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OSHA/ANSI Fall Protection Standards

Including the Latest Updates

The Pinnacle of Structural Engineering

Innovative Engineering Inc.

Learning Objectives

- **Fall Protection**
 - Why
 - OSHA Regulations
 - ANSI Standards
 - System Requirements

AIA
Continuing
Education
Provider

- **Scott L. Weiland PE**
 - BSCE University of Michigan
 - **Graduate Studies:**
 - San Jose State University
 - Georgia Institute of Technology
 - **Articles:**
 - Structure Magazine – Building Façade Inspection Part I & II
 - Georgia Engineer – Building façade Inspection Part I & II
 - AIA Design Equilibrium – Building Façade Inspection
 - BOMA Georgia Insight magazine - Falling Building Façade Closes Atlanta Streets



- **James T. Boatright PE**
 - **BSCE, Virginia Military Institute**
 - **Professional Engineer (PE)**
 - **OSHA Fall Protection**
 - **Qualified Person**
 - **Competent Person Trainer**
 - **ICRI Board Member**



Lunch Atop a Skyscraper



1932



2011

OSHA – Employer Requirements



- **Worker Rights to:**
 - **Safe and healthful workplace**
 - Know about hazardous chemicals
 - Information about injuries and illnesses in your workplace
 - Complain or request hazard correction from employer
 - Training
 - Hazard exposure and medical records
 - File a complaint with OSHA
 - Participate in an OSHA inspection
 - **Be free from retaliation** for exercising safety and health rights

OSHA Standards



OSHA 1910 – General Industry



OSHA 1926 – Construction

Worker Coverage



- **Who is covered?**

- Private Workers
- State & Local Government Workers Covered by Approved State Plan
- Federal Workers Covered by a Federal Agency program

- **Who is not?**

- **State & Local Government Workers**
- Self-Employed
- Immediate Family Members of Farm Employers
- Workplace Hazards Regulated by Another Federal Agency

2017 OSHA Update

• Updates

- Fall Protection Options
- Align with 29 CFR Part 1926 Construction
- Ladders
- Rope Descent Systems (RDS)
- Scaffolding
- Connection Equipment
- Falling Objects
- Outdoor Advertising/Billboards
- Low Slope Roofs
- Training & Retraining

• Timeline

- **January 17th, 2017** – New rules become effective.
- **May 17th, 2017** – Fall Hazard Training
- **November 20th, 2017** – Rope Descent System (RDS) anchors inspected & certified
- **November 19th, 2018**
 - New Ladders >24 ft Personal Fall Arrest or Ladder Safety System
 - Existing Ladders > 24 ft Cage, Well, Personal Fall Arrest or Ladder Safety System
- **November 18th, 2036** All ladders > 24 ft Personal Fall Arrest or Ladder safety System

