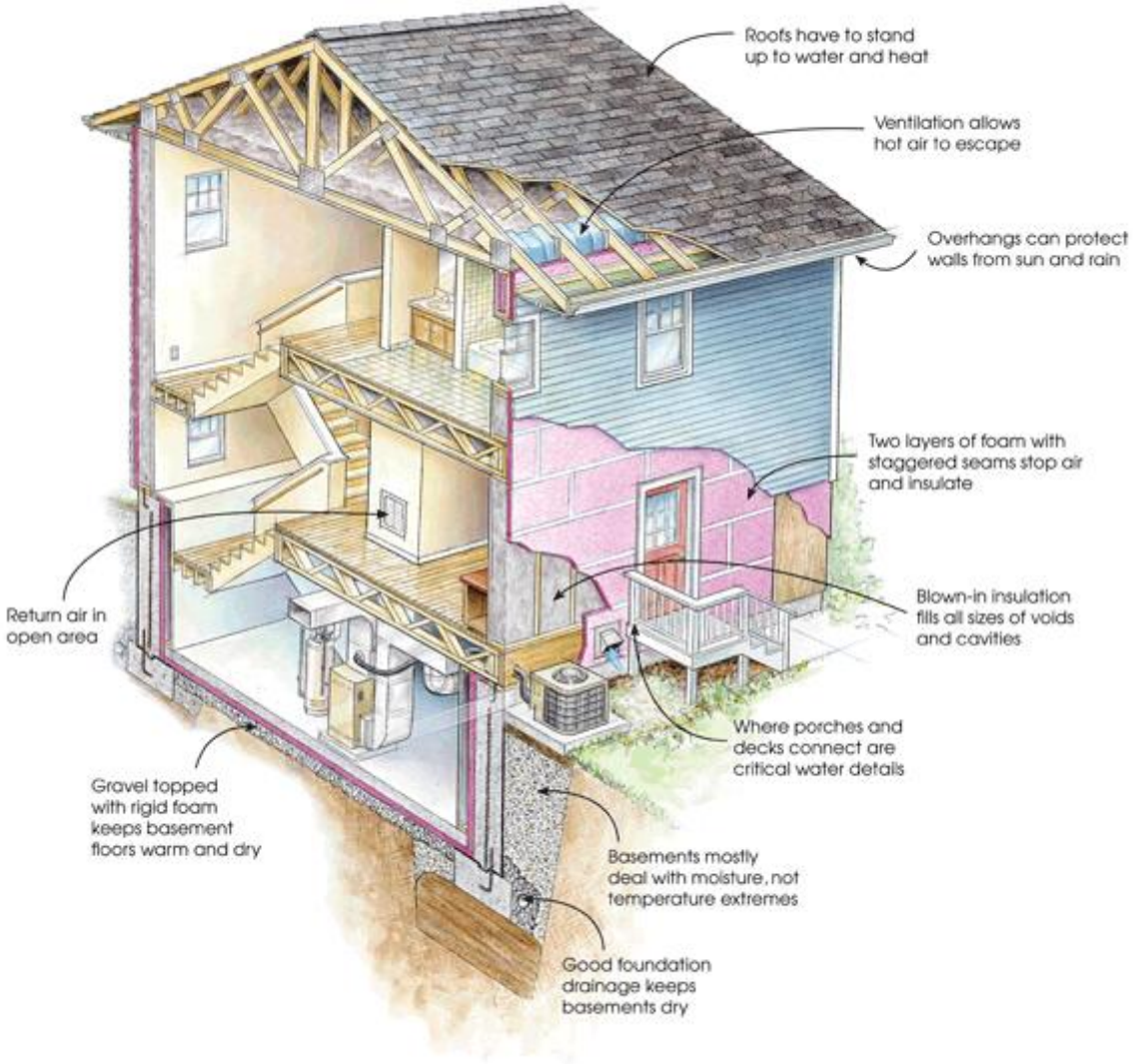
https://www.youtube.com/watch?v=UluRLLwpwew&ab_channel=GreenstoneBuildingProducts



What are the common elements of exterior enclosure?

