METAL BUILDINGS INSTITUTE™

Training Module:

FALL PROTECTION BASICS

Subpart R 1926.761(b), Subpart M 1926.503(a)(1)

CERTIFIED APPRENTICESHIP PROGRAM
RAPIDS CODE: 0877
O*NET/SOC CODE: 47-2221.00

AC478 Compliant

Disclaimer

METAL BUILDINGS INSTITUTE™

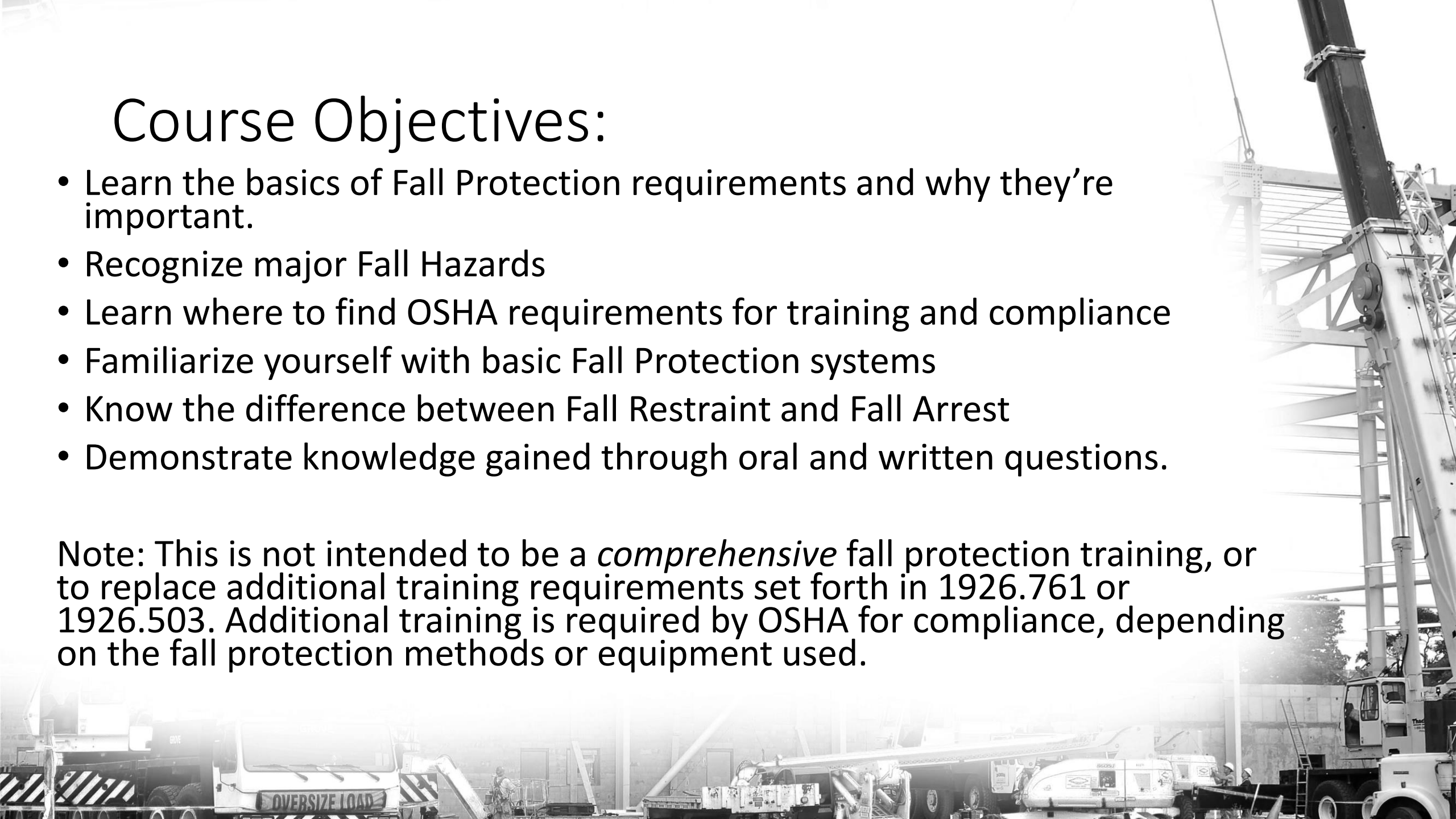
The information provided in this training module has been established in good faith by the MBI in order to assist with compliance regarding OSHA's Fall Protection and Fall Hazard regulations. It does not alter or determine compliance responsibilities in the standard or the Occupational Safety and Health Act of 1970. Since interpretations and enforcement policy may change over time, the reader should consult current OSHA interpretations and decisions by the Occupational Safety and Health Review Commission and the courts for additional guidance on OSHA compliance requirements. The ultimate responsibility for verification of compliance and the accuracy of information presented herein rests with the individual employer. Note that some states have additional requirements beyond existing Federal standards. Users agree to hold the MBI, MBCEA and its officers/directors harmless from any claims resulting from the use of this material.

Instructor Introduction

Course Objectives:

- Learn the basics of Fall Protection requirements and why they're important.
- Recognize major Fall Hazards
- Learn where to find OSHA requirements for training and compliance
- Familiarize yourself with basic Fall Protection systems
- Know the difference between Fall Restraint and Fall Arrest
- Demonstrate knowledge gained through oral and written questions.

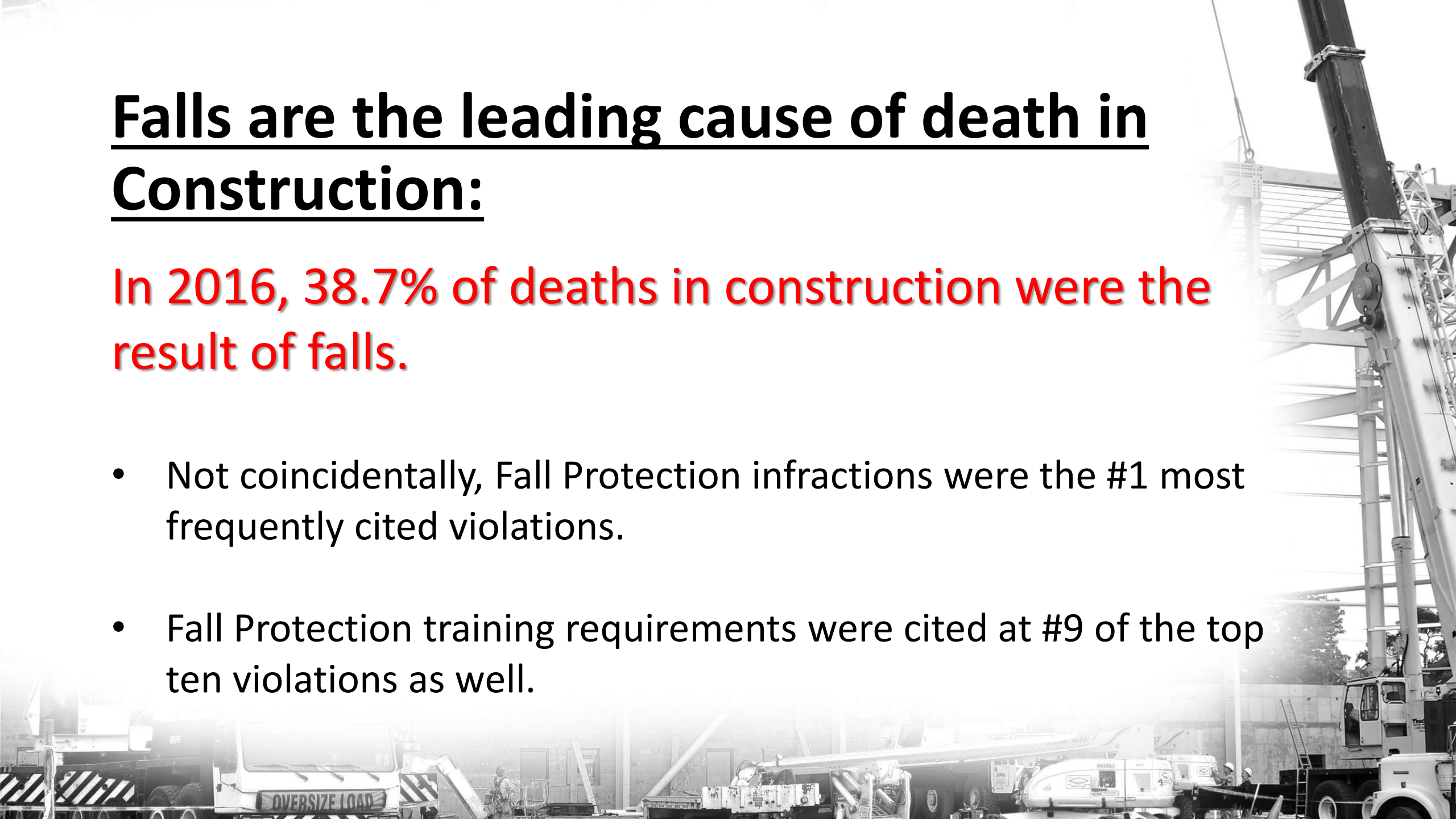
Note: This is not intended to be a *comprehensive* fall protection training, or to replace additional training requirements set forth in 1926.761 or 1926.503. Additional training is required by OSHA for compliance, depending on the fall protection methods or equipment used.



Falls are the leading cause of death in Construction:

In 2016, 38.7% of deaths in construction were the result of falls.

- Not coincidentally, Fall Protection infractions were the #1 most frequently cited violations.
- Fall Protection training requirements were cited at #9 of the top ten violations as well.



Statistically, someone dies every day from a fall on a construction site.

Worker dies in **fall** at Sound Transit light-rail **construction** site in Bellevue
Seattle Times - May 22, 2018
A **construction** worker died early Tuesday after he fell 30 to 40 feet to the ground while working on a column for Sound Transit's Eastside ...

Construction worker killed in 40-foot **fall** off column in Redmond
Highly Cited - Q13 FOX - May 22, 2018

Man killed in **fall** at uptown tower **construction** site
Charlotte Observer - May 23, 2018
A 24-year-old man died Wednesday afternoon in a **fall** at an uptown Charlotte office building under **construction**, authorities said.

Construction worker dies after **falling** 19 stories from uptown ...
FOX 46 Charlotte - May 24, 2018

Officials: Md. **construction** worker died in elevator shaft **fall**
WTOP - Jun 8, 2018
COCKEYSVILLE, Md. (AP) — Fire officials in Maryland say a **construction** worker has died after **falling** down an elevator shaft. WBAL reported ...

Baltimore Fishbowl

When is Fall Protection required?

- A fall from any height can kill you or cause injury.
- General Industry Standard = 4 feet
- Maritime Industry Standard = 5 feet
- **Construction Industry Standard = 6 feet**

  Fall protection is required when working over dangerous equipment or machinery, regardless of the distance

There are exceptions for steel erection and connectors directly involved with connecting while using hoisting equipment, but remember that 6 feet is the general rule for the construction industry.

Major fall hazards:

Roofing and leading edge work

Major fall hazards:

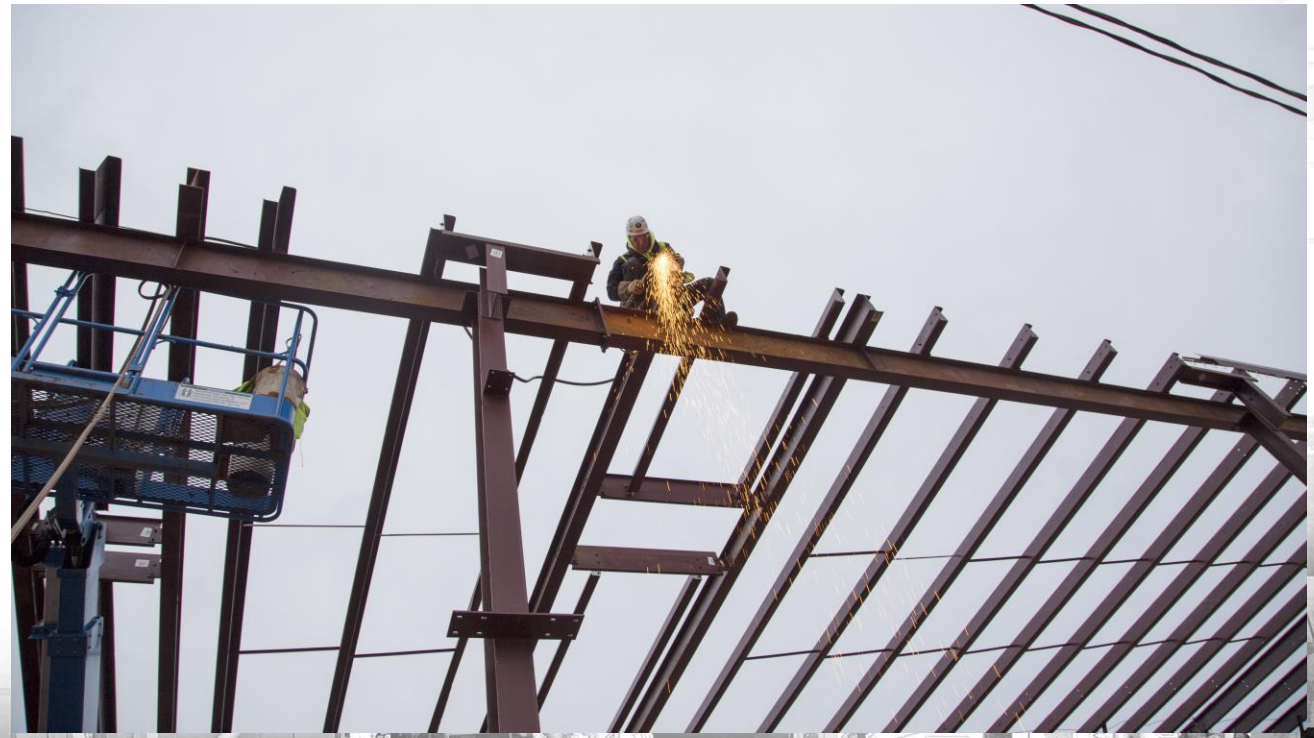
Roof and floor openings

Major fall hazards:

Impalement

Major fall hazards:

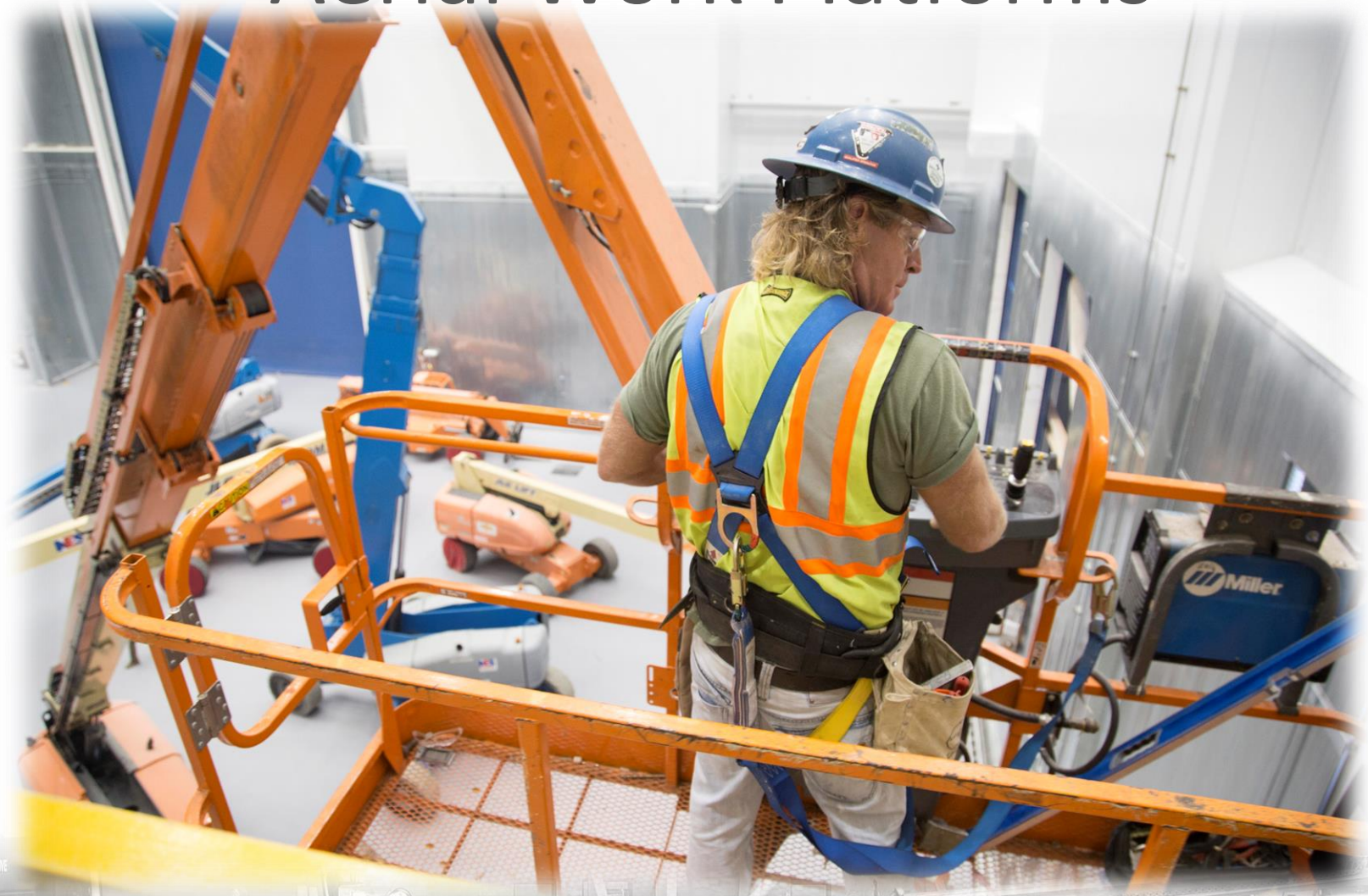
Steel erection activities



Major fall hazards:

Walking and working surfaces, housekeeping, loose fasteners and slippery conditions

Major fall hazards:
Aerial Work Platforms



Best Practice:
Hazard Control Hierarchy
Fall Protection Examples

1. Eliminate the Hazard.
   - *Perform work on the ground instead of at elevation*
2. Substitute a lesser Hazard.
   - *Use a scaffold instead of a crane personnel platform*
3. Engineer the Hazard
   - *Design or install a compliant guardrail into the work area*
4. Administer the Hazard
   - *Provide hazard recognition and avoidance training and enforce safe work practices*
5. Personal Protective Equipment
   - *Harness and lanyard should always be the last resort when no other option is available.*