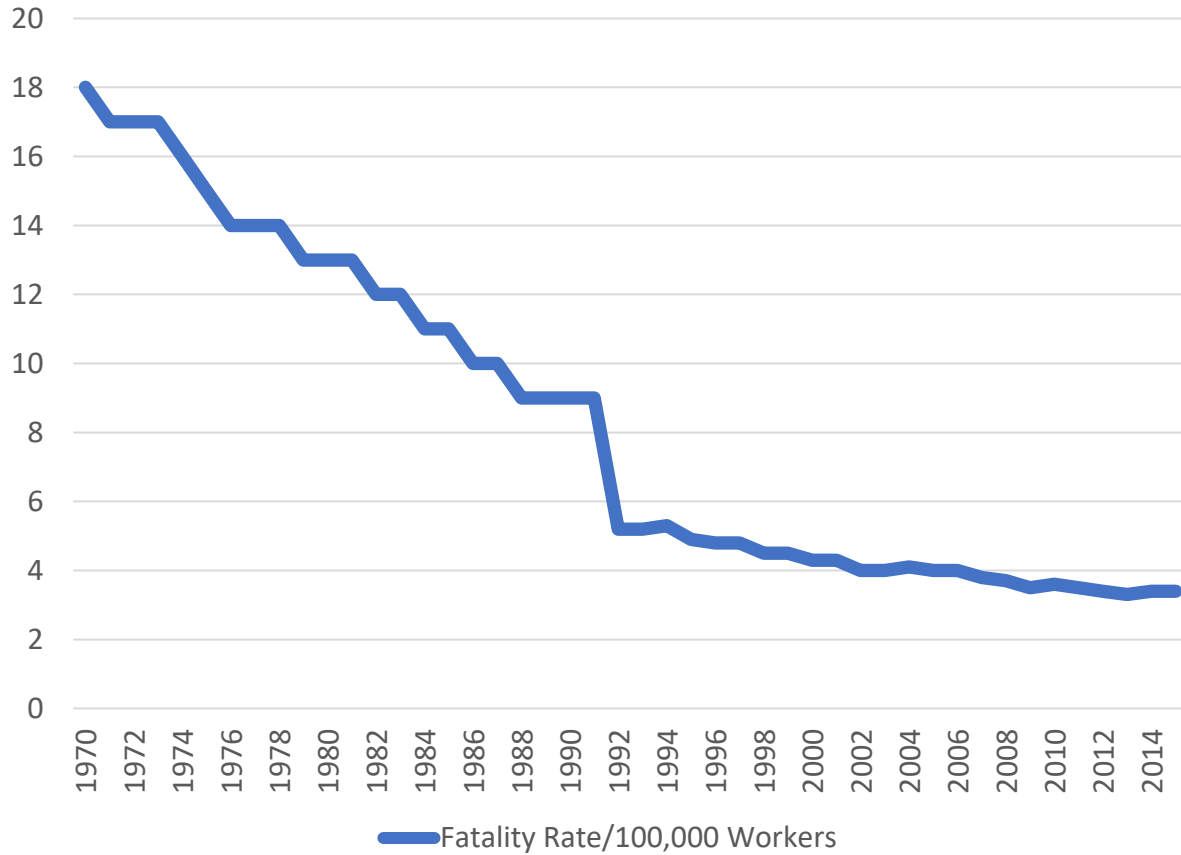
Other Standards

- **IBC**
 - Design load
 - Test Load & Duration
- **ANSI/ASSE Z359 Fall Protection Standards (Voluntary)**
- **IWCA I14.1 Window Cleaning Safety (Withdrawn)**
- **ASME A120.1 Safety Requirements for Powered Platforms and Traveling Ladders and Gantries for Building Maintenance**