Structural Elements

- The framework of the building, including **walls, roofs, floors**, and **foundations**, forms the structural elements of the enclosure. These elements support the building and provide a framework for the exterior materials.

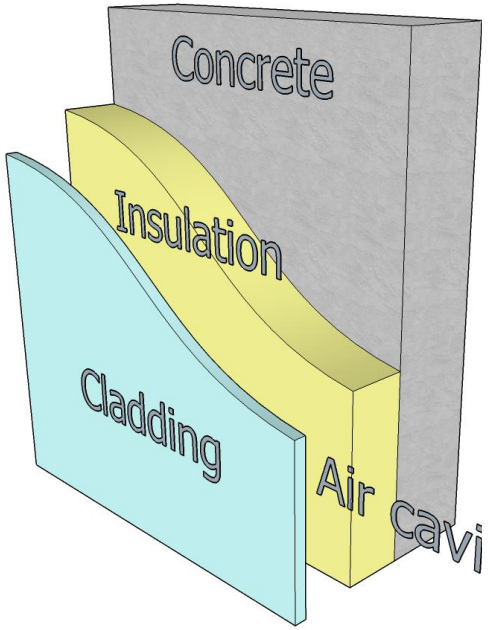


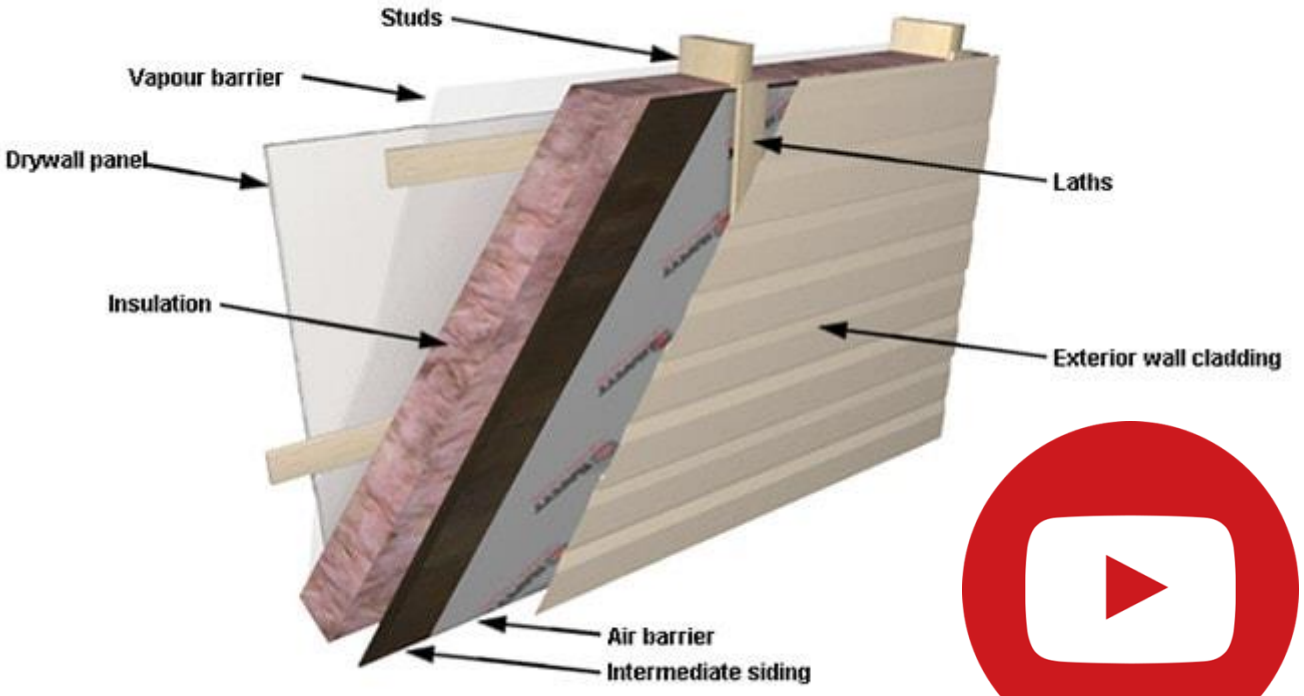
What are the common elements of exterior enclosure?

