



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:

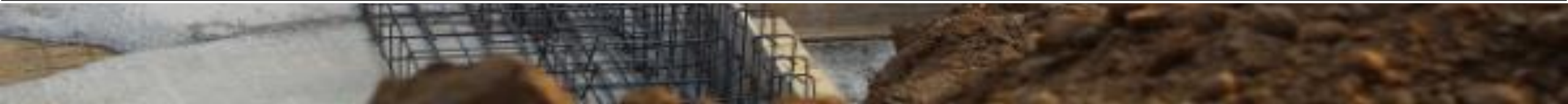
1. Implement strict adherence to safe operating procedures for each type of heavy equipment, including proper startup and shutdown protocols, safe loading and unloading practices, and guidelines for navigating various terrains.
2. Emphasize the use of seat belts, harnesses, and other safety restraints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

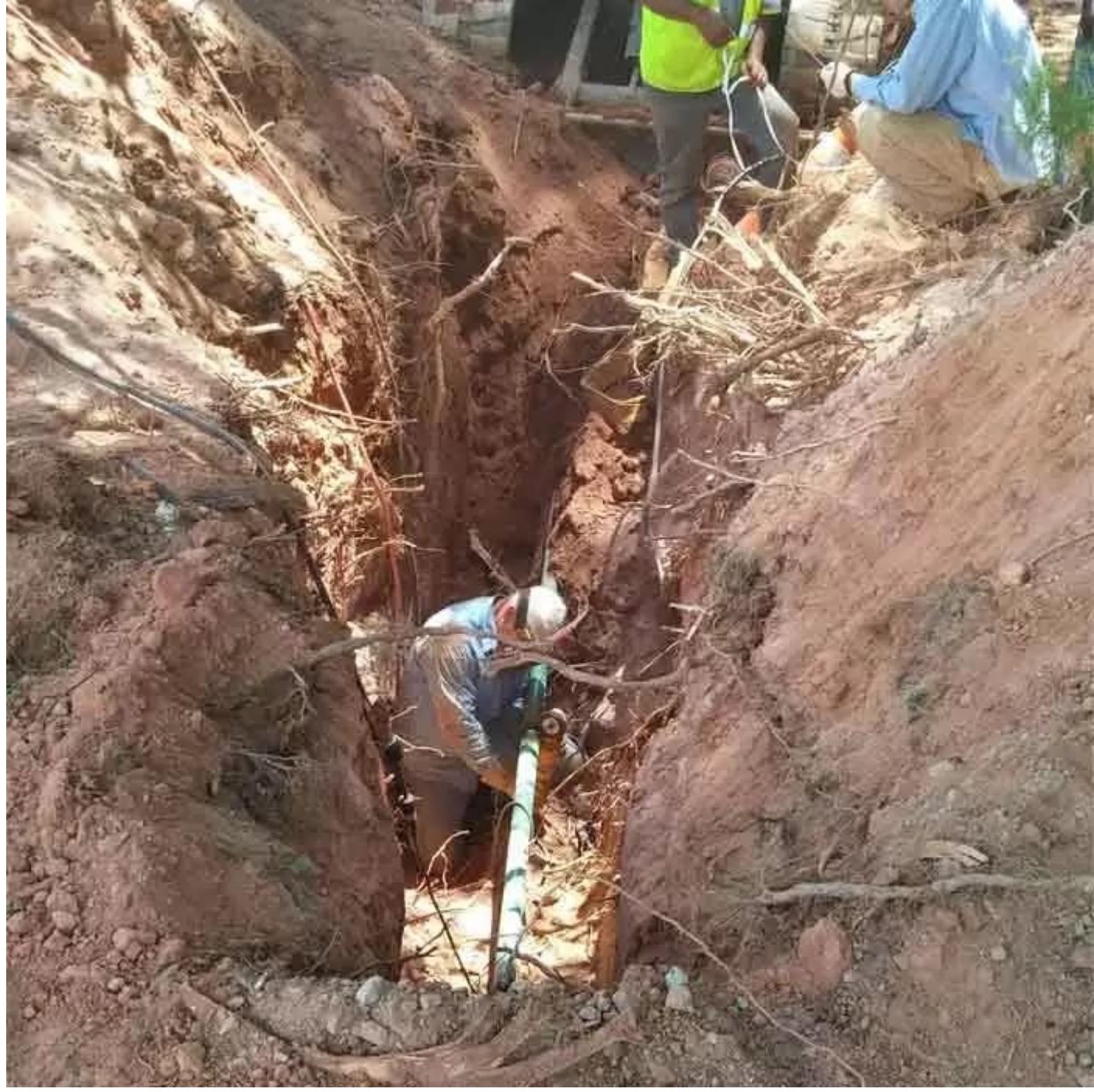
- Video: Most Excavation Fatalities Are Caused By Cave-ins