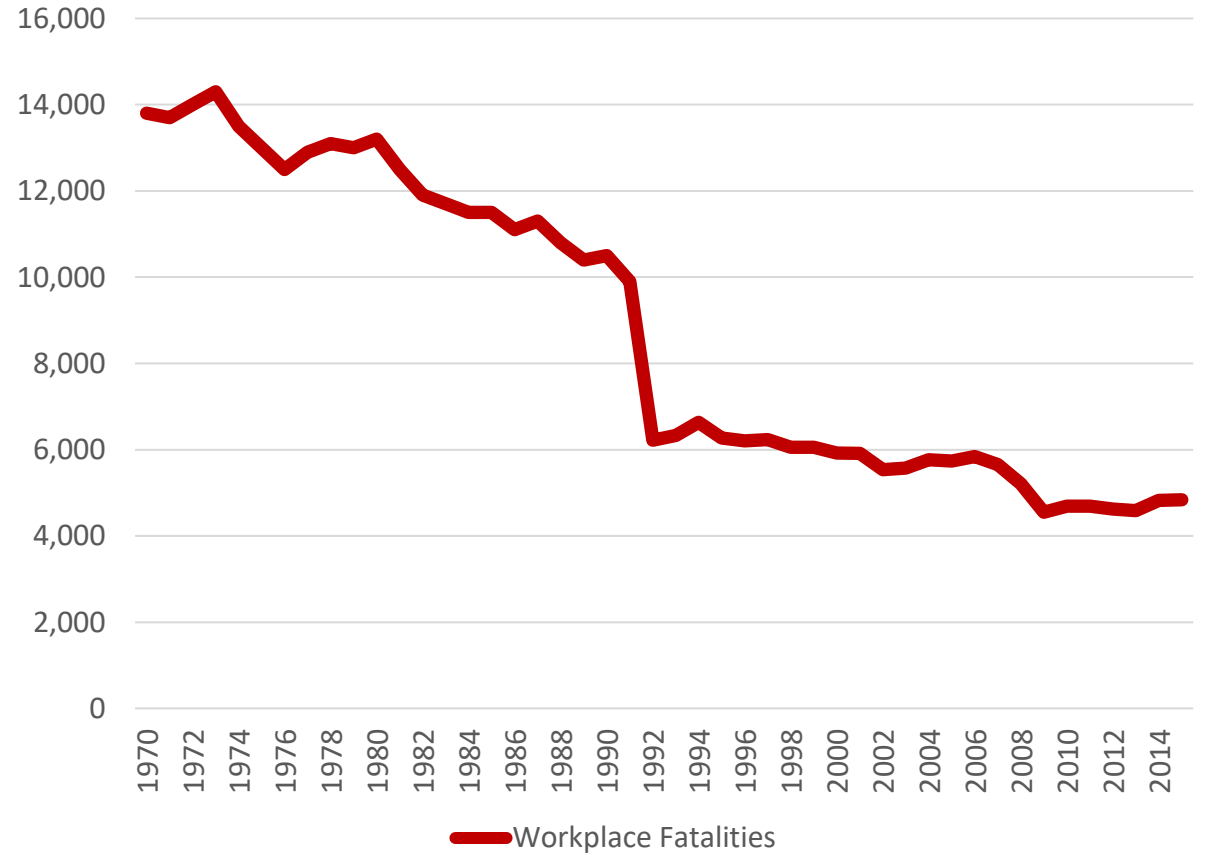


Worker Fatality Statistics

Fatality Rate/100,000 Workers