Exterior Cladding

- This is the **outermost layer of the enclosure** and includes materials like **siding, brick, stucco, or other finishes** that provide **protection against the weather** and **enhance the building's aesthetic** appeal.







https://www.youtube.com/watch?v=kbAJtCUoF50&ab_channel=TheHomeImprovementsChannelUK

What are the common elements of exterior enclosure?

Weather-Resistant Barrier

- A weather-resistant barrier is installed **beneath the exterior cladding** to prevent the **penetration of water and air into the building**. This barrier helps **manage moisture** and **protects against water damage**.





https://www.youtube.com/watch?v=VMzDVNhpUP0&ab_channel=Lowe%27sHomeImprovement

What are the common elements of exterior enclosure?

Insulation

- Insulation is placed **within the walls and roof to regulate the temperature inside the building.** It helps in maintaining a **comfortable indoor environment** and improves **energy efficiency.**





https://www.youtube.com/watch?v=z53EWwDYNao&ab_channel=SkillBuilder

What are the common elements of exterior enclosure?

Windows and Doors

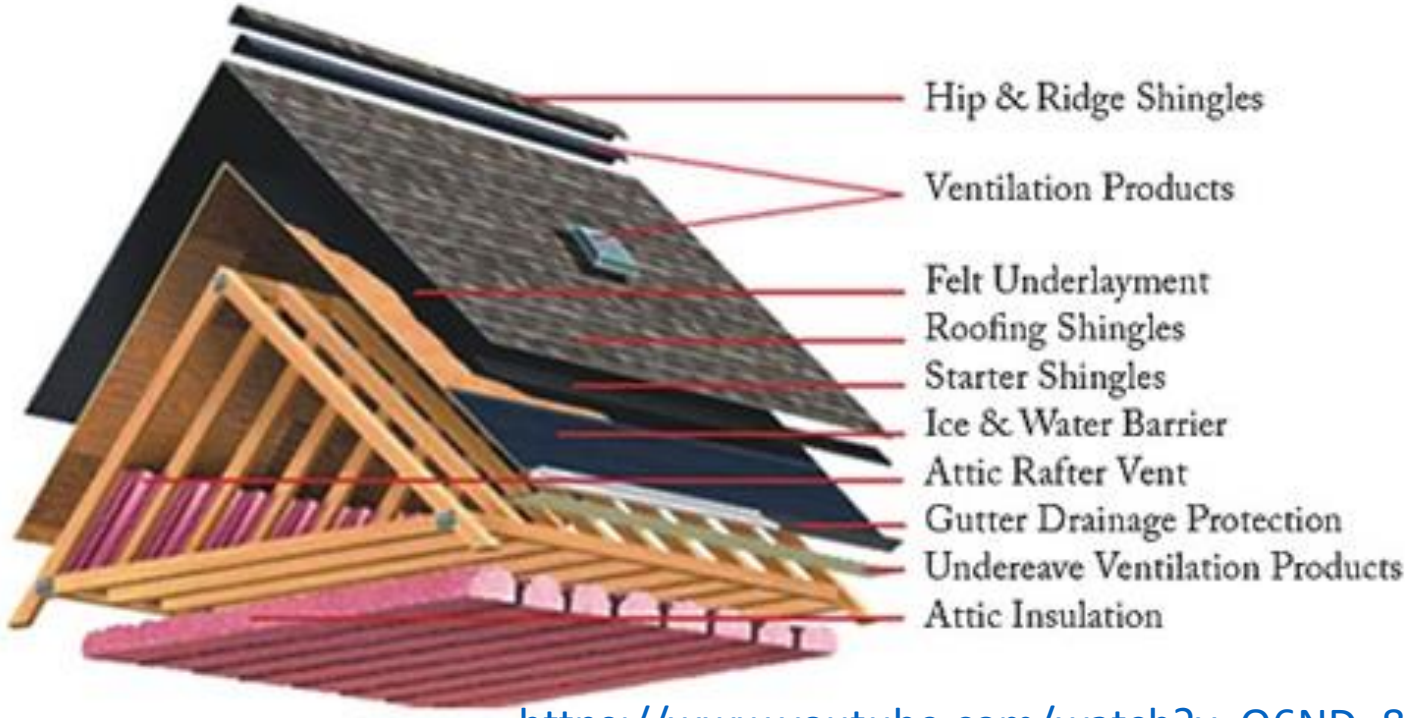
- Openings in the enclosure, such as windows and doors, are designed to **allow natural light and ventilation** while providing a barrier against the elements. These openings are equipped with **seals and weather-stripping** to prevent water and air infiltration.