OSHA and Fall Protection – Subpart M

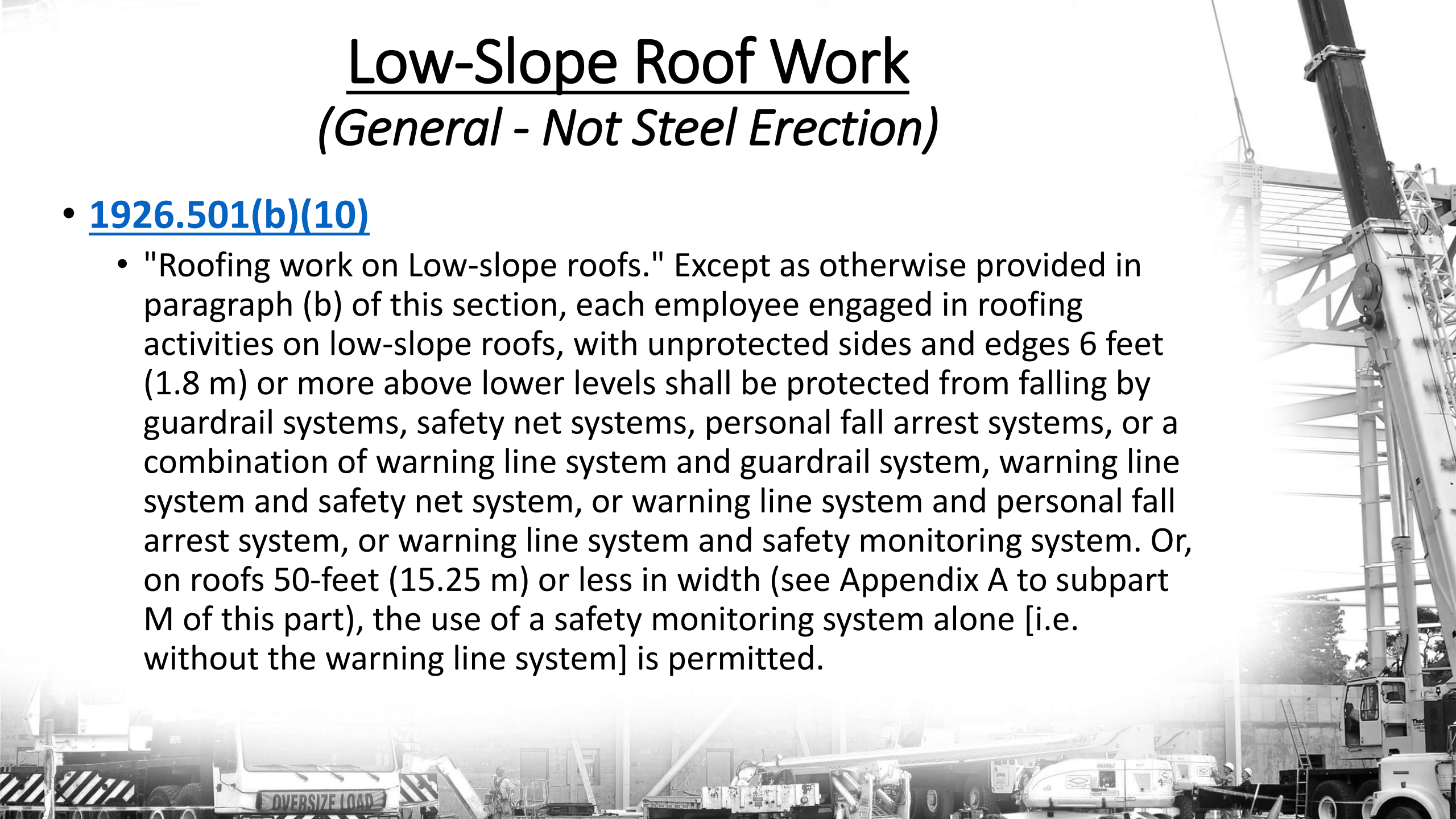
1926.502 – Fall Protection Systems Criteria and Practices.

This covers general requirements for the construction industry. Steel erection has more specific and limited requirements. Systems with an * are considered “conventional” fall protection systems.

- Guard Rail Systems*
- Safety Net Systems*
- Personal Fall Arrest Systems*
- Positioning Device Systems
- Warning Line Systems
- Controlled Access Zones
- Safety Monitoring Systems
- Covers
- Protection from Falling Objects
- Fall Protection Plan

Low-Slope Roof Work
(General - Not Steel Erection)

- **1926.501(b)(10)**
  - "Roofing work on Low-slope roofs." Except as otherwise provided in paragraph (b) of this section, each employee engaged in roofing activities on low-slope roofs, with unprotected sides and edges 6 feet (1.8 m) or more above lower levels shall be protected from falling by guardrail systems, safety net systems, personal fall arrest systems, or a combination of warning line system and guardrail system, warning line system and safety net system, or warning line system and personal fall arrest system, or warning line system and safety monitoring system. Or, on roofs 50-feet (15.25 m) or less in width (see Appendix A to subpart M of this part), the use of a safety monitoring system alone [i.e. without the warning line system] is permitted.



Conventional Fall Protection Systems

Conventional Fall Protection Systems use a physical barrier or restraint which either prevents a worker from reaching a fall hazard or, in the case of a fall, prevents them from hitting a lower level.

The following are considered "conventional" fall protection systems

Guard Rail Systems

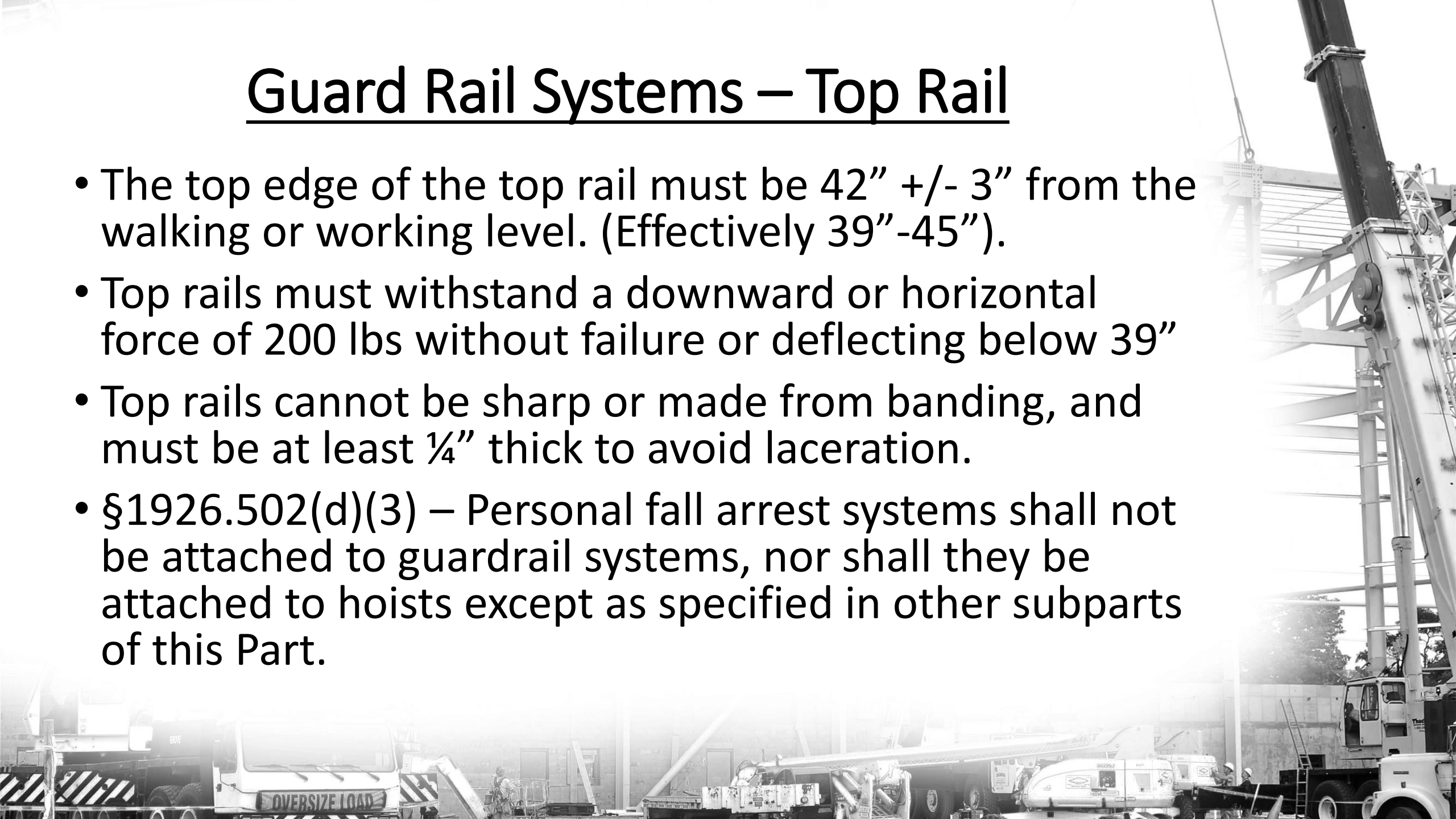
Safety Net Systems

Personal Fall Arrest Systems

Guard Rail Systems

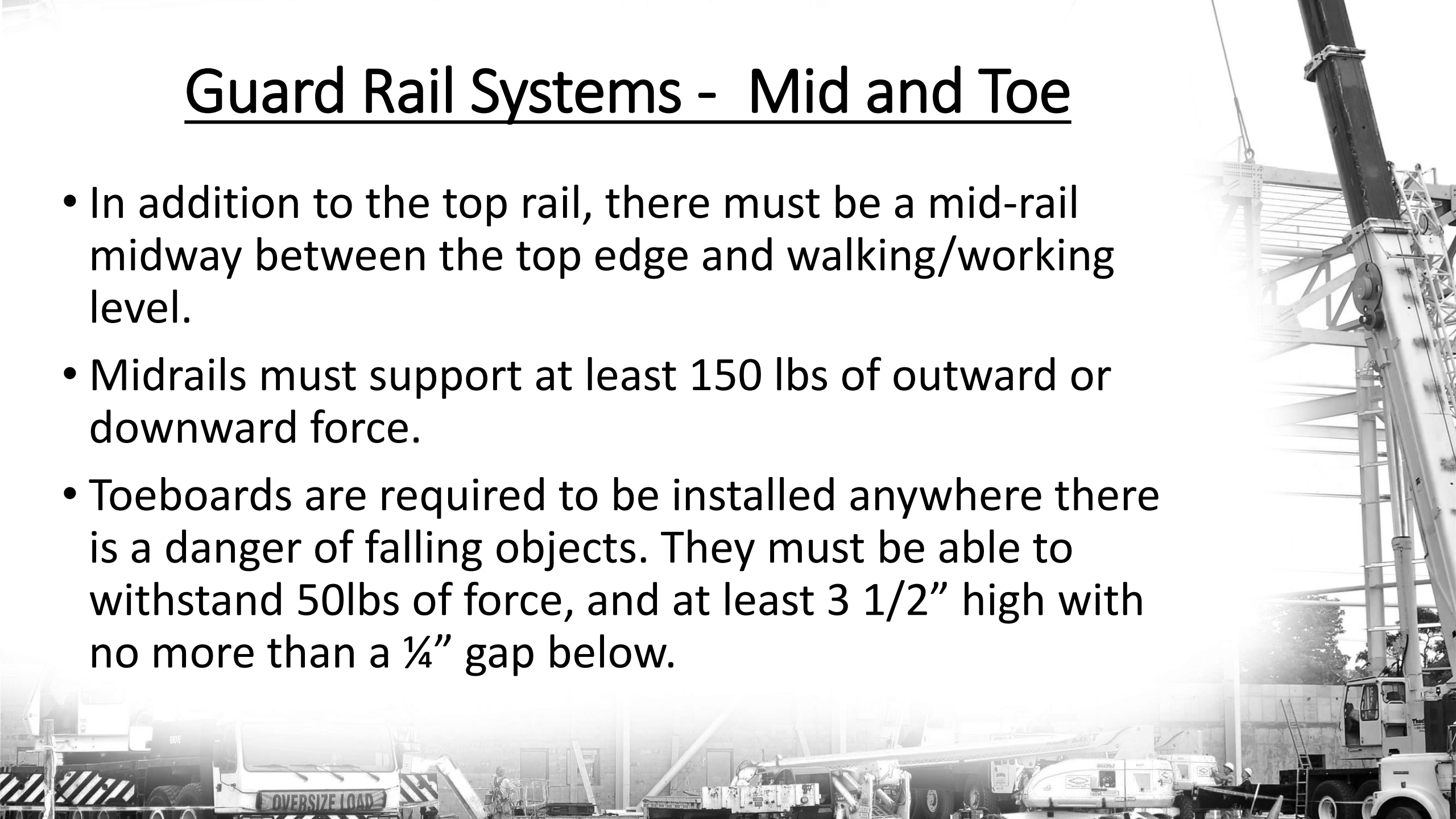
Guard Rail Systems – Top Rail

- The top edge of the top rail must be 42” +/- 3” from the walking or working level. (Effectively 39”-45”).
- Top rails must withstand a downward or horizontal force of 200 lbs without failure or deflecting below 39”
- Top rails cannot be sharp or made from banding, and must be at least ¼” thick to avoid laceration.
- §1926.502(d)(3) – Personal fall arrest systems shall not be attached to guardrail systems, nor shall they be attached to hoists except as specified in other subparts of this Part.



Guard Rail Systems - Mid and Toe

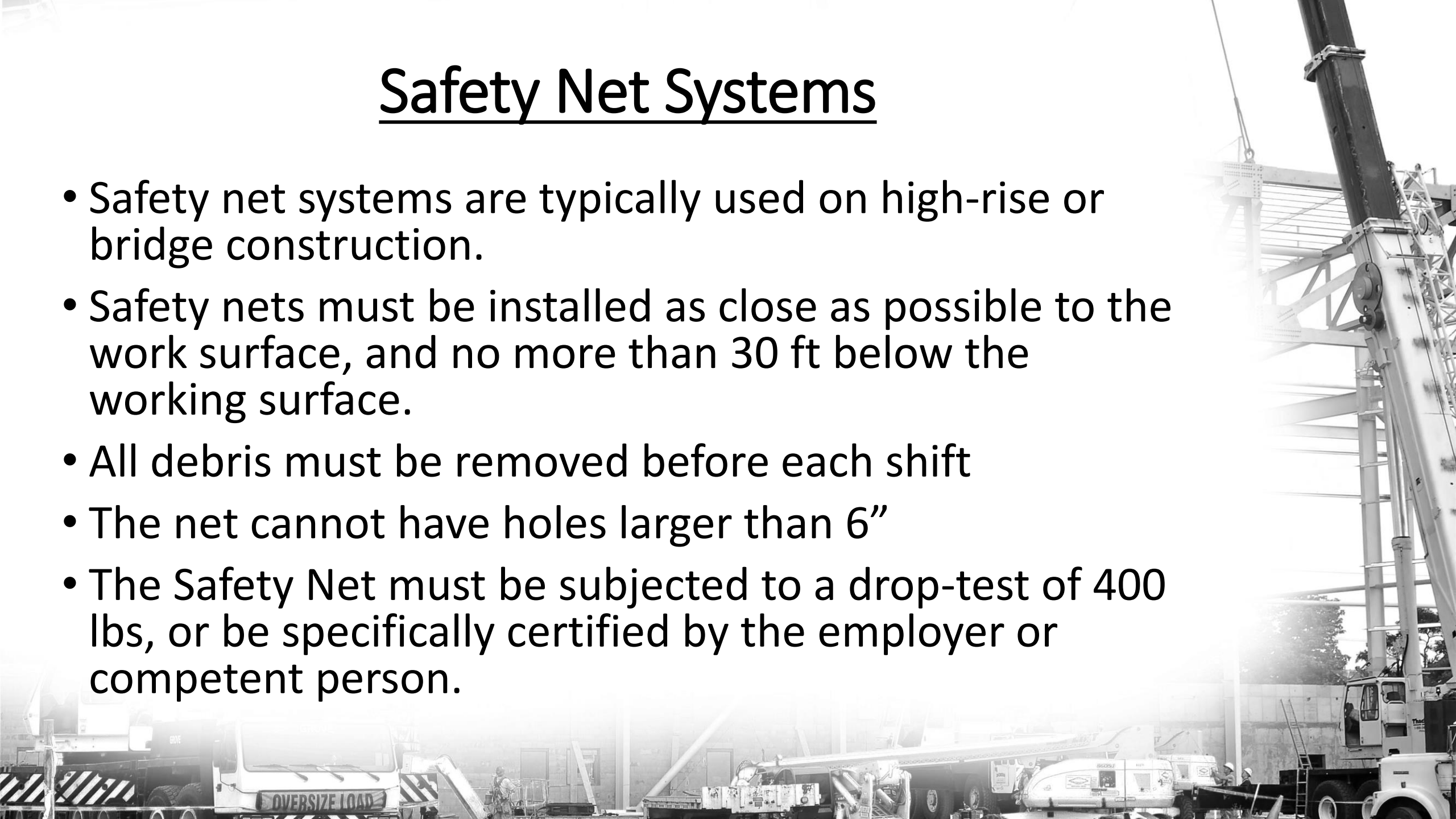
- In addition to the top rail, there must be a mid-rail midway between the top edge and walking/working level.
- Midrails must support at least 150 lbs of outward or downward force.
- Toeboards are required to be installed anywhere there is a danger of falling objects. They must be able to withstand 50lbs of force, and at least 3 1/2” high with no more than a ¼” gap below.



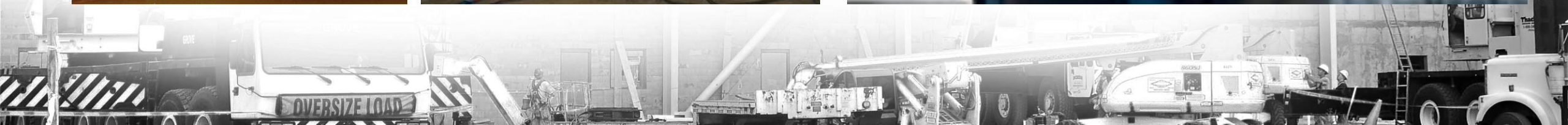
Safety Net Systems

Safety Net Systems

- Safety net systems are typically used on high-rise or bridge construction.
- Safety nets must be installed as close as possible to the work surface, and no more than 30 ft below the working surface.
- All debris must be removed before each shift
- The net cannot have holes larger than 6”
- The Safety Net must be subjected to a drop-test of 400 lbs, or be specifically certified by the employer or competent person.