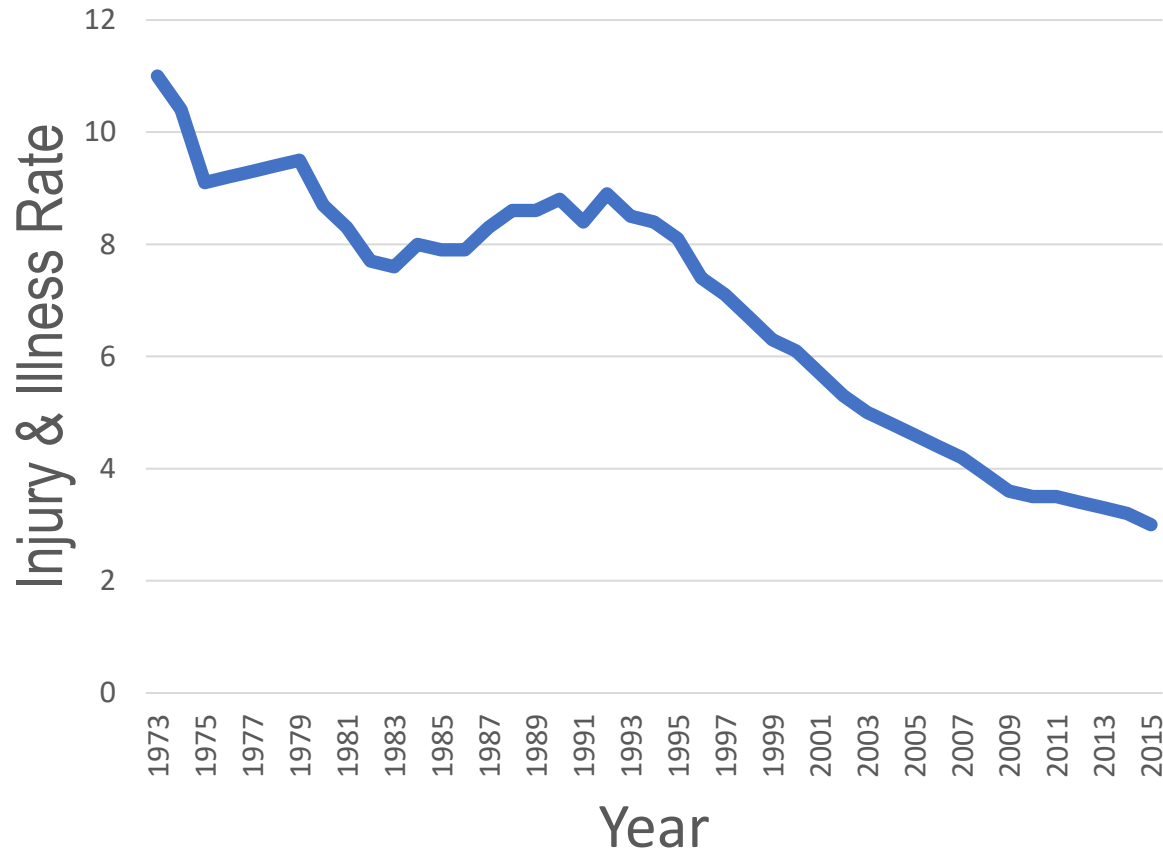


Workplace Fatalities

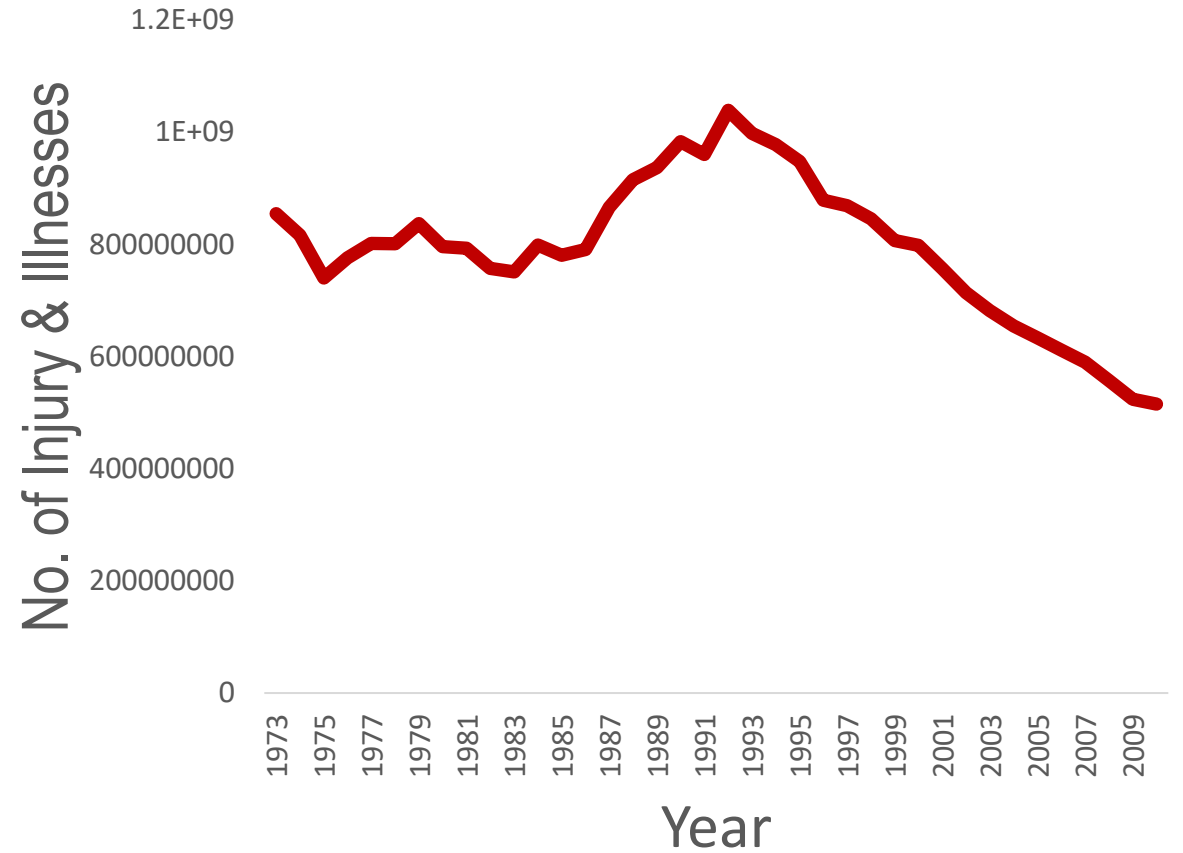


Workplace Injury & Illness Statistics