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

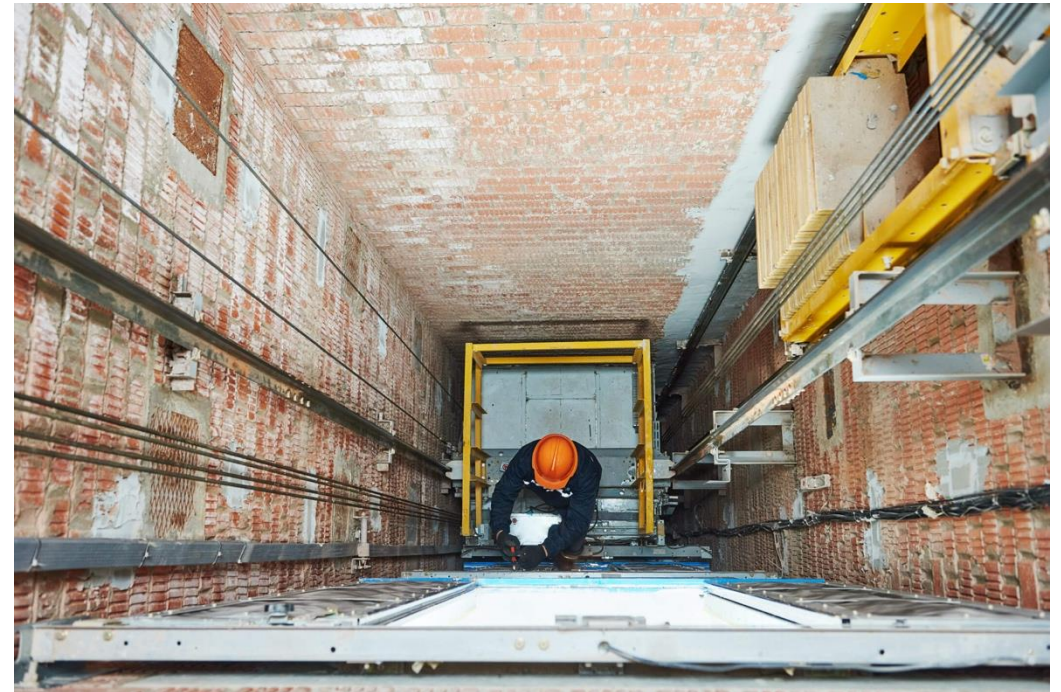


Heavy equipment passing by trenches can cause
cave-ins for the workers who are busy in the trench.

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](#)