What are the common elements of exterior enclosure?

Roofing Systems

- The type of roofing material used plays a crucial role in **protecting the building from rain, snow, and other environmental factors**. Roofing systems can include **shingles, tiles, metal panels, or other materials**.





https://www.youtube.com/watch?v=Q6ND_8glacs&ab_channel=VeteranConstruction

What are the common elements of exterior enclosure?

Flashing

- Flashing is used to **prevent water from entering the building at joints, corners, and intersections**. It is typically made of metal and is installed around windows, doors, and other vulnerable areas.





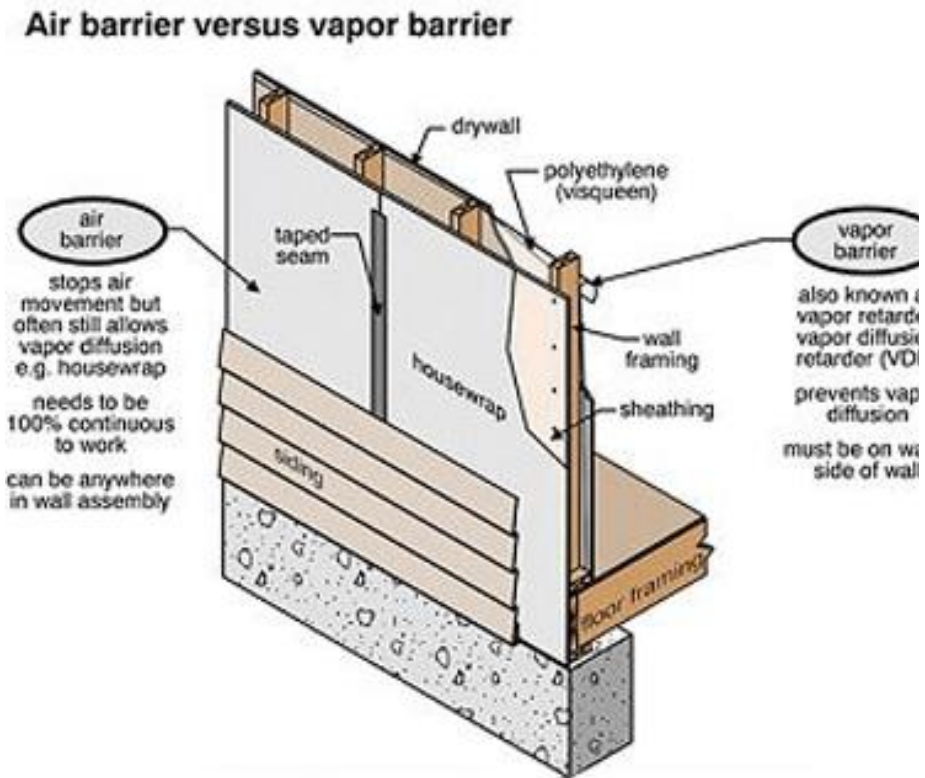


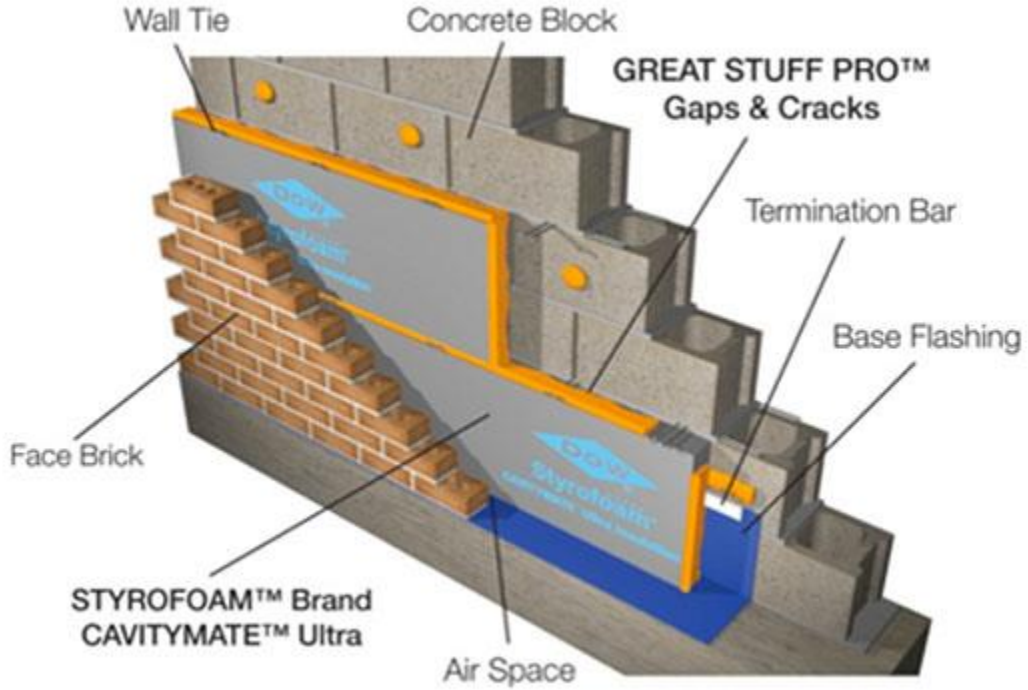
https://www.youtube.com/watch?v=UvLpM_MZB8M&ab_channel=ThisOldHouse

What are the common elements of exterior enclosure?

Air and Vapor Barriers

- These barriers are installed to **control the movement of air and vapor through the building envelope**. They help in **preventing moisture-related issues** and **maintaining indoor air quality.**





What are the common elements of exterior enclosure?

Sealants

- Sealants are used to **fill gaps and joints in the exterior enclosure**, providing an **additional layer of protection against water** and **air infiltration**.



https://www.youtube.com/watch?v=HHEOLfmypyc&ab_channel=AeroBarrier

What are the common elements of exterior enclosure?

Ventilation Systems

- Adequate ventilation is essential for **maintaining indoor air quality**.
- Ventilation components, such as **vents and fans**, are integrated into the building envelope to facilitate air exchange.