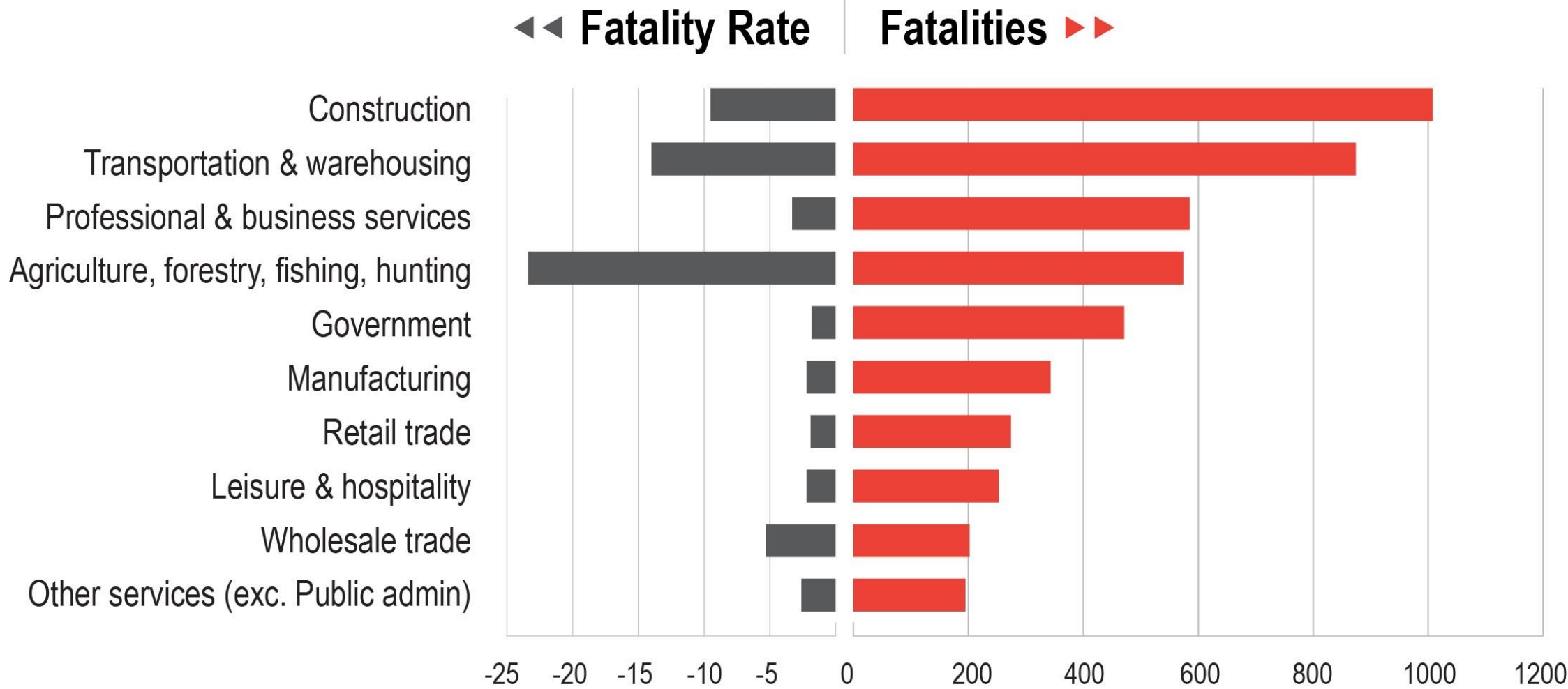
Injury & Illness Rate/100 Workers



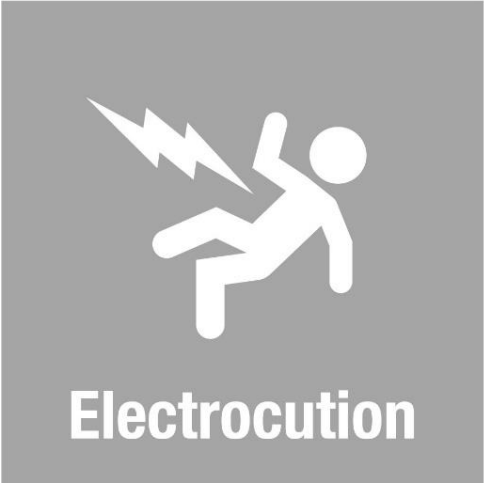