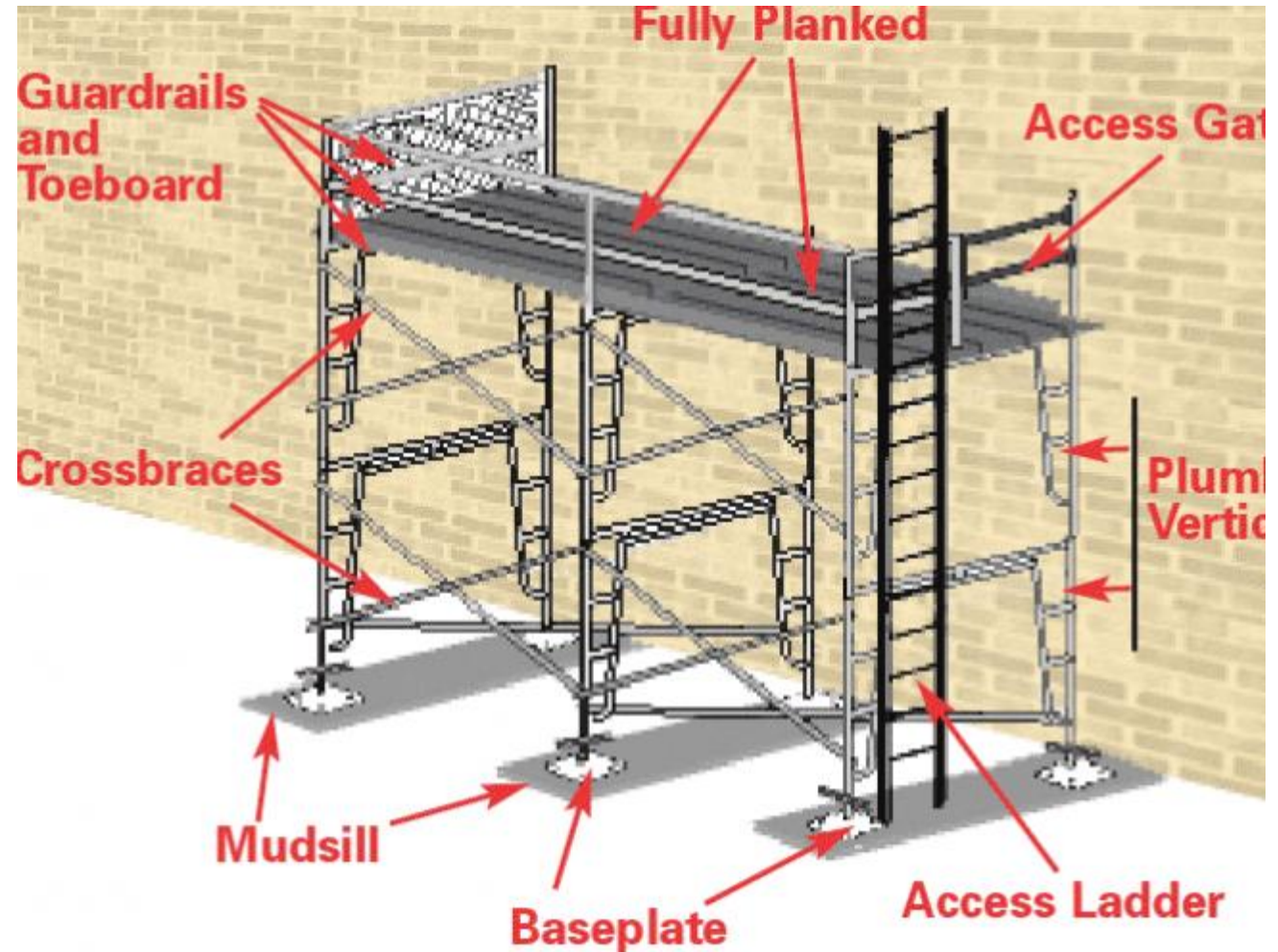
Hazards in scaffolding

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.



From the OSHA Fact Sheet on Narrow Frame Scaffolds



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

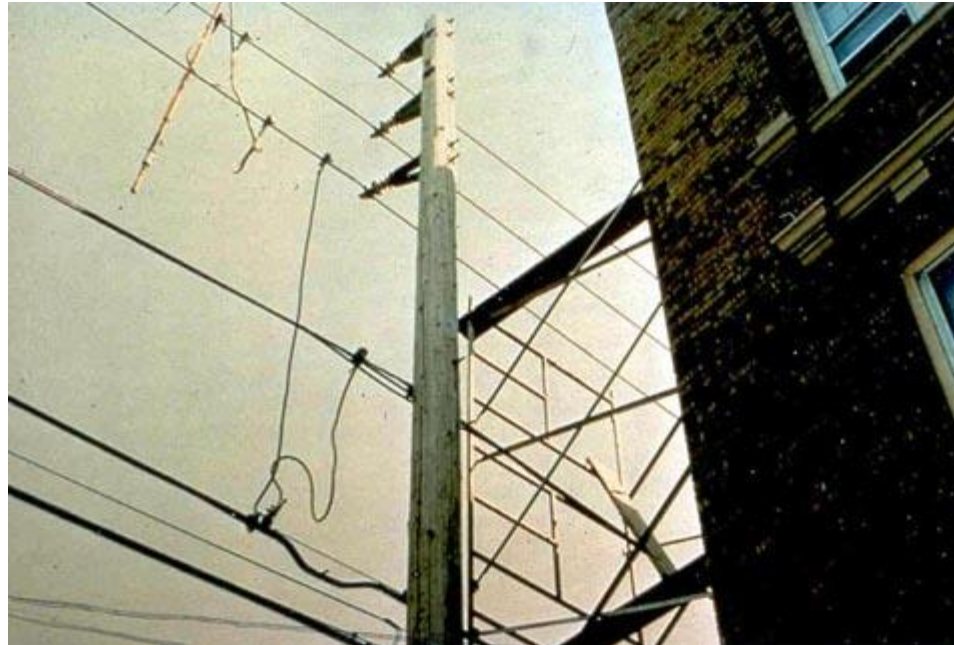
- Adverse weather conditions, such as high winds, rain, ice, or snow, can affect scaffold stability and create slippery surfaces.