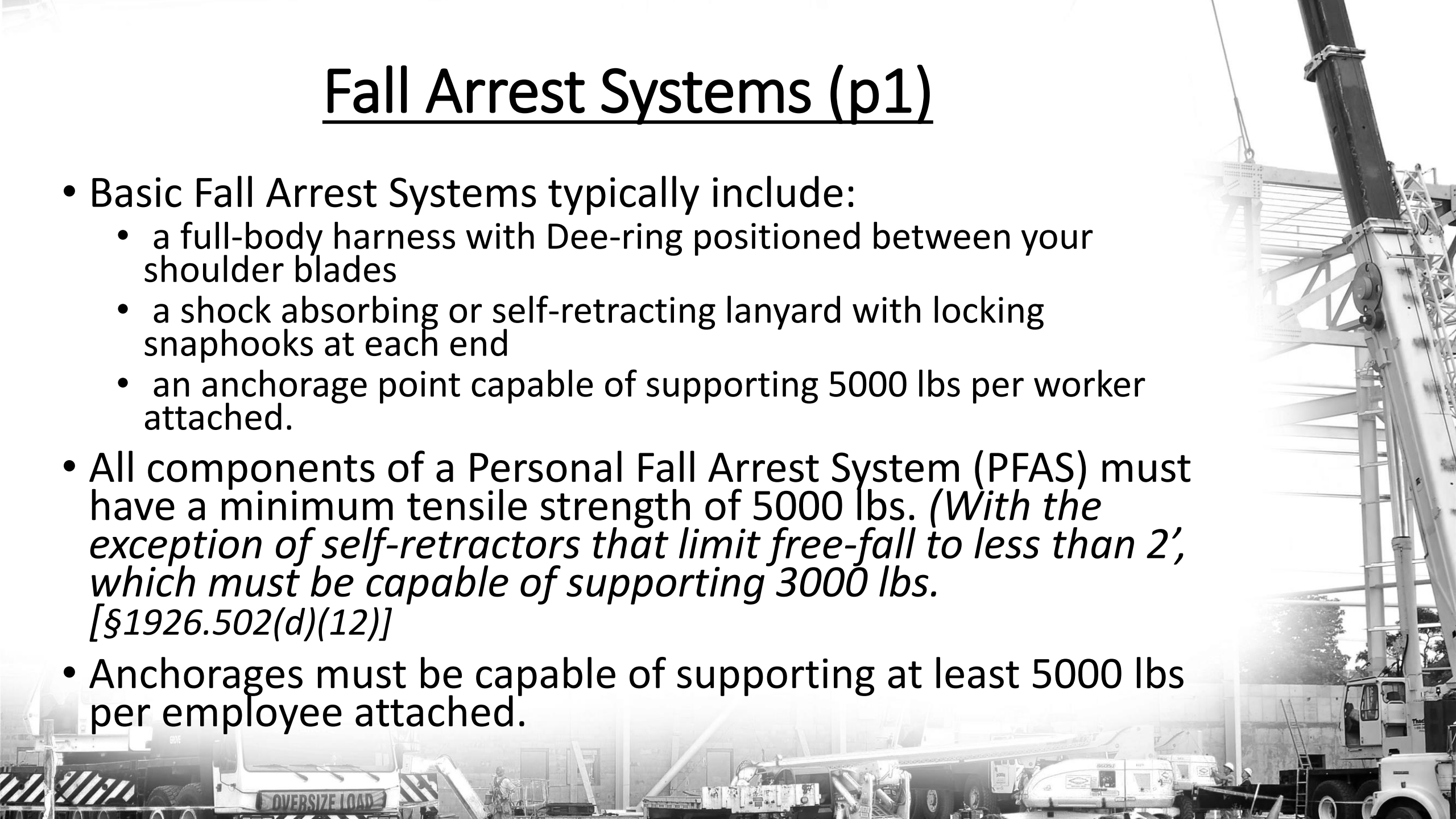


Fall Arrest Systems



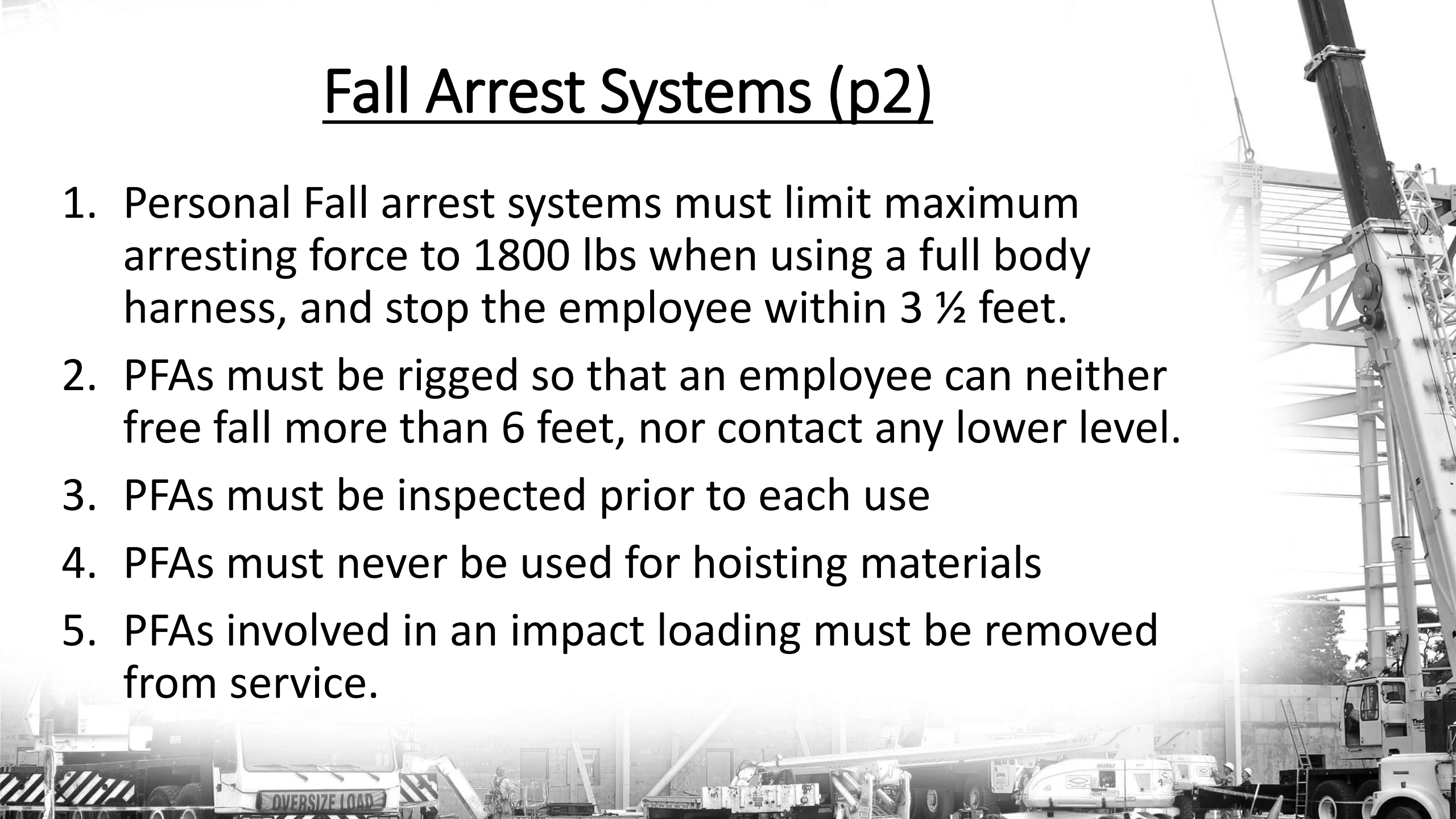
Fall Arrest Systems (p1)

- Basic Fall Arrest Systems typically include:
  - a full-body harness with Dee-ring positioned between your shoulder blades
  - a shock absorbing or self-retracting lanyard with locking snaphooks at each end
  - an anchorage point capable of supporting 5000 lbs per worker attached.
- All components of a Personal Fall Arrest System (PFAS) must have a minimum tensile strength of 5000 lbs. *(With the exception of self-retractors that limit free-fall to less than 2', which must be capable of supporting 3000 lbs. [§1926.502(d)(12)]*
- Anchorages must be capable of supporting at least 5000 lbs per employee attached.



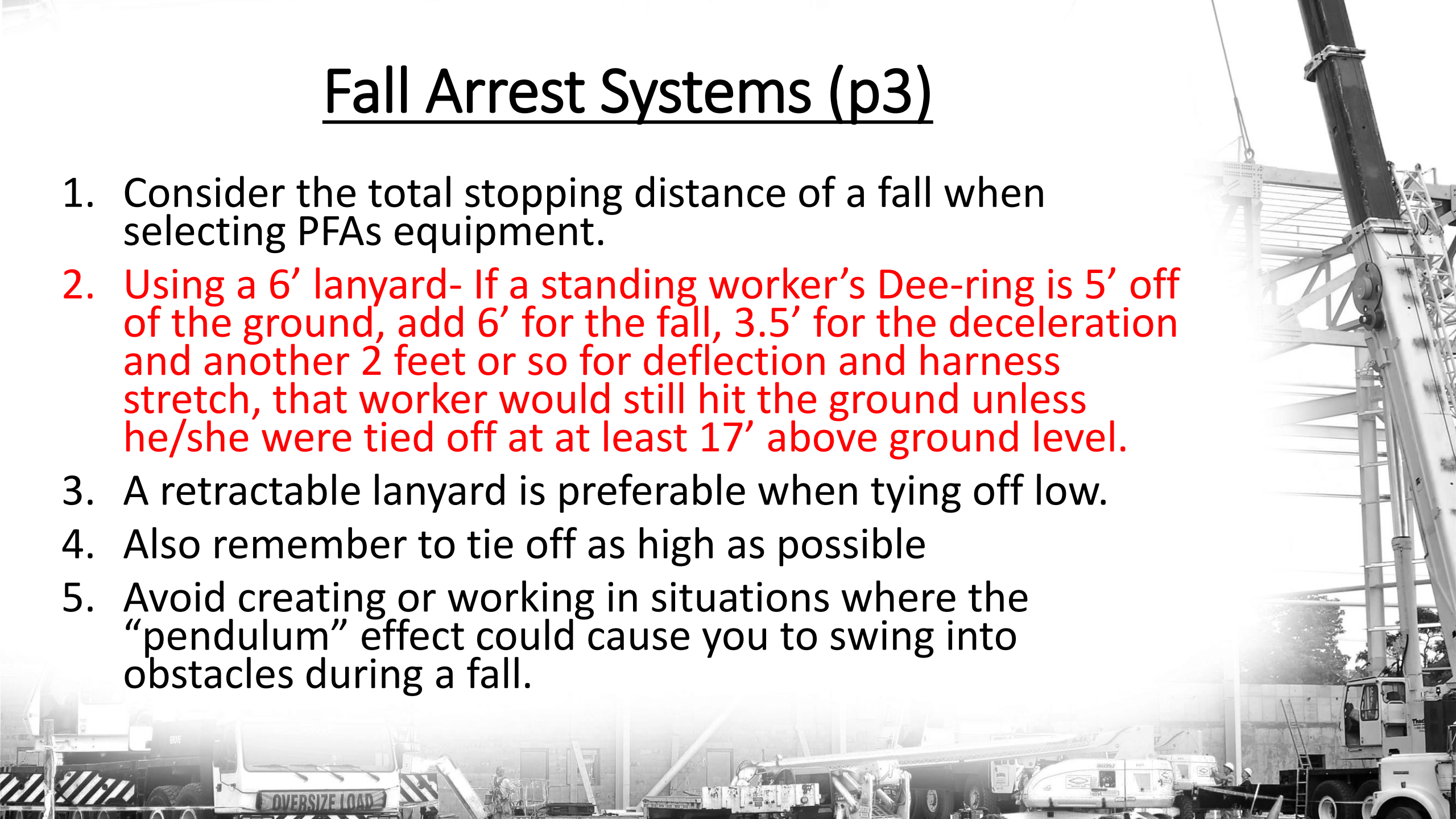
Fall Arrest Systems (p2)

1. Personal Fall arrest systems must limit maximum arresting force to 1800 lbs when using a full body harness, and stop the employee within 3 ½ feet.
2. PFAs must be rigged so that an employee can neither free fall more than 6 feet, nor contact any lower level.
3. PFAs must be inspected prior to each use
4. PFAs must never be used for hoisting materials
5. PFAs involved in an impact loading must be removed from service.



Fall Arrest Systems (p3)

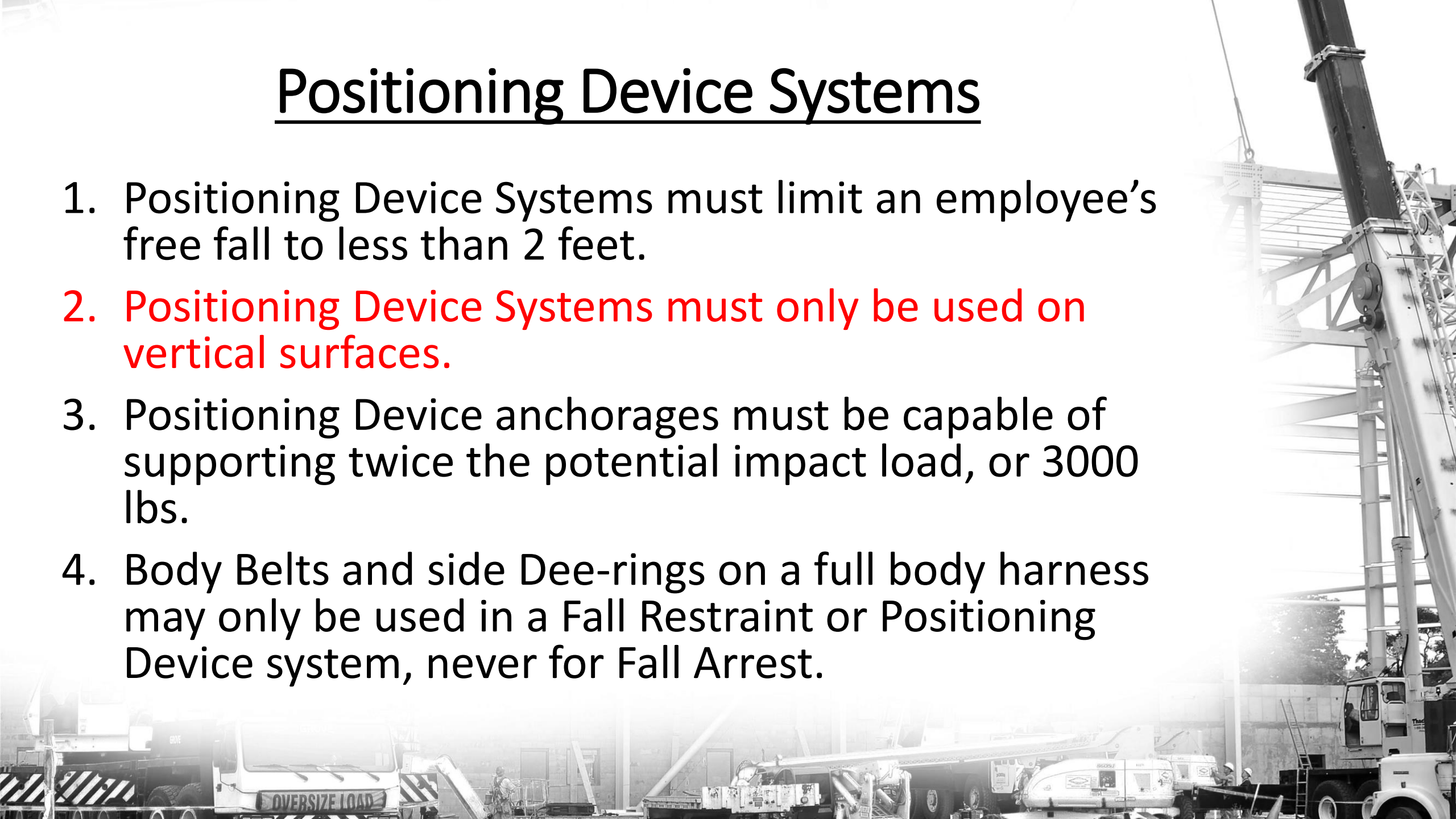
1. Consider the total stopping distance of a fall when selecting PFAs equipment.
2. Using a 6’ lanyard- If a standing worker’s Dee-ring is 5’ off of the ground, add 6’ for the fall, 3.5’ for the deceleration and another 2 feet or so for deflection and harness stretch, that worker would still hit the ground unless he/she were tied off at at least 17’ above ground level.
3. A retractable lanyard is preferable when tying off low.
4. Also remember to tie off as high as possible
5. Avoid creating or working in situations where the “pendulum” effect could cause you to swing into obstacles during a fall.