Injury & Illness Cases



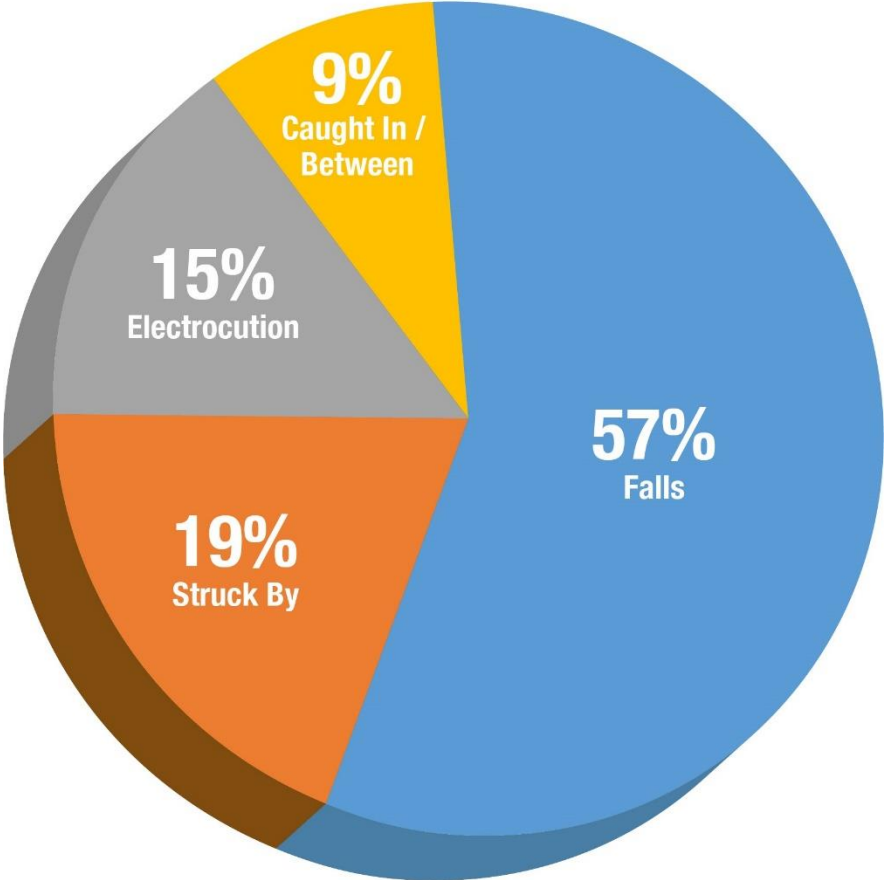
2018 Fatal Work Injuries by Industry Sector