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*

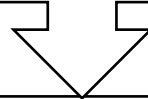
- **Stability:** Ensure that the scaffold is stable and properly supported. Use base plates, mud sills, or adjustable leveling jacks as needed to maintain stability on uneven surfaces.
- **Weather Conditions:** Monitor and address weather conditions that can affect scaffold stability, such as high winds, 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.



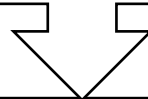
Steelwork Safety

What are the four main tasks in steel erection?

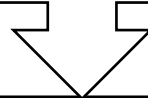
1. Establishing that the foundations are suitable and safe for an erection to commence.



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.

Video

Steel Erection Safety Training



- https://www.youtube.com/watch?v=9wUSHKIGOYM&ab_channel=VectorSolutionsIndustrial



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



What are the Hazards in Steel Erections?

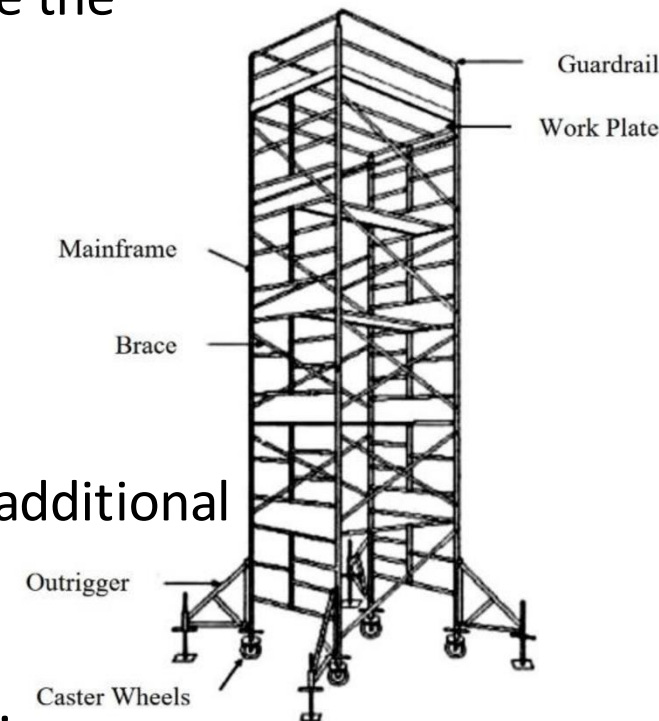
Hazards for cutting, grinding, and welding

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- Injury due to fall of person and/or materials from height
 - Injury due to spark and fires while welding

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 three 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.



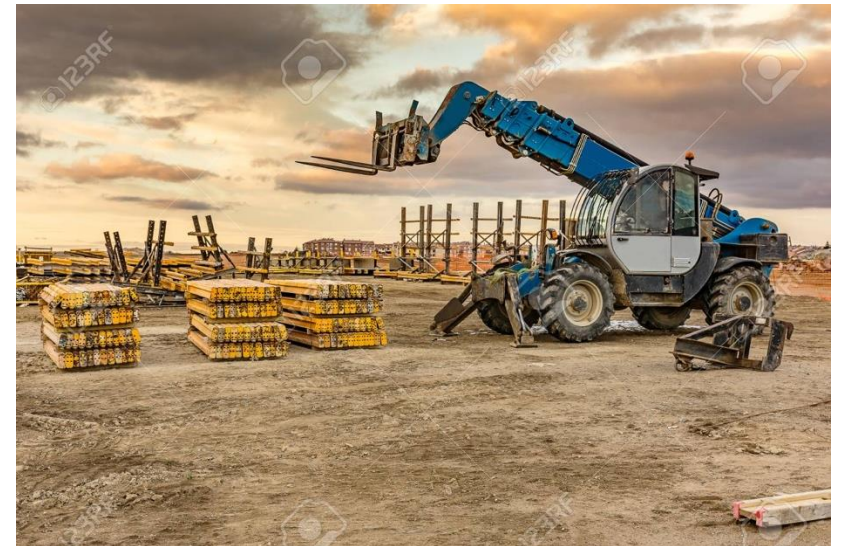


Keep fire extinguishers nearby to all welding operations, as well as additional fire extinguishers should be available.