Positioning Device Systems

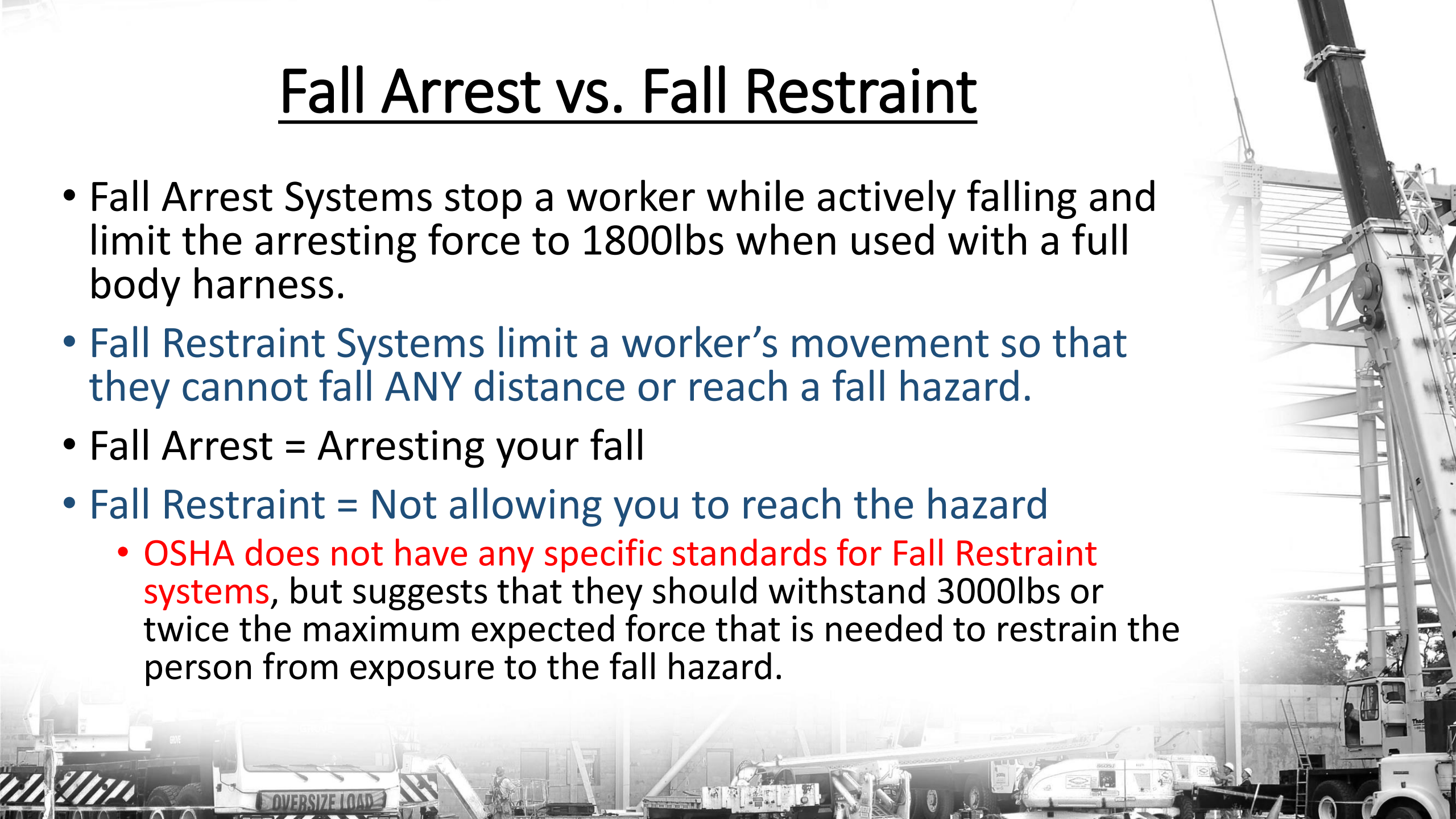
Positioning Device Systems

1. Positioning Device Systems must limit an employee's free fall to less than 2 feet.
2. Positioning Device Systems must only be used on vertical surfaces.
3. Positioning Device anchorages must be capable of supporting twice the potential impact load, or 3000 lbs.
4. Body Belts and side Dee-rings on a full body harness may only be used in a Fall Restraint or Positioning Device system, never for Fall Arrest.



Fall Arrest vs. Fall Restraint

- Fall Arrest Systems stop a worker while actively falling and limit the arresting force to 1800lbs when used with a full body harness.
- Fall Restraint Systems limit a worker's movement so that they cannot fall ANY distance or reach a fall hazard.
- Fall Arrest = Arresting your fall
- Fall Restraint = Not allowing you to reach the hazard
  - OSHA does not have any specific standards for Fall Restraint systems, but suggests that they should withstand 3000lbs or twice the maximum expected force that is needed to restrain the person from exposure to the fall hazard.



Warning Line Systems

Warning Lines and Control Lines

Word choice is important when referring to fall protection systems that are not "conventional". Though all use a "line" to mark the edge of a work area, realize that a "Warning Line System" is a very specific system with its own regulations, and that term should not be used to refer to all similar systems. A CDZ is NOT a Warning Line System.

For General Construction

Warning Line System

- Uses a **WARNING LINE**
- Requires a site-specific FALL PROTECTION PLAN
- Must be installed at 34"- 39" above work surface
- 500 lb line strength
- Must not tip over with 16 lbs of force applied
- **Must be used with another fall protection system**

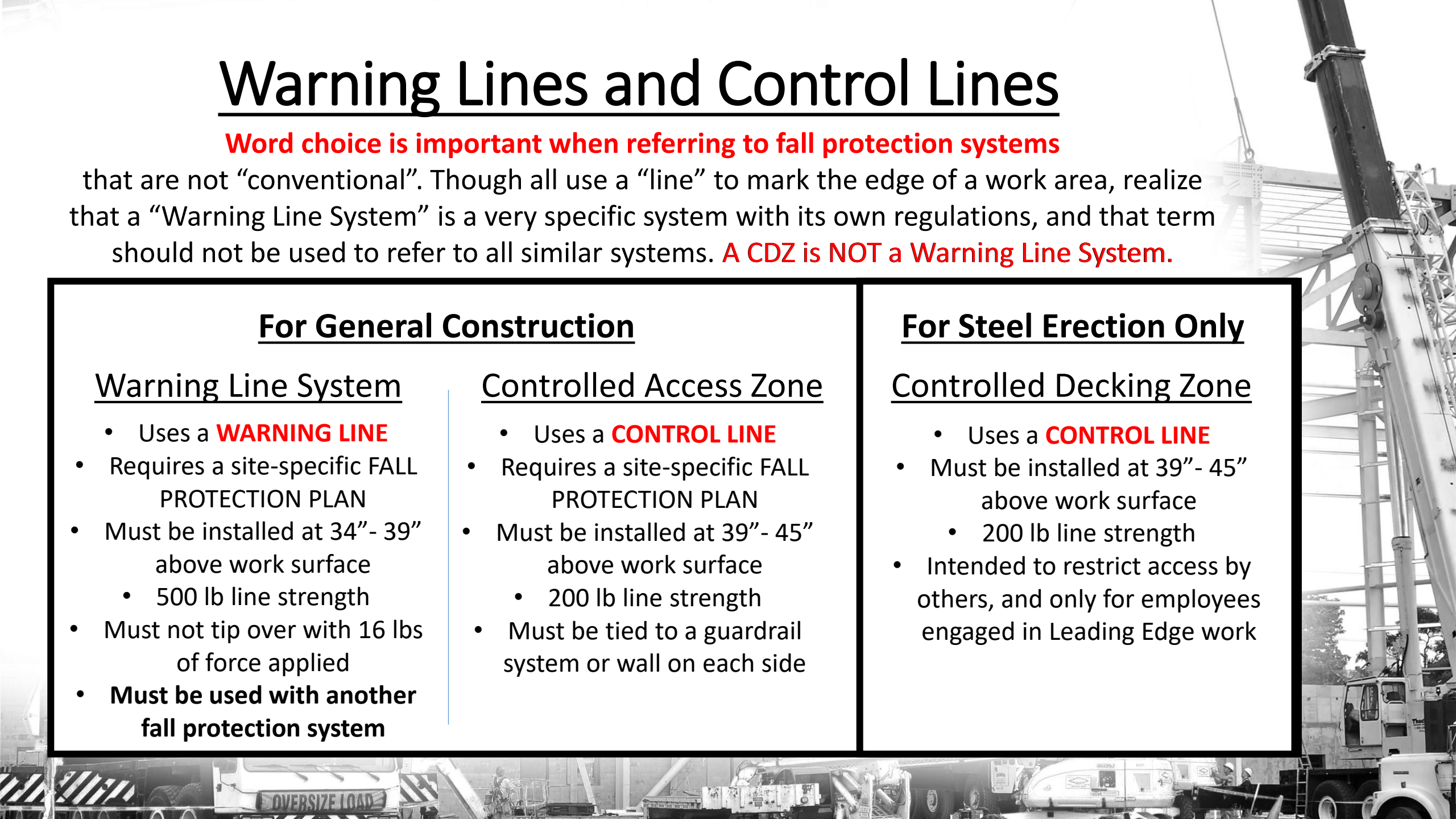
Controlled Access Zone

- Uses a **CONTROL LINE**
- Requires a site-specific FALL PROTECTION PLAN
- Must be installed at 39"- 45" above work surface
- 200 lb line strength
- Must be tied to a guardrail system or wall on each side

For Steel Erection Only

Controlled Decking Zone

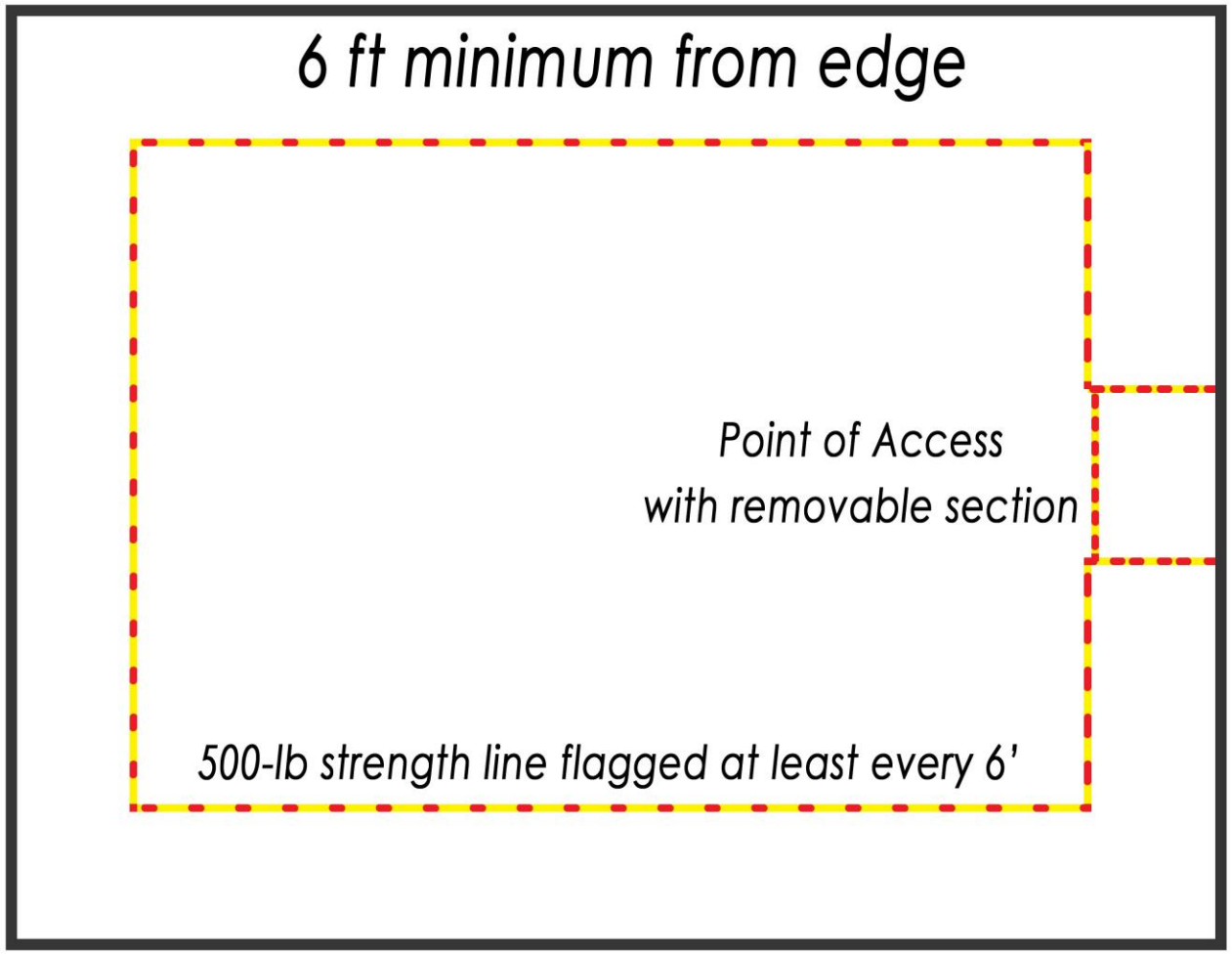
- Uses a **CONTROL LINE**
- Must be installed at 39"- 45" above work surface
- 200 lb line strength
- Intended to restrict access by others, and only for employees engaged in Leading Edge work



Warning Line Systems (1)

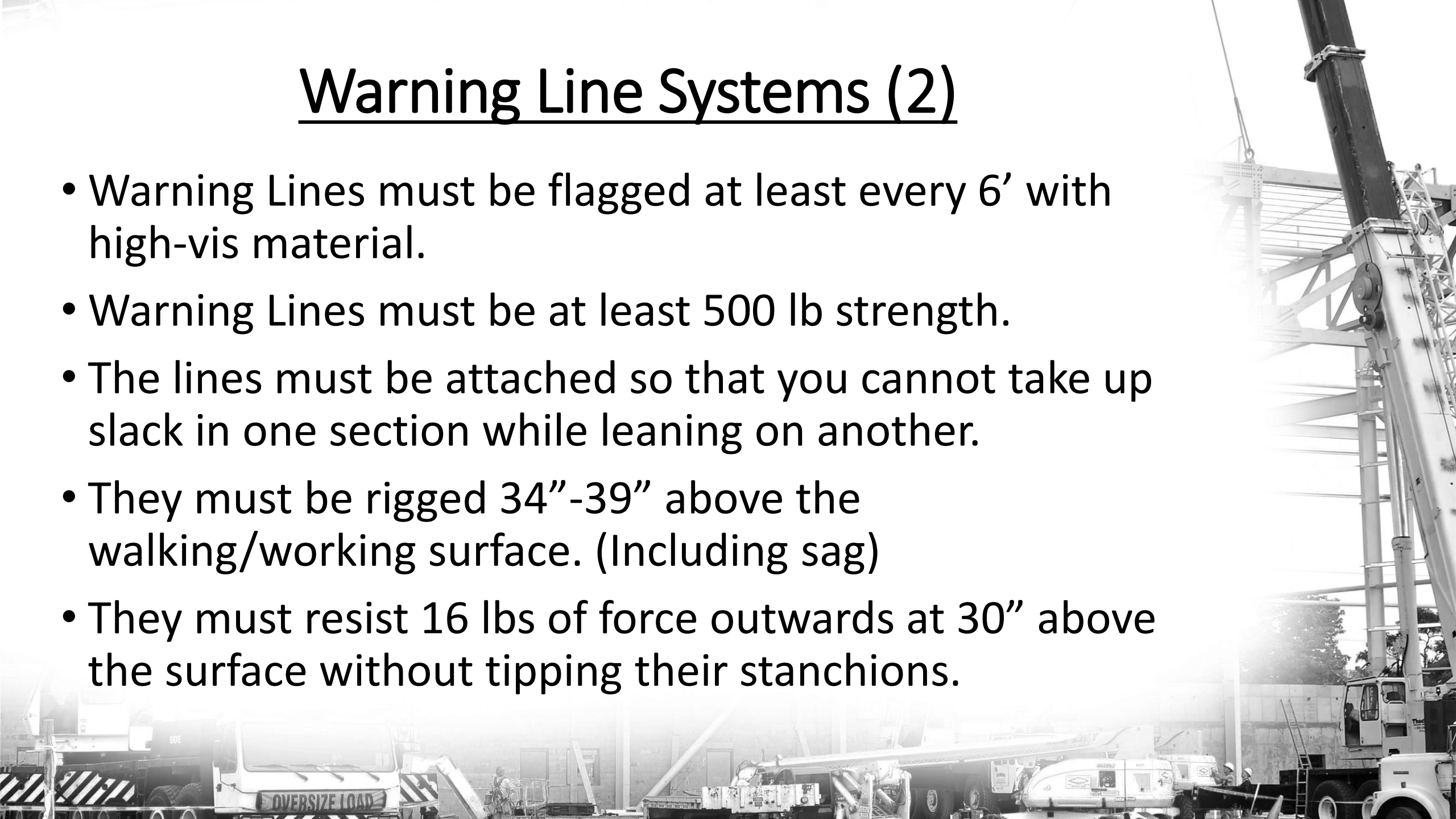
A Warning Line System (in conjunction with conventional systems or Safety Monitor) may be used on low-slope roof work (less than 4/12) by establishing a line 6’ from every roof edge.

This must be increased to 10’ on the sides perpendicular to the travel direction of any mechanical equipment being used.



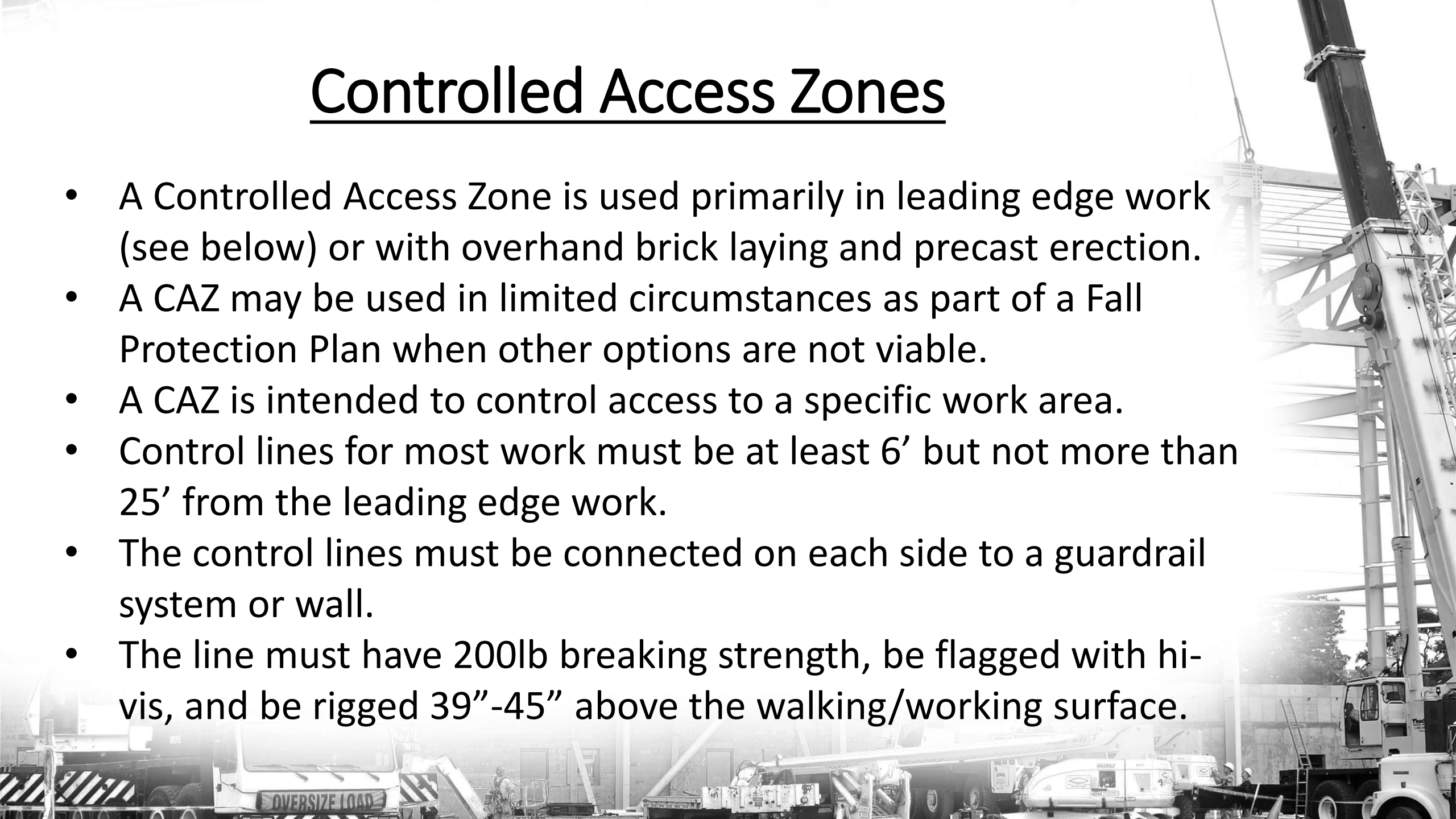
Warning Line Systems (2)

- Warning Lines must be flagged at least every 6’ with high-vis material.
- Warning Lines must be at least 500 lb strength.
- The lines must be attached so that you cannot take up slack in one section while leaning on another.
- They must be rigged 34”-39” above the walking/working surface. (Including sag)
- They must resist 16 lbs of force outwards at 30” above the surface without tipping their stanchions.