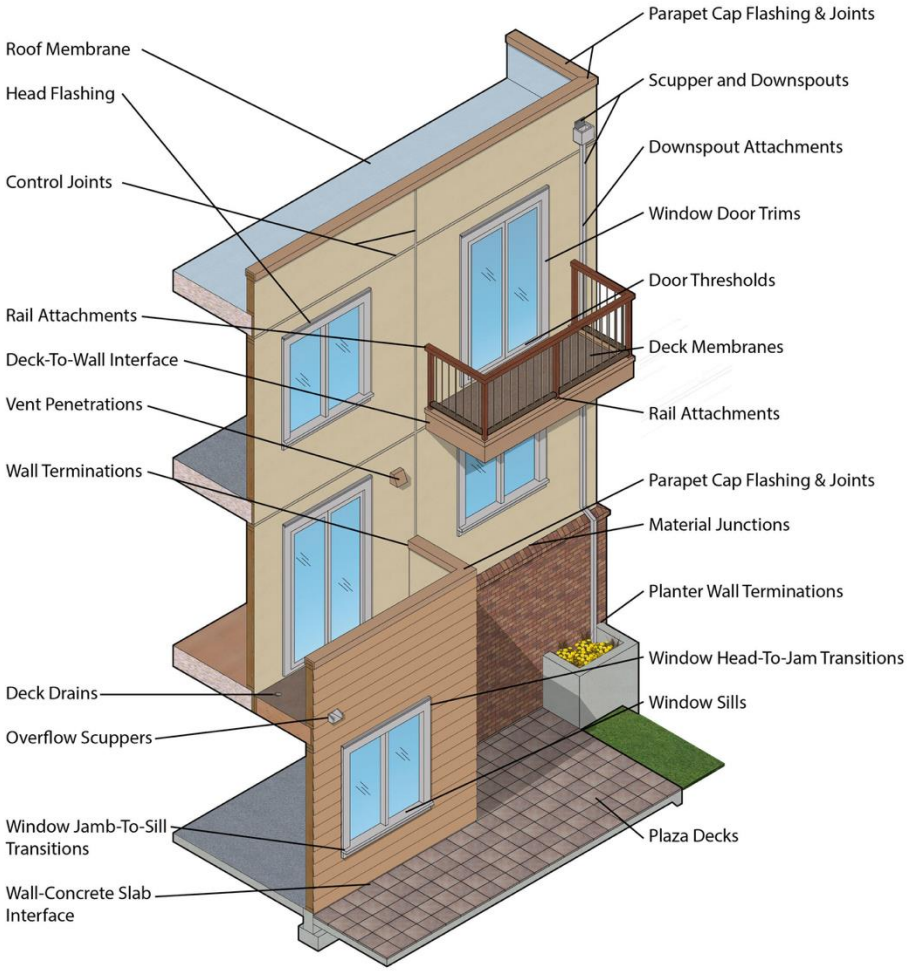


*Diagram is for reference purposes only

Hazards In Installation of Building Envelope Elements

Hazards in installation of building envelope elements

Fall Hazards

- Workers involved in the installation of structural elements often work at heights, especially during the construction of walls, roofs, and floors.
- Fall protection measures, such as **guardrails**, **safety nets**, or personal fall **arrest systems**, should be in place to prevent falls from elevated surfaces.





Hazards in installation of building envelope elements
Lifting and Rigging Safety

- The handling and placement of heavy structural components require proper lifting and rigging procedures.
- Workers should be trained in the safe use of cranes, hoists, and other lifting equipment *(this has been covered in previous lectures)*.
- Load capacities must be strictly adhered to, and all equipment should be regularly inspected for safety.



Hazards in installation of building envelope elements

Material Handling

- The movement and placement of construction materials can pose risks of musculoskeletal injuries.
- Proper ergonomics and lifting techniques, as well as the use of mechanical aids, can help reduce the likelihood of strains and injuries.



Hazards in installation of building envelope elements

Structural Stability

- During installation, temporary supports and bracing are often used to stabilize structural elements until the building reaches a certain level of completion.

- Ensuring the stability of these temporary structures is crucial to prevent collapses or shifting during construction.



Hazards in installation of building envelope elements

Tool Safety

- The use of hand and power tools is common in the installation of structural elements.
- Workers should be trained on the proper use of tools, and tools should be well-maintained.
- Personal protective equipment (PPE), such as gloves and eye protection, should be worn as appropriate.



Hazards in installation of building envelope elements

Electrical Safety

- Structural elements often involve electrical work for lighting, wiring, and other systems.
- Proper electrical safety measures, including lockout/tagout procedures and grounding, should be followed to prevent electrical hazards.



Hazards in installation of building envelope elements

Weather Conditions

- Adverse weather conditions, such as high winds, rain, or extreme temperatures, can pose additional risks during the installation of structural elements.
- Work should be planned and coordinated to account for weather-related safety concerns.





Hazards in installation of building envelope elements

Scaffolding Safety

- If scaffolding is used for installation, it should be erected, inspected, and maintained by qualified personnel. Workers should be trained in safe scaffolding practices, and guardrails should be in place to prevent falls.





Hazards in installation of building envelope elements

Traffic and Site Access

- If the installation involves work near roadways or areas with vehicular traffic, workers should be aware of traffic control measures, wear high-visibility clothing, and follow safety procedures to prevent accidents involving vehicles.