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.



STEPS TO PROTECTING WORKERS FROM FORKLIFT HAZARDS



Only **trained and licensed** personnel can operate forklifts.



Keep loads **secure to prevent falls**. Make sure the area is clear, so no personnel are harmed.

Cautiously approach ramps, turns, and aisles while driving the forklift.



On ramps, **tilt load back pointing up hill** and **drive reverse while descending**.



Immediately report damages or issues to your supervisor while on the job.



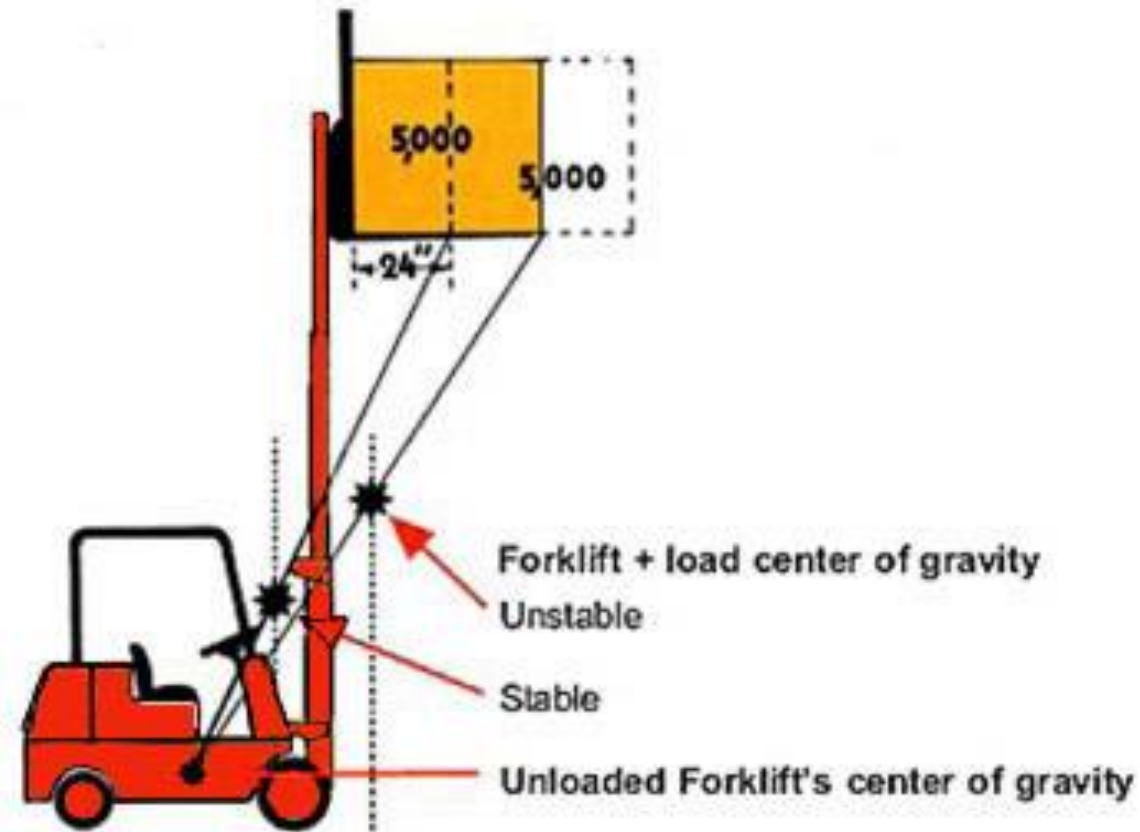
If forklift is being used to elevate a worker, make sure worker **uses restraints and is elevated using a platform or cage**.