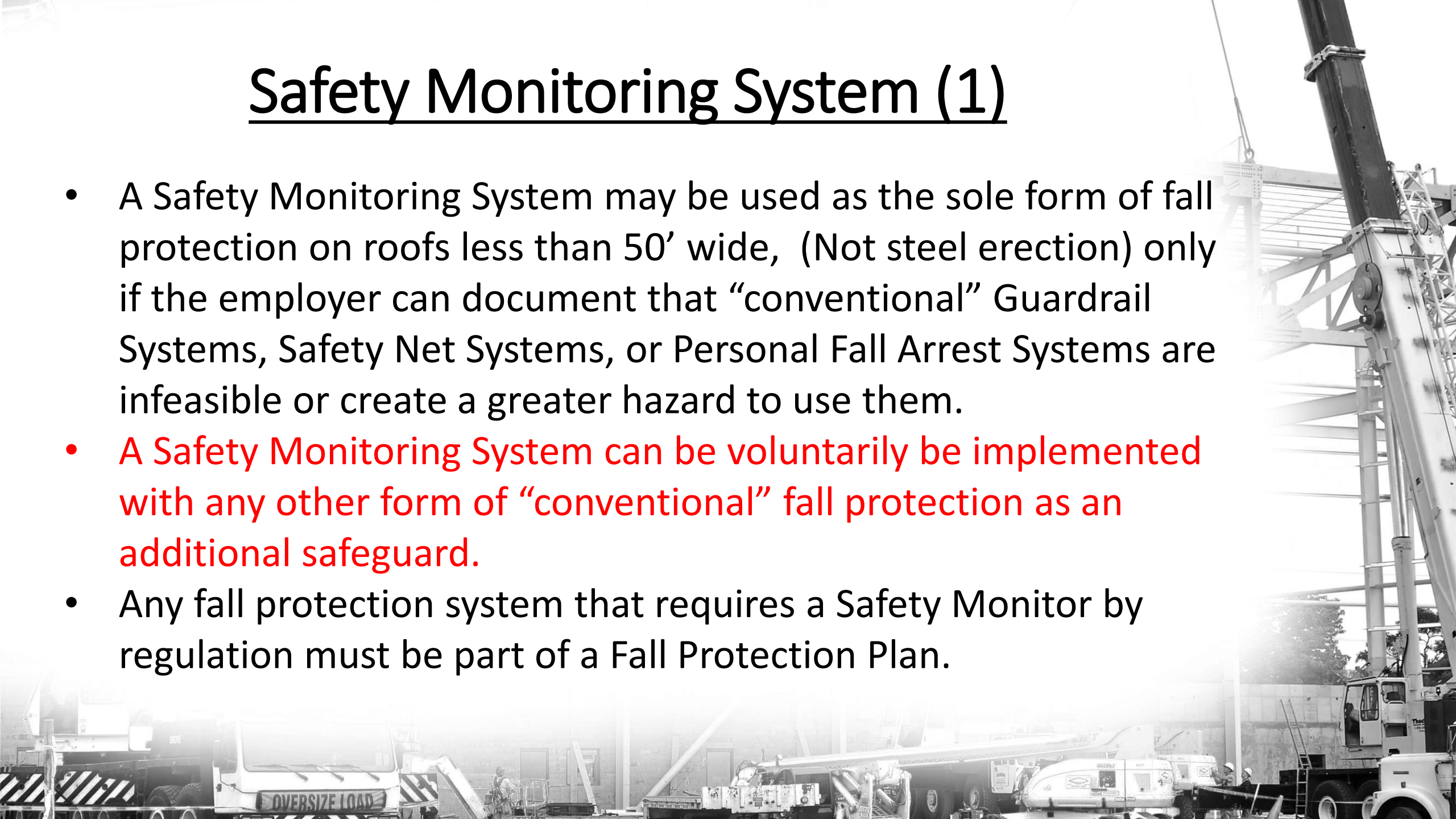
Controlled Access Zones

- A Controlled Access Zone is used primarily in leading edge work (see below) or with overhand brick laying and precast erection.
- A CAZ may be used in limited circumstances as part of a Fall Protection Plan when other options are not viable.
- A CAZ is intended to control access to a specific work area.
- Control lines for most work must be at least 6’ but not more than 25’ from the leading edge work.
- The control lines must be connected on each side to a guardrail system or wall.
- The line must have 200lb breaking strength, be flagged with hi-vis, and be rigged 39”-45” above the walking/working surface.



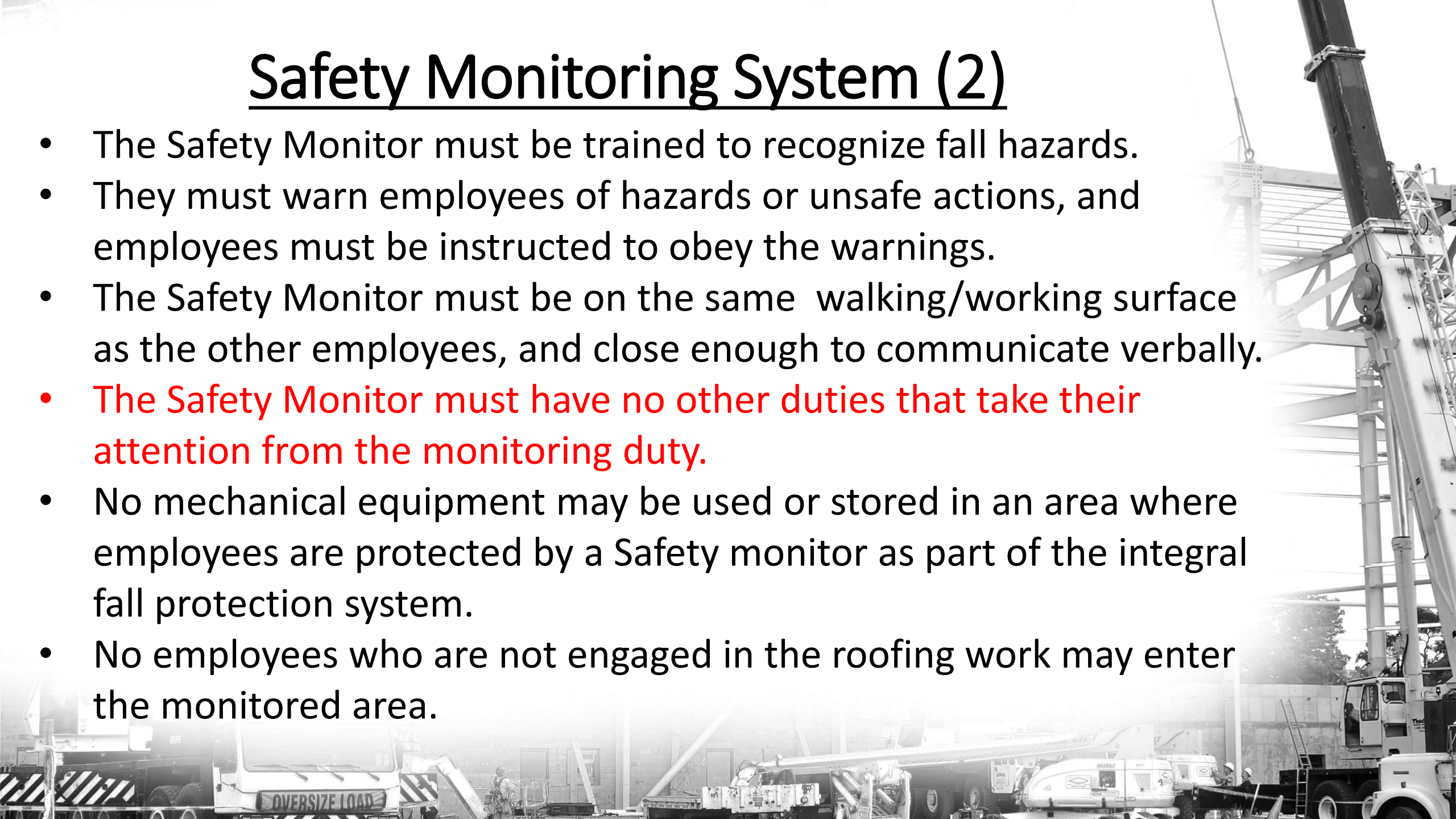
Safety Monitoring System (1)

- A Safety Monitoring System may be used as the sole form of fall protection on roofs less than 50’ wide, (Not steel erection) only if the employer can document that “conventional” Guardrail Systems, Safety Net Systems, or Personal Fall Arrest Systems are infeasible or create a greater hazard to use them.
- A Safety Monitoring System can be voluntarily be implemented with any other form of “conventional” fall protection as an additional safeguard.
- Any fall protection system that requires a Safety Monitor by regulation must be part of a Fall Protection Plan.



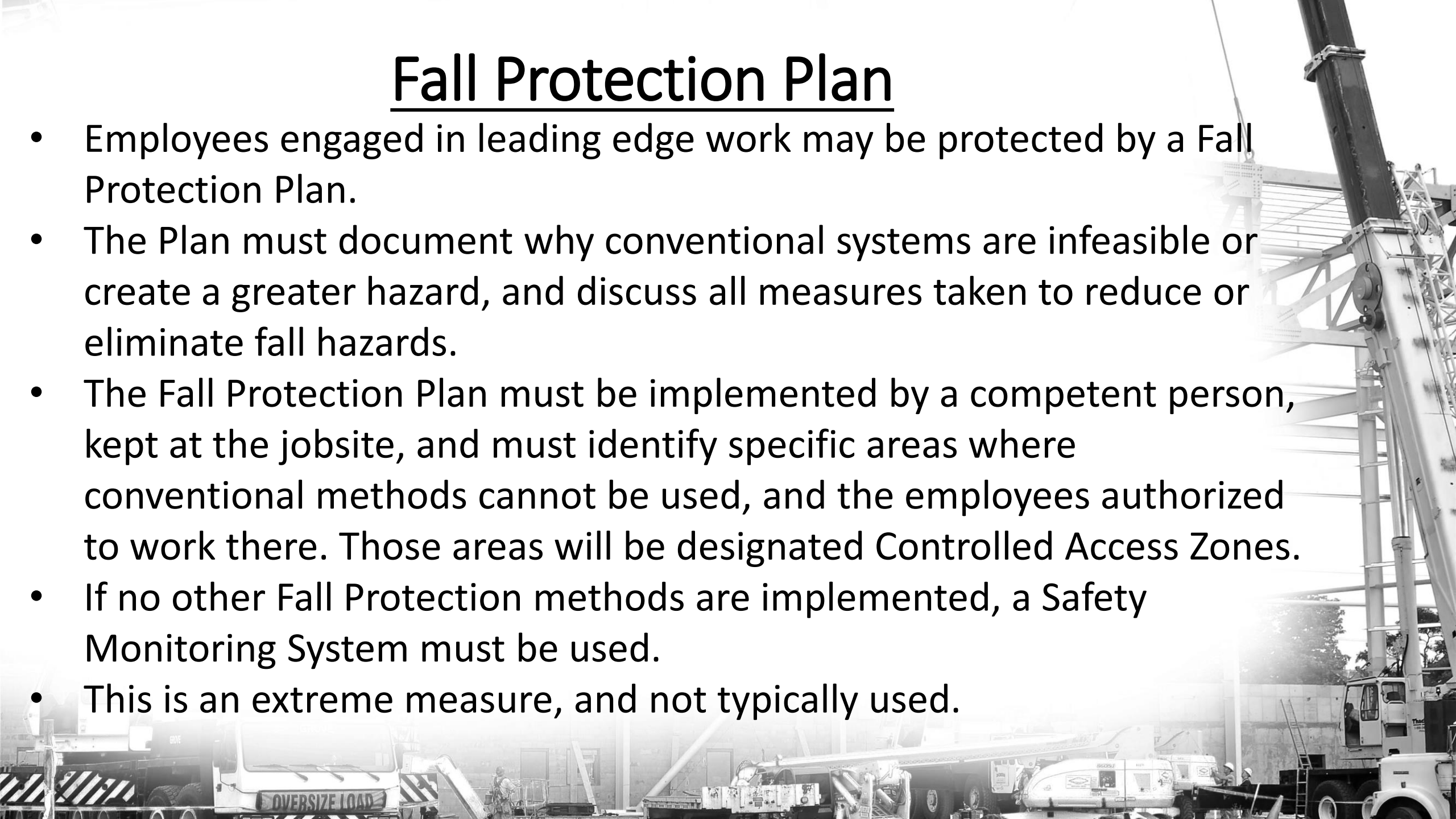
Safety Monitoring System (2)

- The Safety Monitor must be trained to recognize fall hazards.
- They must warn employees of hazards or unsafe actions, and employees must be instructed to obey the warnings.
- The Safety Monitor must be on the same walking/working surface as the other employees, and close enough to communicate verbally.
- The Safety Monitor must have no other duties that take their attention from the monitoring duty.
- No mechanical equipment may be used or stored in an area where employees are protected by a Safety monitor as part of the integral fall protection system.
- No employees who are not engaged in the roofing work may enter the monitored area.



Fall Protection Plan

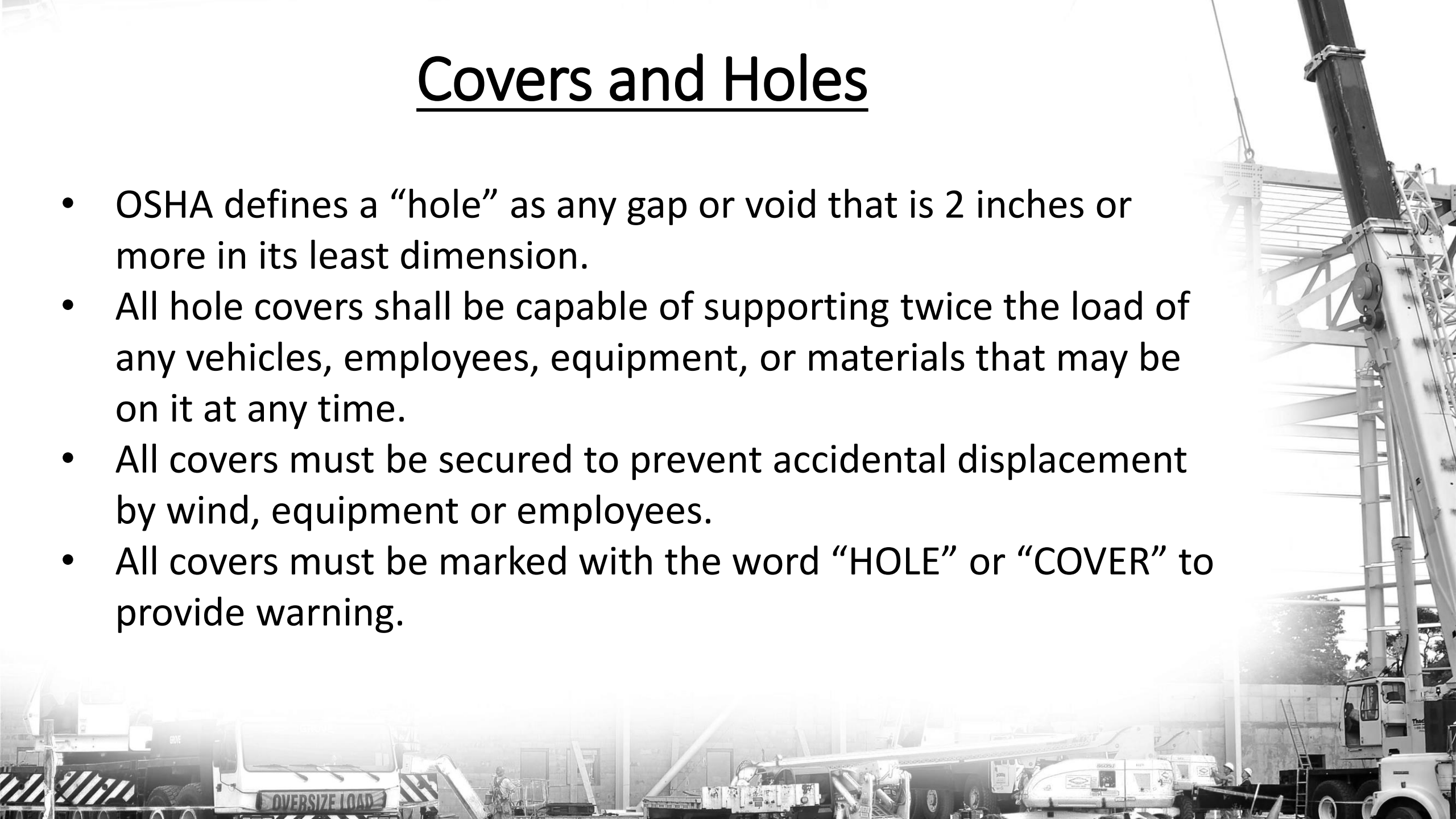
- Employees engaged in leading edge work may be protected by a Fall Protection Plan.
- The Plan must document why conventional systems are infeasible or create a greater hazard, and discuss all measures taken to reduce or eliminate fall hazards.
- The Fall Protection Plan must be implemented by a competent person, kept at the jobsite, and must identify specific areas where conventional methods cannot be used, and the employees authorized to work there. Those areas will be designated Controlled Access Zones.
- If no other Fall Protection methods are implemented, a Safety Monitoring System must be used.
- This is an extreme measure, and not typically used.