Hazards in installation of building envelope elements

Respiratory Hazards

- During installation, workers may be exposed to dust, debris, or fumes, especially if cutting or sanding materials.
- Adequate ventilation and the use of respiratory protection may be necessary to protect against respiratory hazards.





Hazards in Glazing and Installation of Windows

Hazards in Glazing and Installation of Windows

Glass Handling and Breakage

- Cuts and Abrasions: Broken glass edges can be sharp, leading to cuts and abrasions. Workers should wear cut-resistant gloves and handle glass with care.

- Falling Fragments: During installation or removal, glass fragments may fall, posing a risk to workers below. Proper barriers and protective equipment should be in place.



Hazards in Glazing and Installation of Windows

Proper Installation Techniques

- Following manufacturer guidelines and industry best practices is crucial for proper installation.
- Improperly installed windows and doors may pose safety risks, such as structural failures, water leaks, or compromised security.



Hazards in Glazing and Installation of Windows

Crushing Hazards

- The weight of windows and doors can pose a crushing hazard during installation.
- Workers should be cautious when handling and installing large or heavy components, ensuring that there is no risk of trapping body parts.



Hazards in Glazing and Installation of Windows

Sharp Edges and Projections

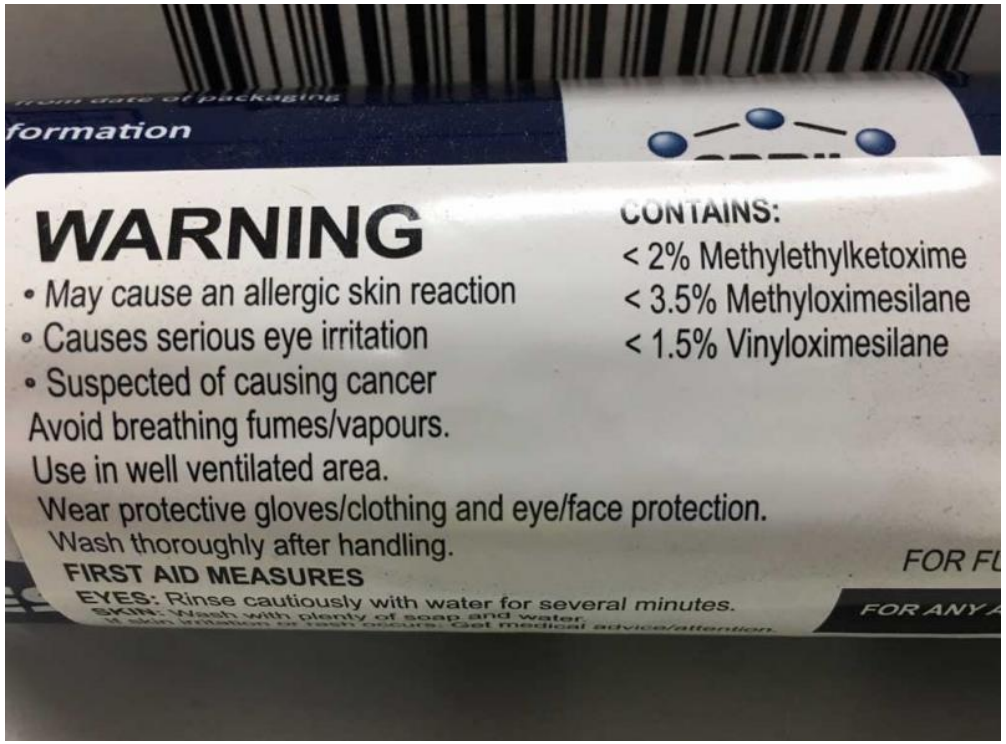
- Windows and doors may have sharp edges or projections that can cause cuts or abrasions.
- Workers should wear appropriate personal protective equipment, such as gloves and safety glasses, to minimize the risk of injuries.



Hazards in Glazing and Installation of Windows

Sealant and Adhesive Hazards

- Chemical Exposure: The use of sealants and adhesives may expose workers to chemicals. Proper ventilation and the use of appropriate PPE, such as gloves and respiratory protection, are necessary.