Construction Fatal Four



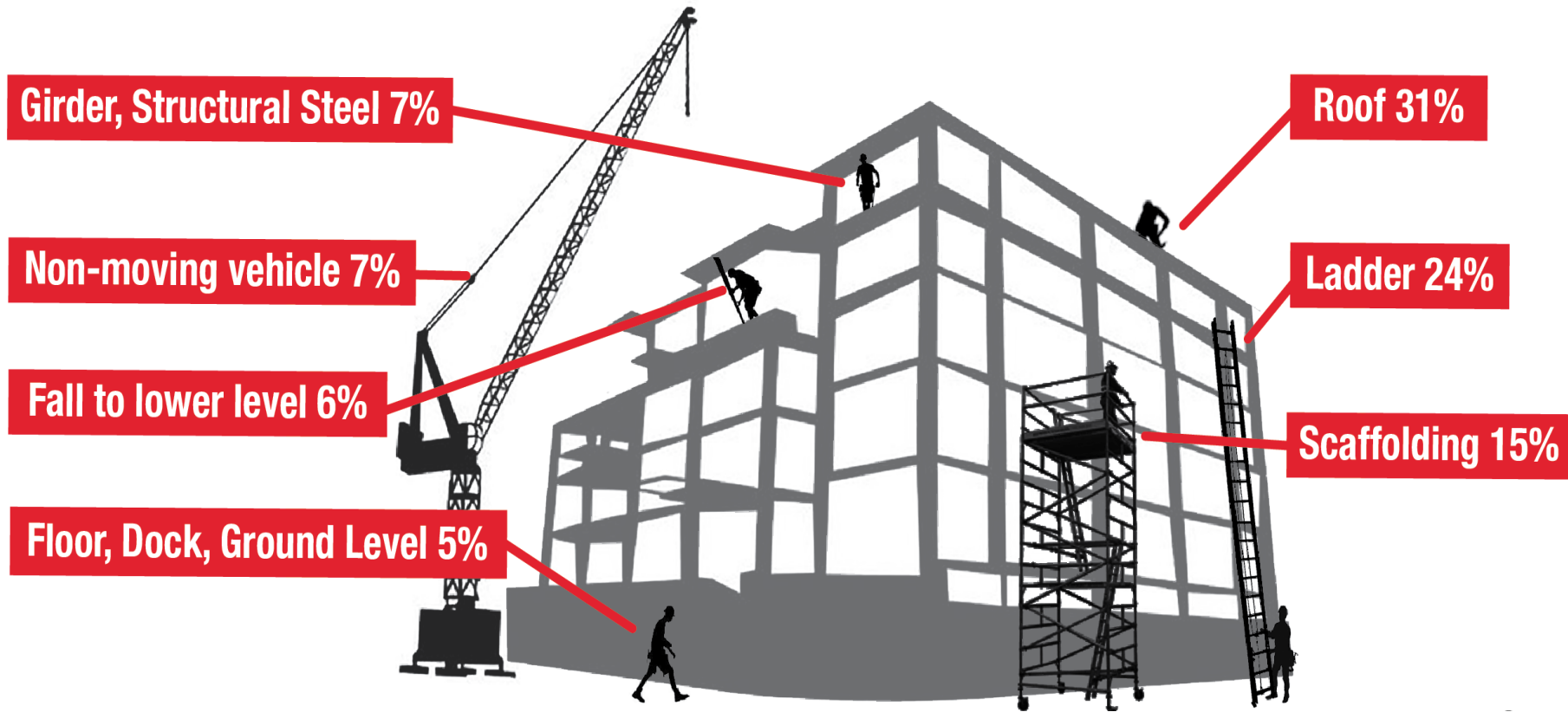
Fatalities



Death from Falls

DEATH FROM FALLS (BY LOCATION)

Total = 891 deaths (2008-2010)



Managed Fall Protection Program

- Policy
- Program
 - Responsibilities
 - Training
 - Hazard Survey
 - Hazard Elimination & Control
 - Rescue
 - Incident Investigation
 - Program Evaluation