Covers and Holes

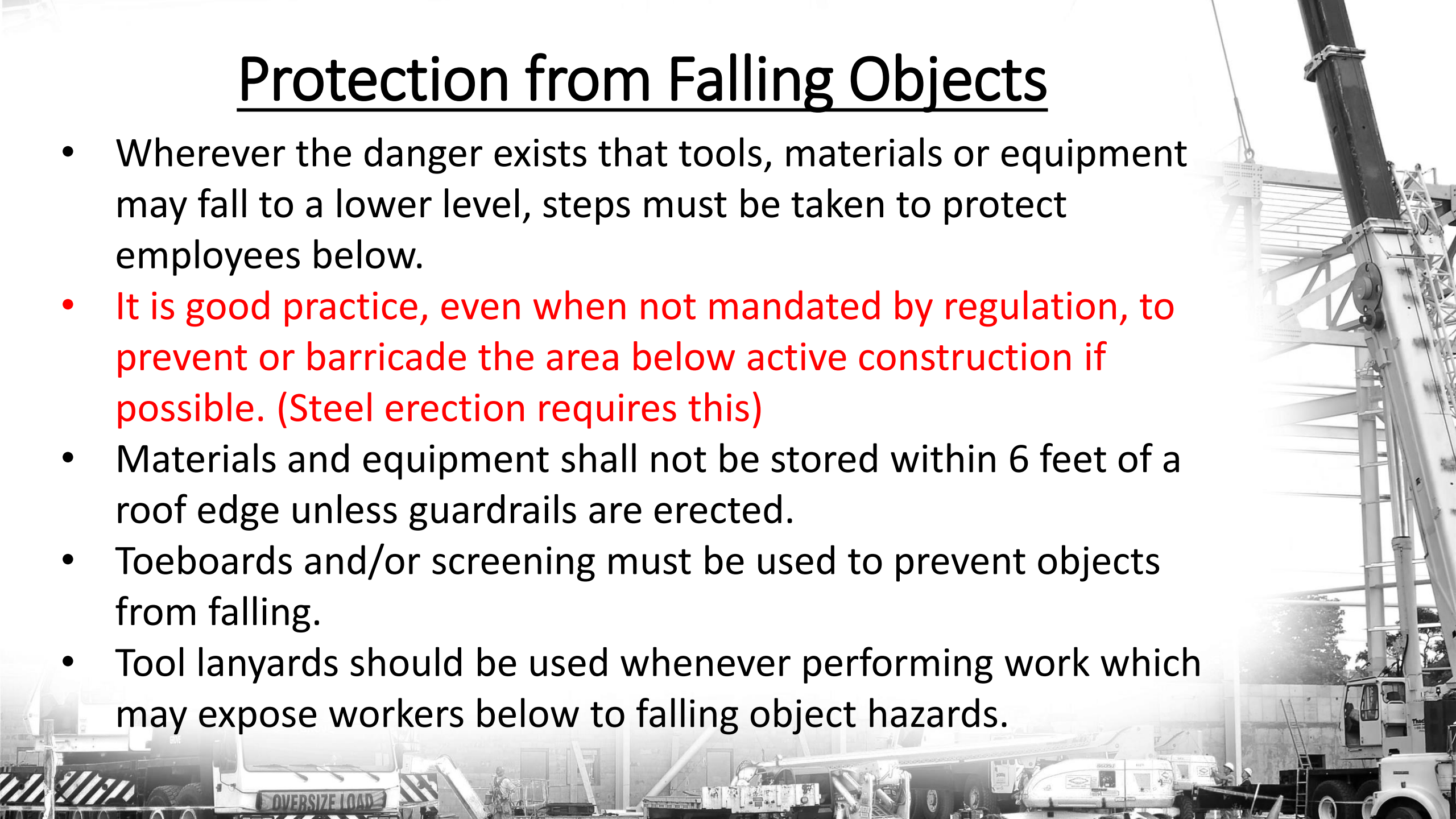
Covers and Holes

- OSHA defines a “hole” as any gap or void that is 2 inches or more in its least dimension.
- All hole covers shall be capable of supporting twice the load of any vehicles, employees, equipment, or materials that may be on it at any time.
- All covers must be secured to prevent accidental displacement by wind, equipment or employees.
- All covers must be marked with the word “HOLE” or “COVER” to provide warning.



Protection from Falling Objects

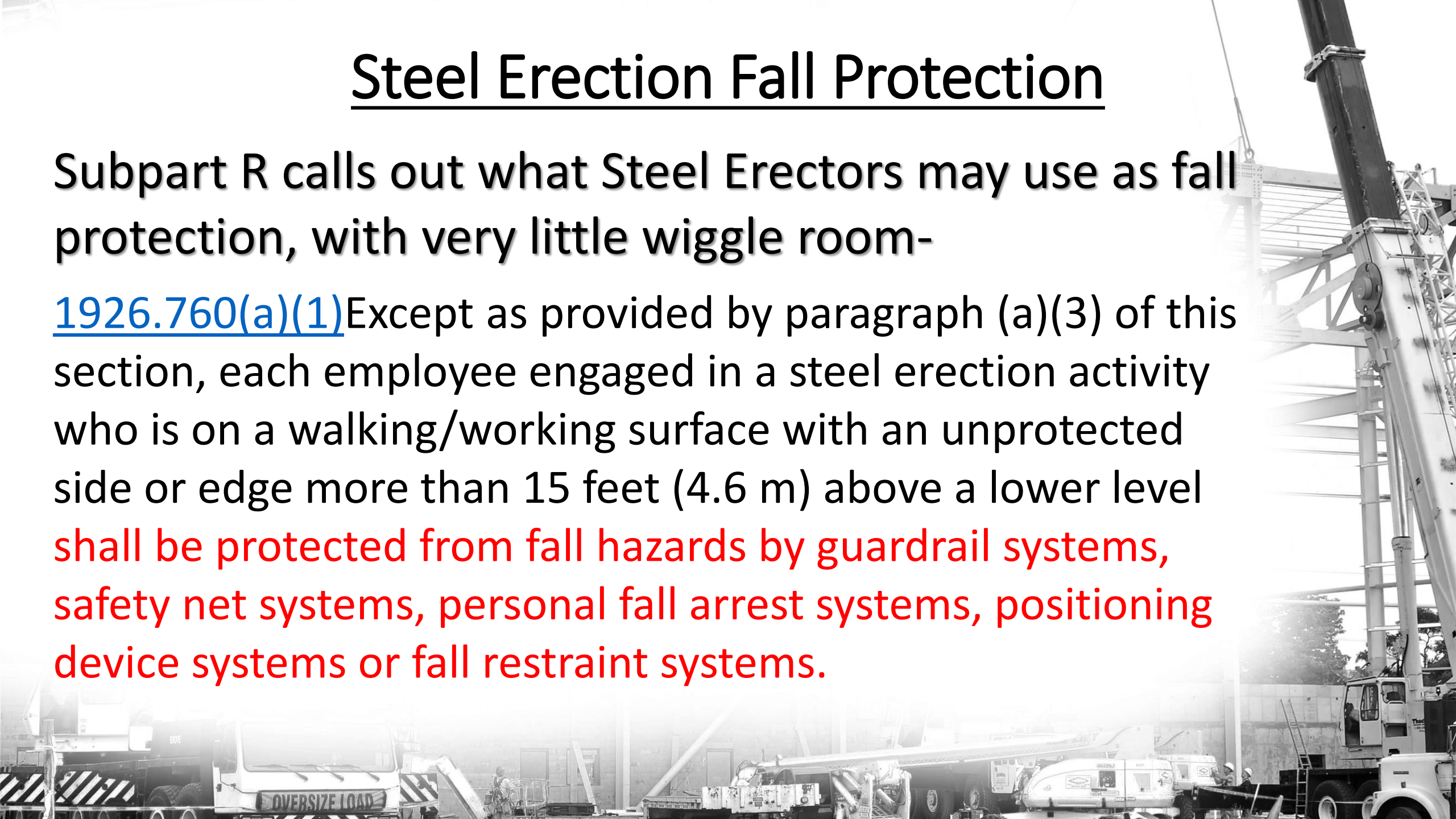
- Wherever the danger exists that tools, materials or equipment may fall to a lower level, steps must be taken to protect employees below.
- It is good practice, even when not mandated by regulation, to prevent or barricade the area below active construction if possible. (Steel erection requires this)
- Materials and equipment shall not be stored within 6 feet of a roof edge unless guardrails are erected.
- Toeboards and/or screening must be used to prevent objects from falling.
- Tool lanyards should be used whenever performing work which may expose workers below to falling object hazards.



Steel Erection Fall Protection

Subpart R calls out what Steel Erectors may use as fall protection, with very little wiggle room-

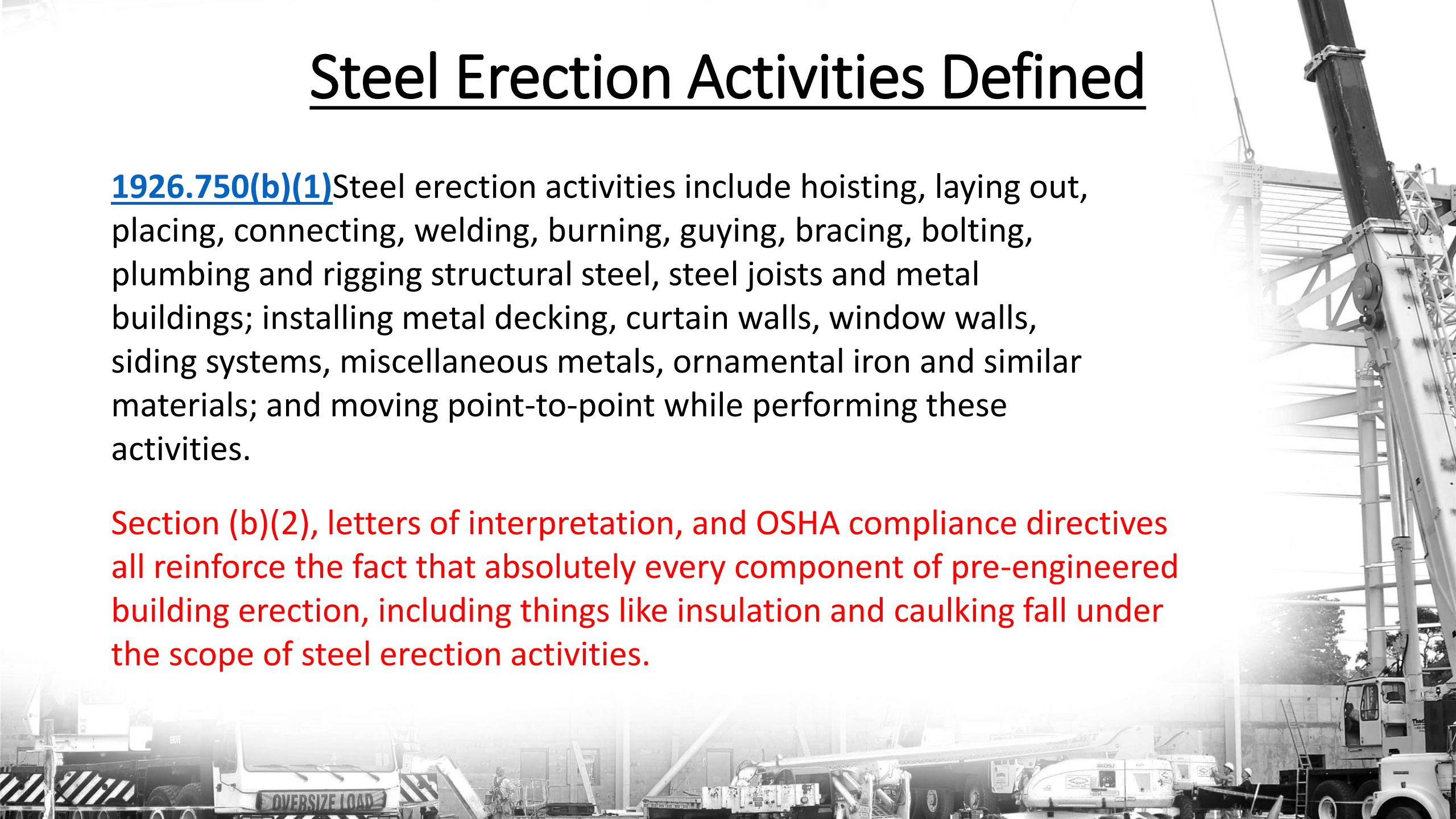
1926.760(a)(1)Except as provided by paragraph (a)(3) of this section, each employee engaged in a steel erection activity who is on a walking/working surface with an unprotected side or edge more than 15 feet (4.6 m) above a lower level shall be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.



Steel Erection Activities Defined

1926.750(b)(1)Steel erection activities include hoisting, laying out, placing, connecting, welding, burning, guying, bracing, bolting, plumbing and rigging structural steel, steel joists and metal buildings; installing metal decking, curtain walls, window walls, siding systems, miscellaneous metals, ornamental iron and similar materials; and moving point-to-point while performing these activities.

Section (b)(2), letters of interpretation, and OSHA compliance directives all reinforce the fact that absolutely every component of pre-engineered building erection, including things like insulation and caulking fall under the scope of steel erection activities.

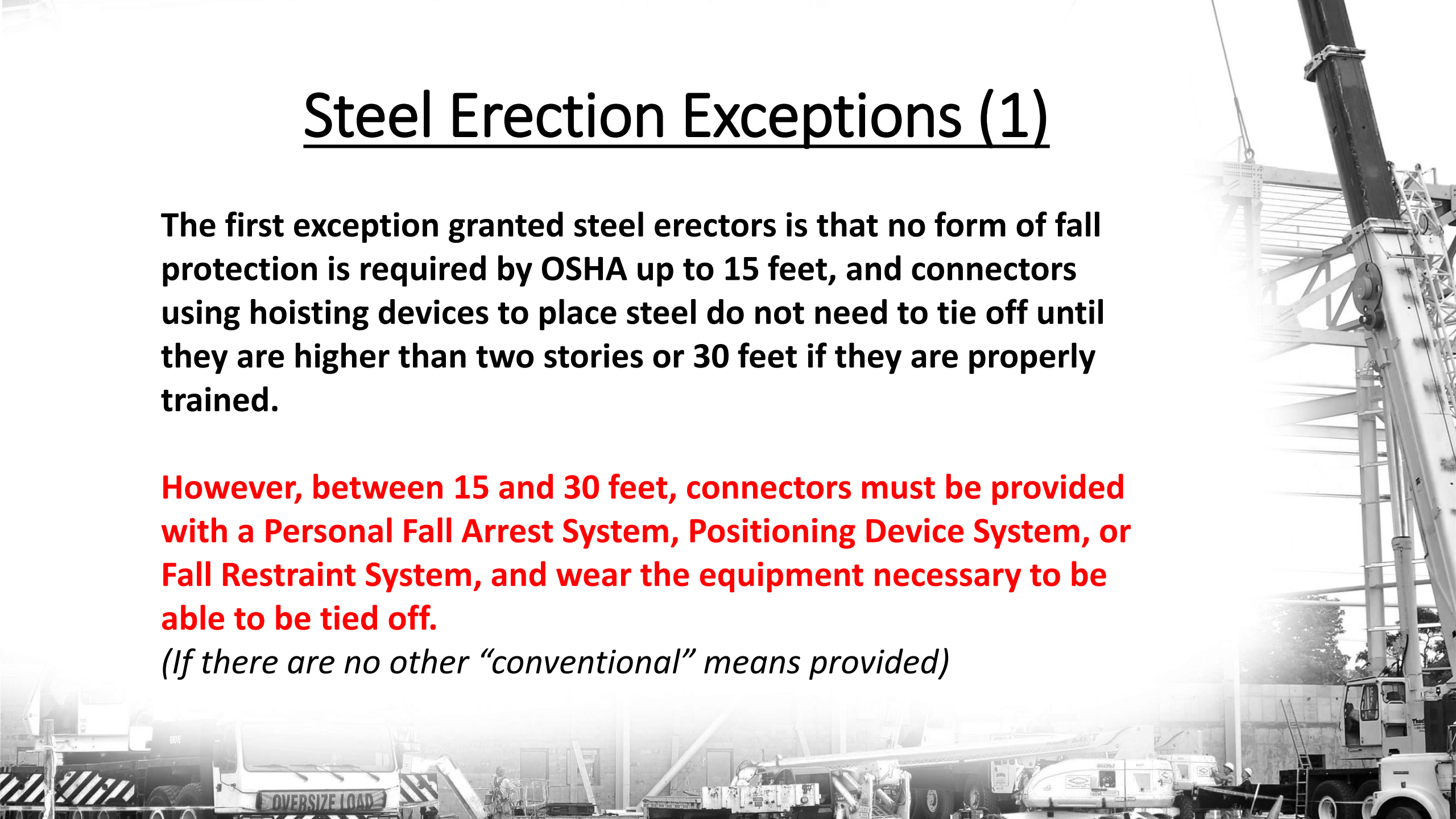


Steel Erection Exceptions (1)

The first exception granted steel erectors is that no form of fall protection is required by OSHA up to 15 feet, and connectors using hoisting devices to place steel do not need to tie off until they are higher than two stories or 30 feet if they are properly trained.

However, between 15 and 30 feet, connectors must be provided with a Personal Fall Arrest System, Positioning Device System, or Fall Restraint System, and wear the equipment necessary to be able to be tied off.