Hazards in Glazing and Installation of Windows

Glass Fragments and Sharp Edges

- Injuries from Edges: The edges of glass panels can be sharp, leading to injuries if not handled or finished correctly. Workers should be cautious and wear appropriate PPE.





Hazards in Roofing

Hazards in Roofing

Slips and Trips

- Wet or Slippery Surfaces: Weather conditions, such as rain or dew, can create slippery surfaces on the roof. Proper footwear with slip-resistant soles and caution are necessary.



Hazards in Roofing

Tool and Equipment Hazards

- Power Tools: Incorrect use of power tools, such as nail guns or saws, can result in injuries. Workers should be trained on tool operation and safety measures.
- Falling Objects: Tools, equipment, or materials can fall from the roof, posing a danger to workers and bystanders. Implement barricades and warning signs to mark the danger zone.



Hazards in Roofing

Roof Openings

- Unprotected Skylights or Roof Hatches: Workers can fall through unprotected openings on the roof.
- Install guardrails or protective covers to prevent falls.



Hazards in Roofing

Heat Stress

- Exposure to Sun and High Temperatures: Working on a roof under direct sunlight can lead to heat-related illnesses.
- Adequate hydration, breaks, and shaded areas are essential to prevent heat stress.





Hazards in Wood Stud Framing & Sheathing

What is Wood Stud Framing & Sheathing?

- Wood stud framing is a method of constructing the skeletal framework of a building using wooden studs. Studs are vertical members that form the primary structural element of walls.

- Sheathing refers to the material applied to the outer surface of the framing to provide structural support, protect against the elements, and serve as a base for exterior finishes.



What types of materials are used in sheathing?

- **Plywood:** Layers of wood veneers glued together in a cross-grain pattern for strength and stability.
- **Oriented Strand Board (OSB):** Engineered wood product made by compressing strands of wood with resin and wax.
- **Gypsum or Fiberboard:** Specialized sheathing materials that may have fire-resistant or moisture-resistant properties.



What are the functions of sheathing?

- **Structural Support:** Sheathing enhances the overall strength and stability of the building structure.
- **Weather Resistance:** It provides a protective barrier against the elements, such as wind, rain, and snow.
- **Base for Finishes:** Sheathing serves as a surface to attach exterior finishes, such as siding or stucco.



What is the installation process of sheathing?

- Sheathing is typically attached directly to the **exterior side** of the wood stud framing.
- The sheets are secured with **nails or screws**, and the seams are often **staggered** for additional strength.
- Proper installation ensures a **continuous and rigid surface** for exterior finishes.



Hazards in sheathing

Falls from Heights

- **Hazard:** Sheathing is often installed at elevated positions, especially in multi-story buildings. This poses a risk of falls from heights.
- **Safety Measures:** Workers should use appropriate fall protection equipment, such as guardrails, safety nets, or personal fall arrest systems.



Hazards in sheathing

Manual Handling and Lifting

- **Hazard:** Sheathing materials, such as plywood or oriented strand board (OSB), can be heavy and awkward to handle, leading to musculoskeletal injuries.
- **Safety Measures:** Workers should use proper lifting techniques, seek assistance when needed, and utilize mechanical aids to reduce the risk of strain.



Hazards in sheathing

Tool Use and Electrical Hazards

- **Hazard:** Power tools, such as saws and drills, are commonly used in sheathing installation, posing a risk of cuts and electrical hazards.

- **Safety Measures:** Workers should receive training in the safe use of power tools, wear appropriate personal protective equipment (PPE), and follow electrical safety protocols.



Hazards in sheathing

Ergonomic Issues

- **Hazard:** Repetitive motions and awkward postures during sheathing installation can lead to ergonomic issues and discomfort.
- **Safety Measures:** Workers should be trained on proper ergonomic practices, and regular breaks should be encouraged to prevent overexertion.



Hazards in sheathing

Material Storage and Handling

- **Hazard:** Improperly stored sheathing materials can create tripping hazards or cause materials to fall.

- **Safety Measures:** Materials should be stored in designated areas, and workers should be trained on safe handling practices.