Do not overload past forklift's capacity. Keep load balanced and slightly raised so it clears the ground while transporting.

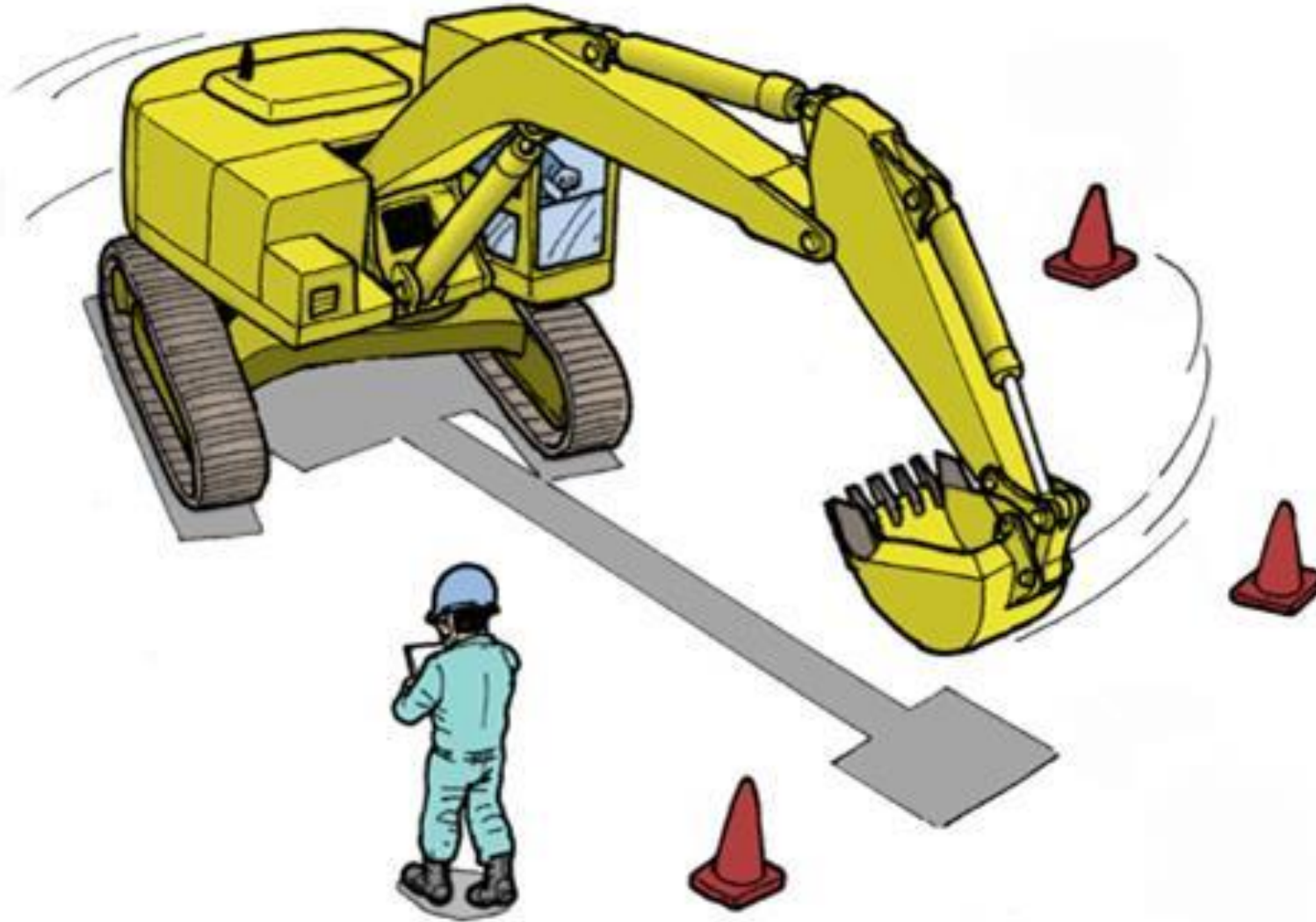


Use seat belts, assigned seats and no joy riding while operating. **When work is complete, engage brakes, lower forks and turn off controls.**





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.



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

Video Forklift Workshop for Construction

https://www.youtube.com/watch?v=Jcy9-8k9Jr0&ab_channel=J.J.Keller%26Associates%2CInc