(If there are no other "conventional" means provided)

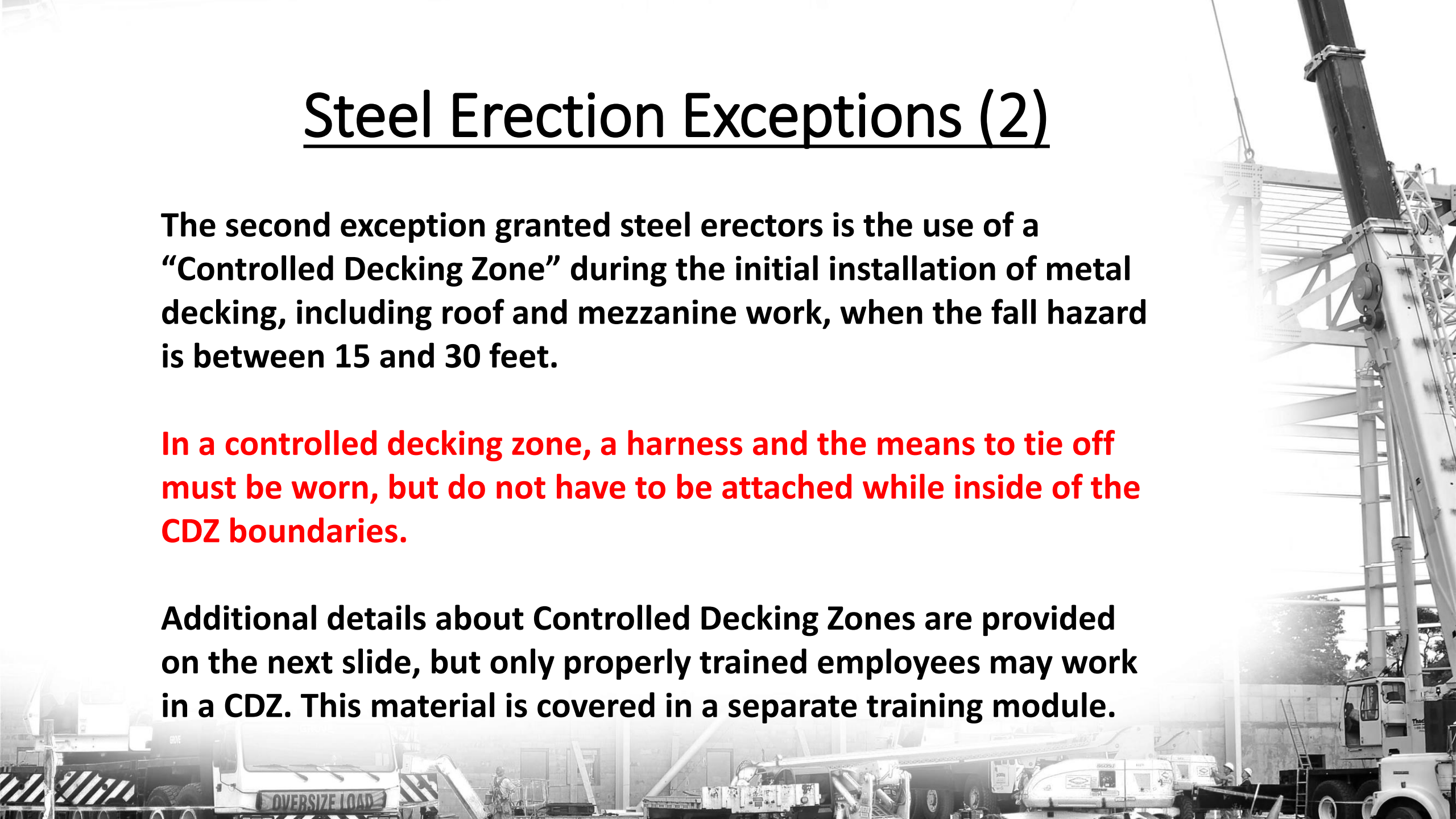


Steel Erection Exceptions (2)

The second exception granted steel erectors is the use of a "Controlled Decking Zone" during the initial installation of metal decking, including roof and mezzanine work, when the fall hazard is between 15 and 30 feet.

In a controlled decking zone, a harness and the means to tie off must be worn, but do not have to be attached while inside of the CDZ boundaries.

Additional details about Controlled Decking Zones are provided on the next slide, but only properly trained employees may work in a CDZ. This material is covered in a separate training module.



When is a Controlled Decking Zone Used?

- The main criteria for use of a Controlled Decking zone are:

1. The roof or deck is low-slope. (Less than 4/12 pitch)
2. The fall exposure from any unprotected side or leading edge is 2 stories or less, and between 15’ and 30’ from the ground or lower levels.
3. Only trained employees (CDZ-specific and other steel erection training) who are engaged in leading edge work are allowed in a CDZ.
4. A CDZ may only be used for the INITIAL decking panel installation. After this is completed, an alternate form of fall protection is required.
5. The CDZ should not be more than 90’ deep (from the leading edge) nor more than 90’ wide.
6. No more than 3000 ft^2 of unsecured decking may be laid out.
7. All panels should be attached with at least two safety connections per panel. This is typically the eave screws, but may also be the clips in a seamed roof.

CDZ Illustration

Related Fall Hazards

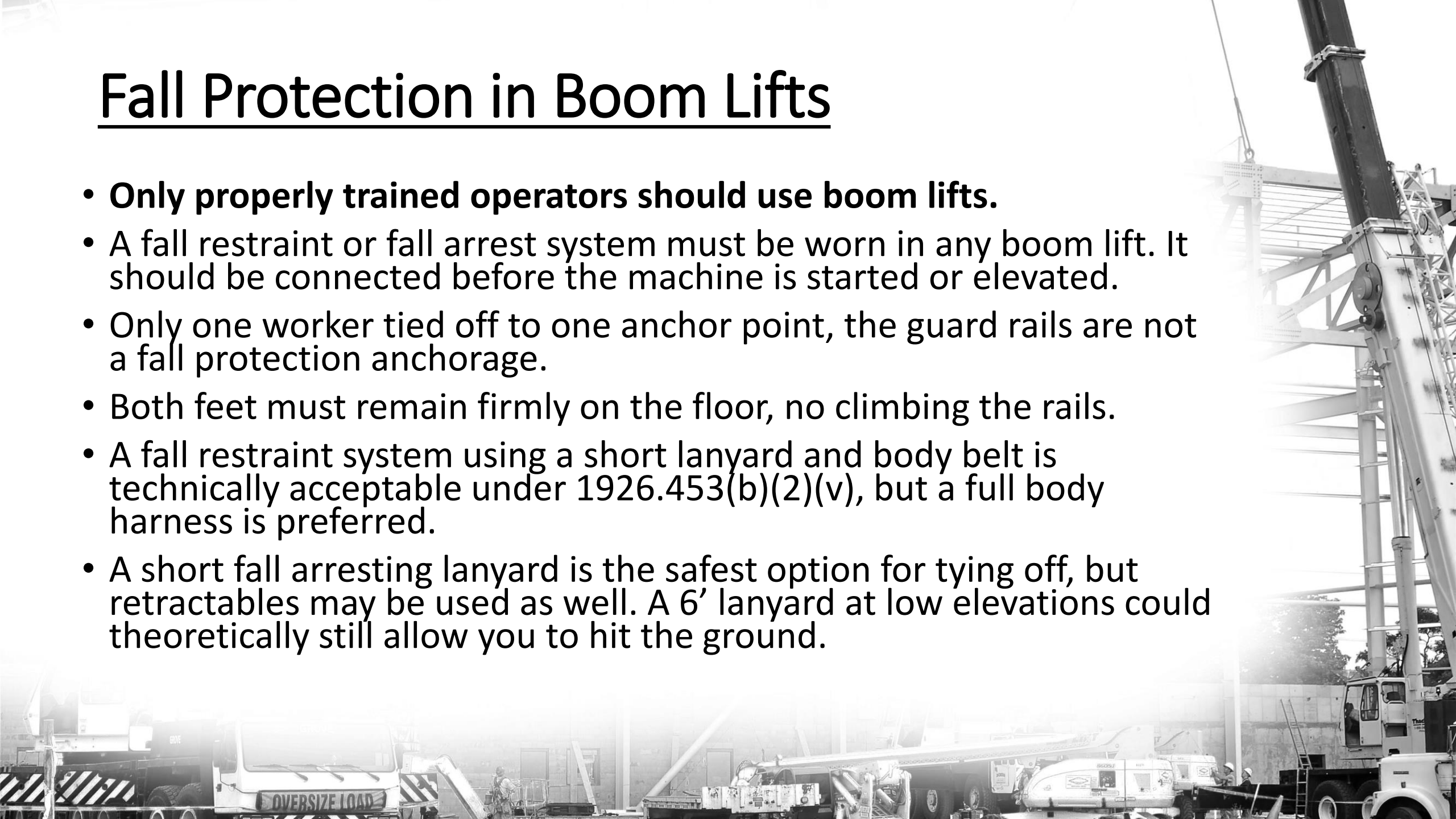
Boom Lifts

Scissor Lifts

Ladders

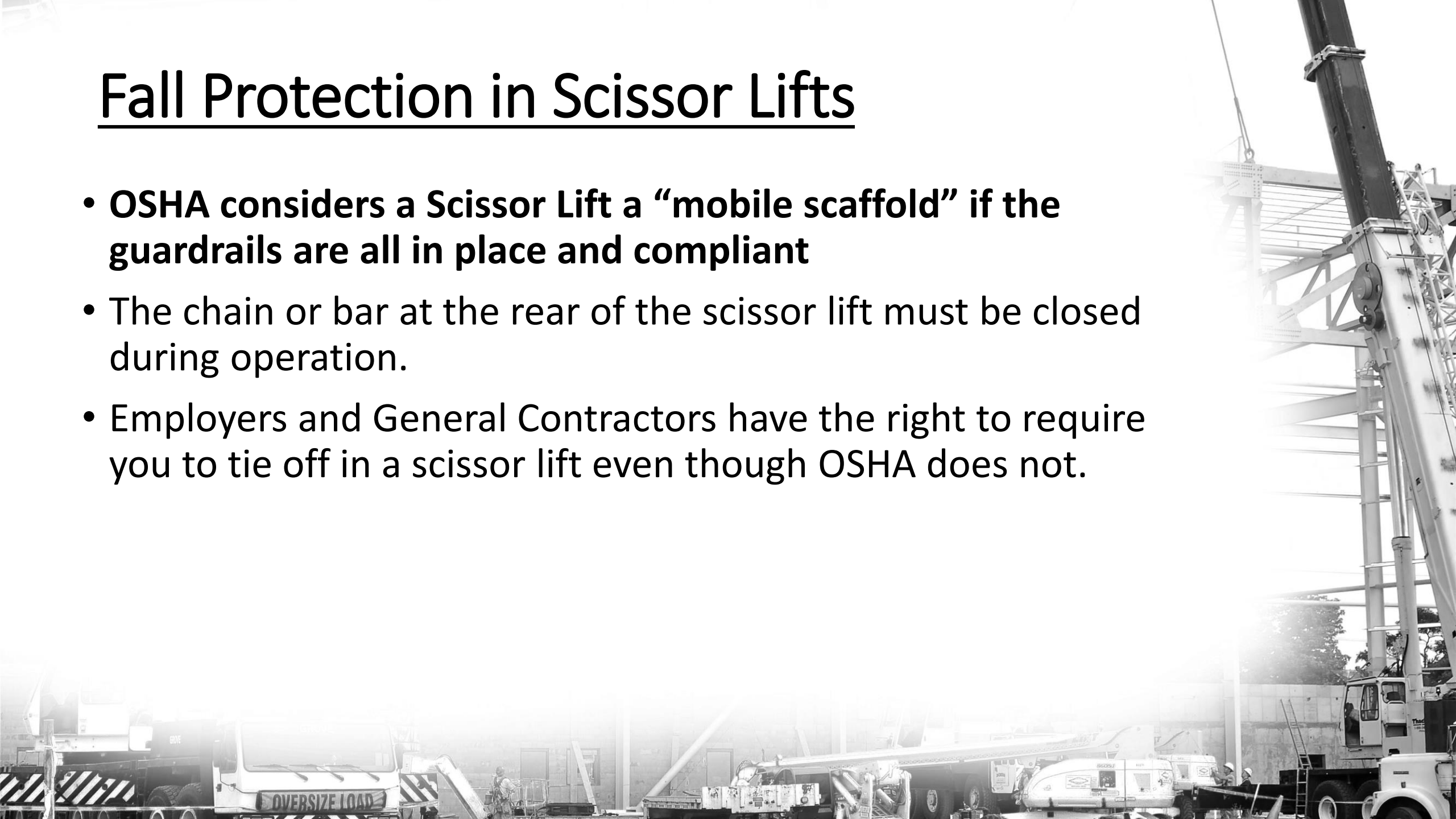
Fall Protection in Boom Lifts

- **Only properly trained operators should use boom lifts.**
- A fall restraint or fall arrest system must be worn in any boom lift. It should be connected before the machine is started or elevated.
- Only one worker tied off to one anchor point, the guard rails are not a fall protection anchorage.
- Both feet must remain firmly on the floor, no climbing the rails.
- A fall restraint system using a short lanyard and body belt is technically acceptable under 1926.453(b)(2)(v), but a full body harness is preferred.
- A short fall arresting lanyard is the safest option for tying off, but retractables may be used as well. A 6’ lanyard at low elevations could theoretically still allow you to hit the ground.



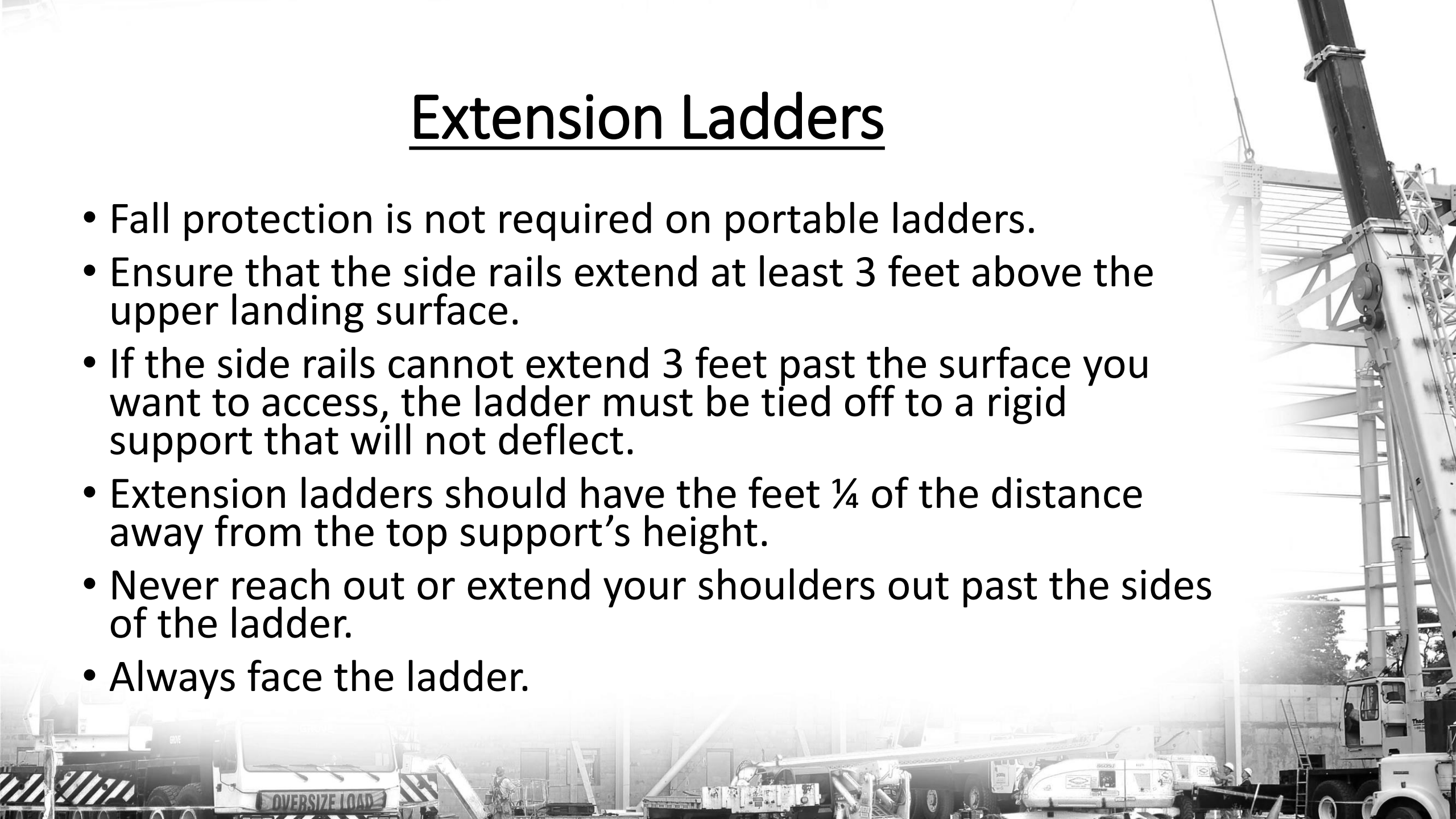
Fall Protection in Scissor Lifts

- **OSHA considers a Scissor Lift a “mobile scaffold” if the guardrails are all in place and compliant**
- The chain or bar at the rear of the scissor lift must be closed during operation.
- Employers and General Contractors have the right to require you to tie off in a scissor lift even though OSHA does not.



Extension Ladders

- Fall protection is not required on portable ladders.
- Ensure that the side rails extend at least 3 feet above the upper landing surface.
- If the side rails cannot extend 3 feet past the surface you want to access, the ladder must be tied off to a rigid support that will not deflect.
- Extension ladders should have the feet ¼ of the distance away from the top support's height.
- Never reach out or extend your shoulders out past the sides of the ladder.
- Always face the ladder.



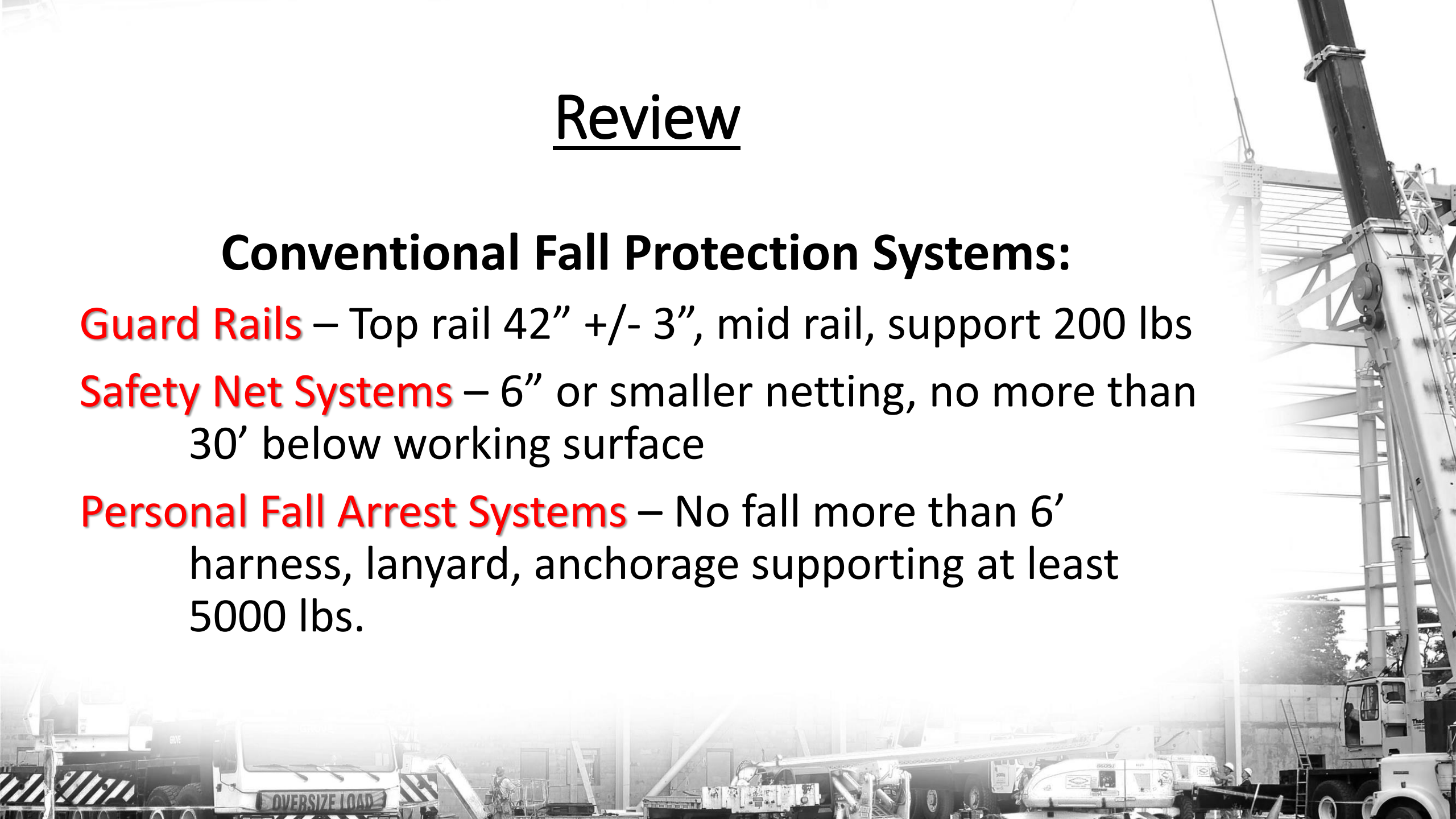
Review

Conventional Fall Protection Systems:

Guard Rails – Top rail 42” +/- 3”, mid rail, support 200 lbs

Safety Net Systems – 6” or smaller netting, no more than 30’ below working surface

Personal Fall Arrest Systems – No fall more than 6’ harness, lanyard, anchorage supporting at least 5000 lbs.



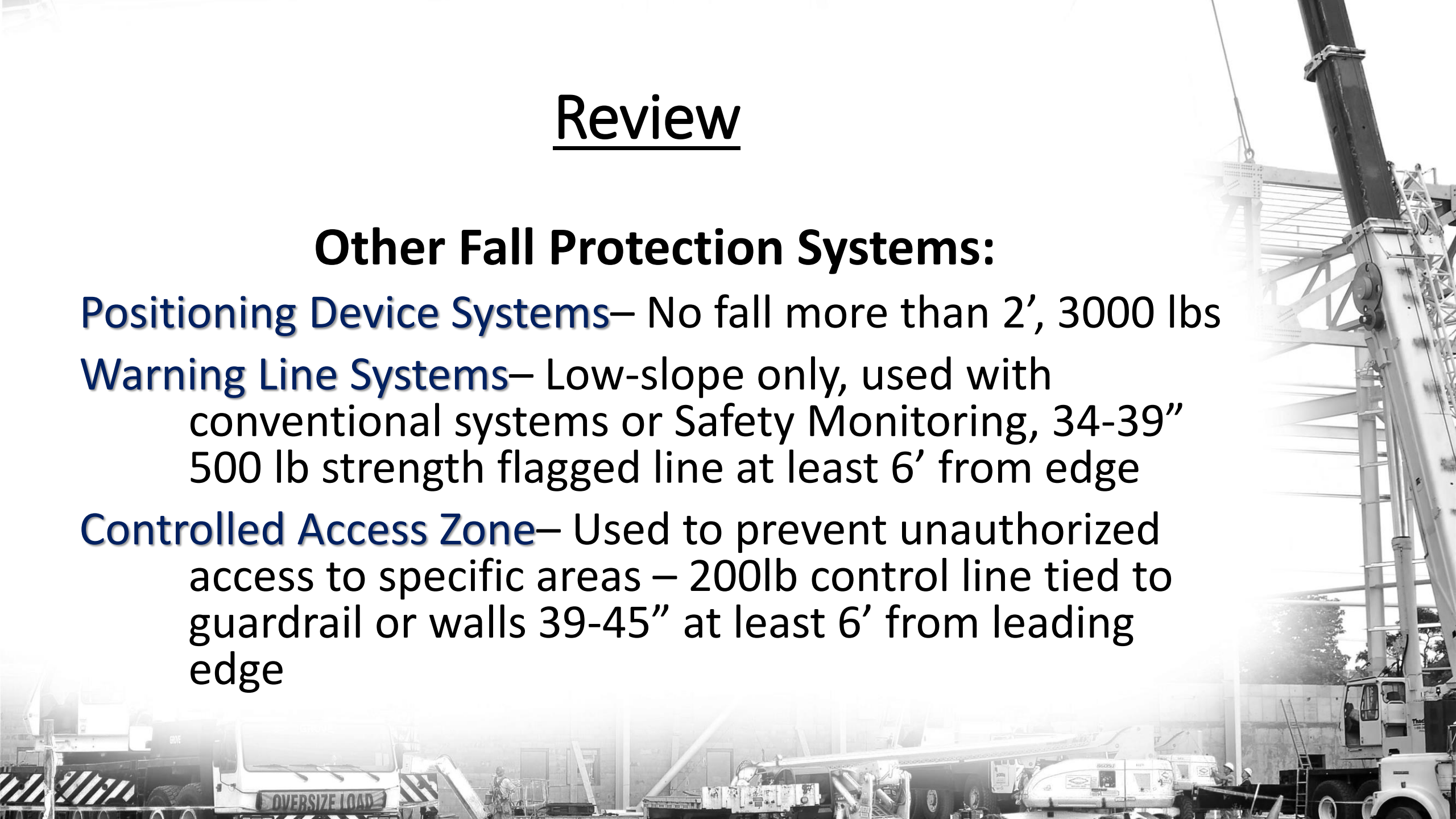
Review

Other Fall Protection Systems:

Positioning Device Systems– No fall more than 2’, 3000 lbs

Warning Line Systems– Low-slope only, used with conventional systems or Safety Monitoring, 34-39” 500 lb strength flagged line at least 6’ from edge

Controlled Access Zone– Used to prevent unauthorized access to specific areas – 200lb control line tied to guardrail or walls 39-45” at least 6’ from leading edge



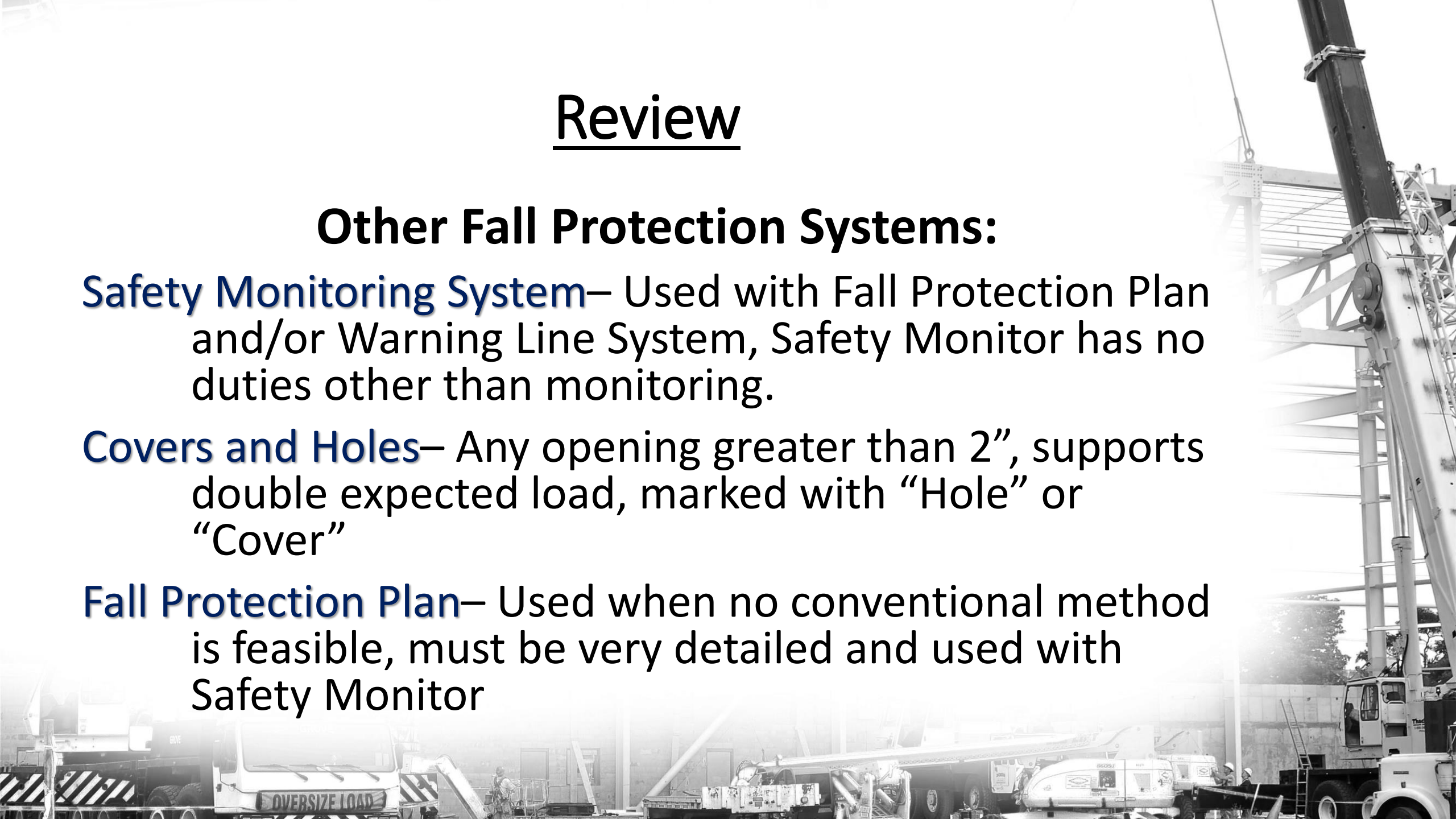
Review

Other Fall Protection Systems:

Safety Monitoring System– Used with Fall Protection Plan and/or Warning Line System, Safety Monitor has no duties other than monitoring.

Covers and Holes– Any opening greater than 2”, supports double expected load, marked with “Hole” or “Cover”

Fall Protection Plan– Used when no conventional method is feasible, must be very detailed and used with Safety Monitor

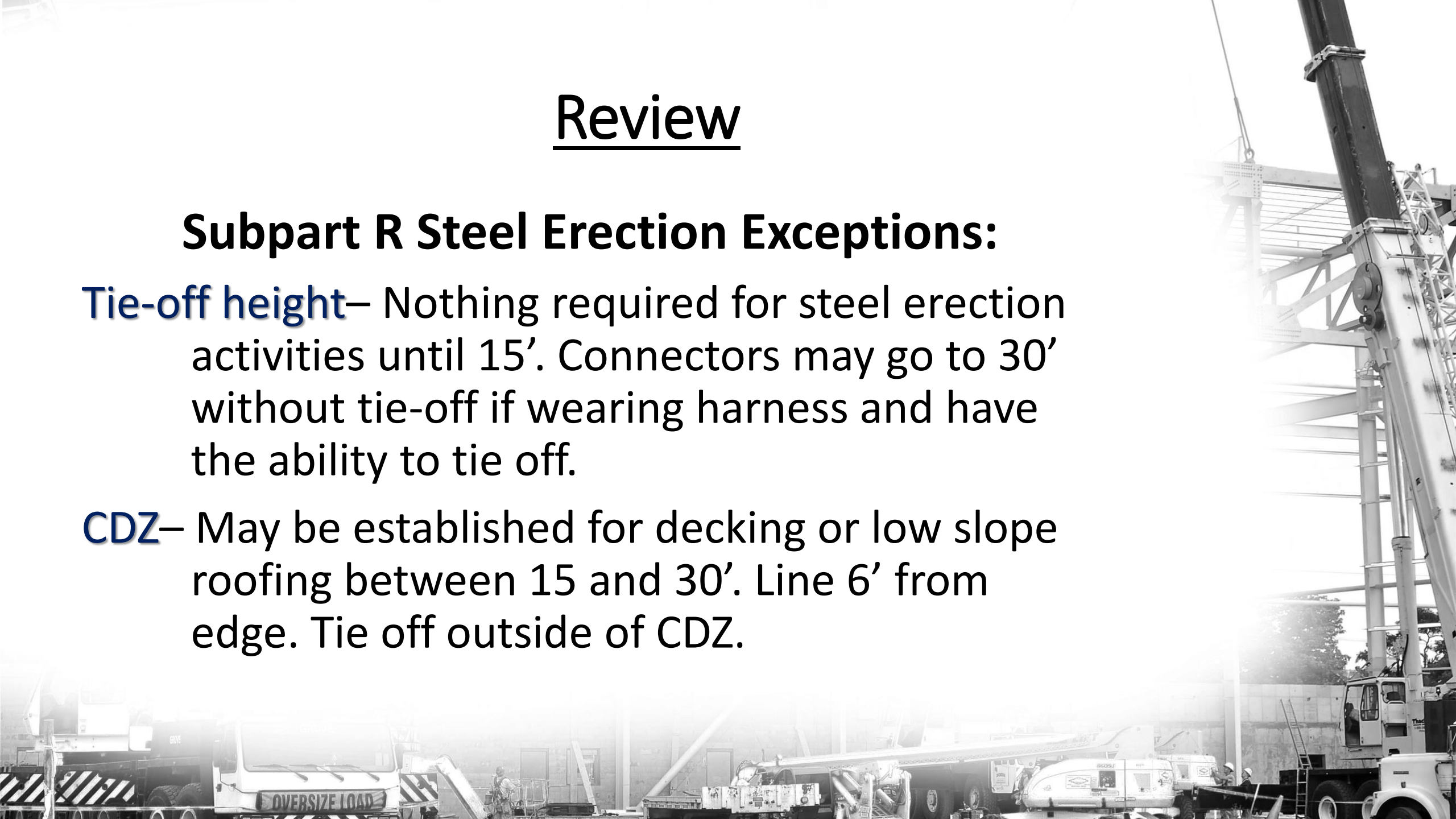


Review

Subpart R Steel Erection Exceptions:

Tie-off height– Nothing required for steel erection activities until 15’. Connectors may go to 30’ without tie-off if wearing harness and have the ability to tie off.

CDZ– May be established for decking or low slope roofing between 15 and 30’. Line 6’ from edge. Tie off outside of CDZ.



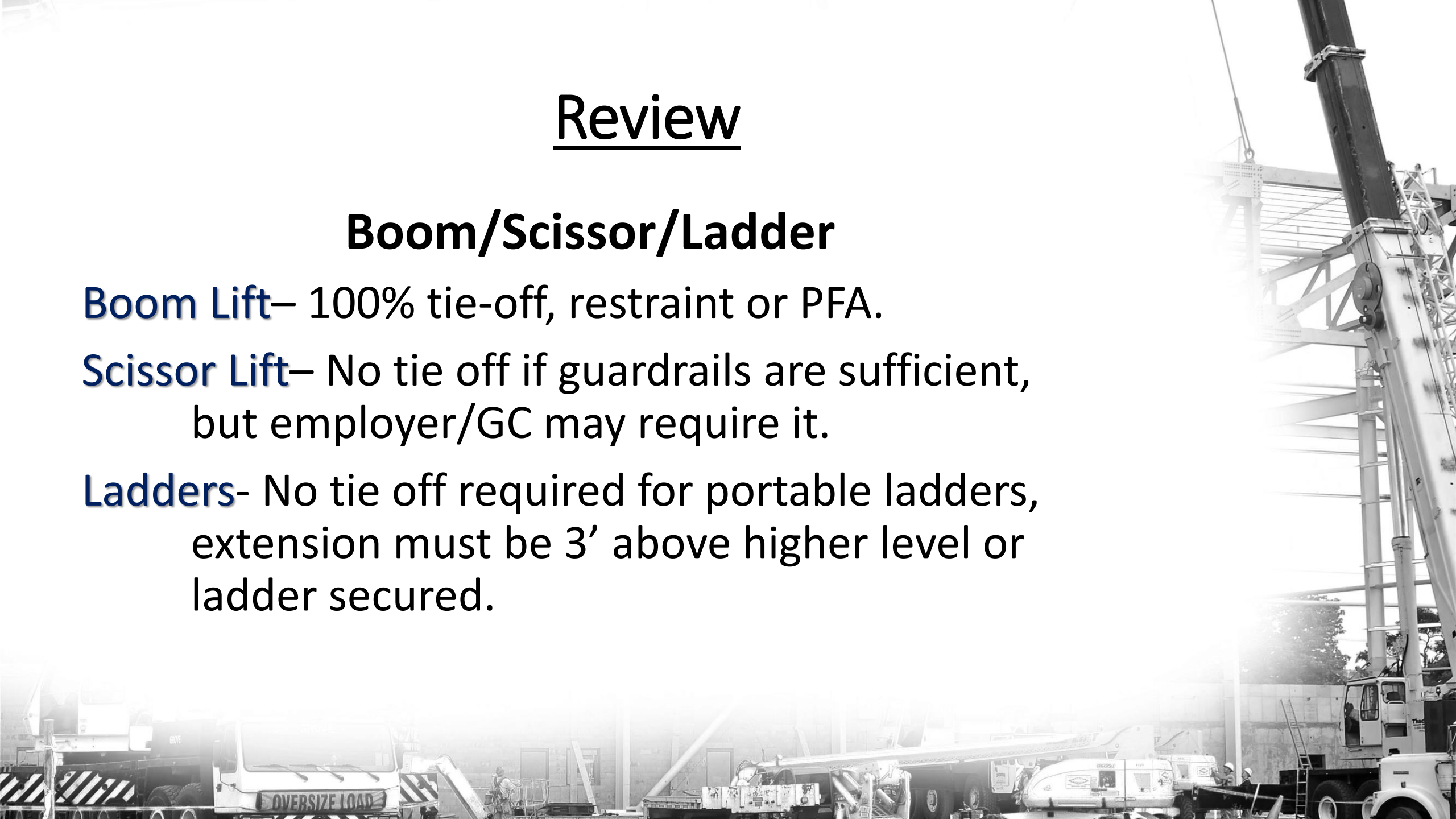
Review

Boom/Scissor/Ladder

Boom Lift– 100% tie-off, restraint or PFA.

Scissor Lift– No tie off if guardrails are sufficient, but employer/GC may require it.

Ladders- No tie off required for portable ladders, extension must be 3’ above higher level or ladder secured.



Questions/Discussion

METAL BUILDINGS INSTITUTE™

Training Module:

FALL PROTECTION BASICS

Subpart R 1926.761(b), Subpart M 1926.503(a)(1)

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