Policy Makers

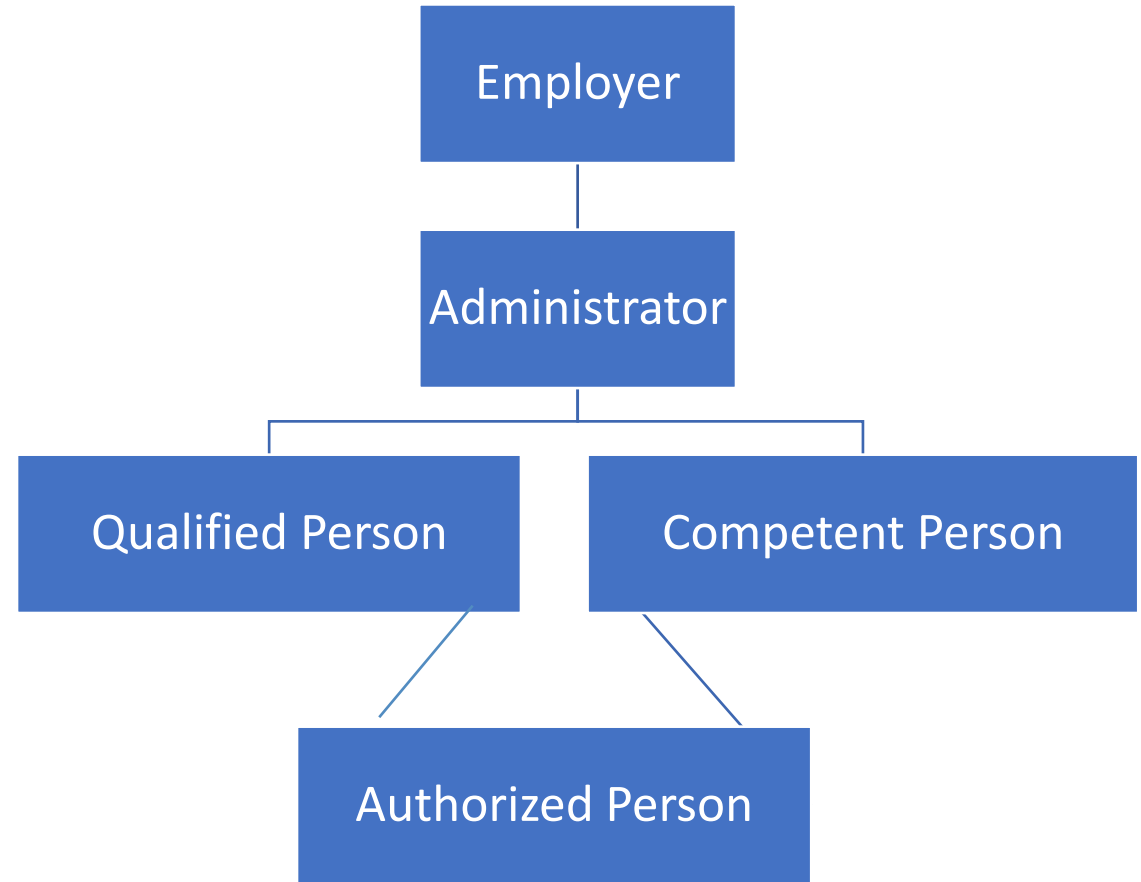
Responsibilities - Owner

- Hazards to own employees
- Hazards to other employees not created by tenant or contractor
- Disclosure of known hazards
 - Lead
 - Asbestos
 - Mold
- Permanent fall protection & davits
- Architect/Engineer – Safe Design



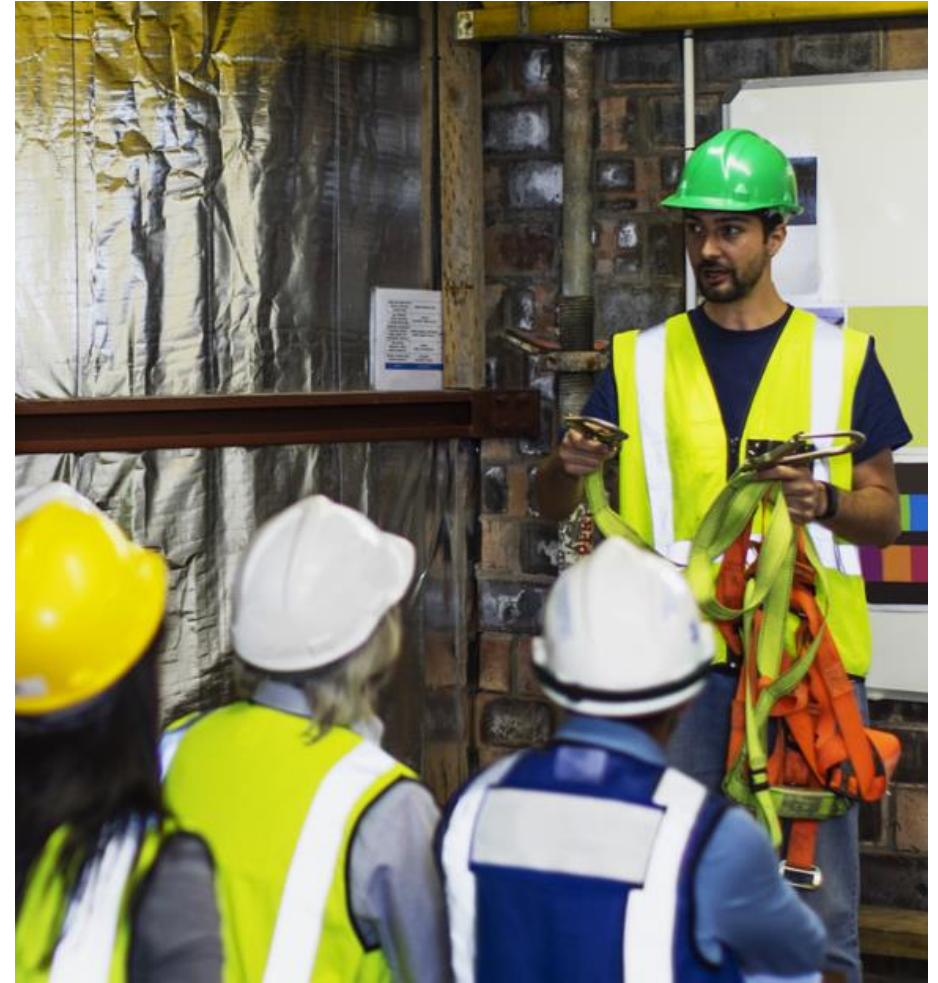
Responsibilities

- **Employer**
- **Program Administrator**
- **Qualified Person**
- **Competent Person**
- **Authorized Person**
- **Competent Rescuer**
- **Authorized Rescuer**
- **Trainer**



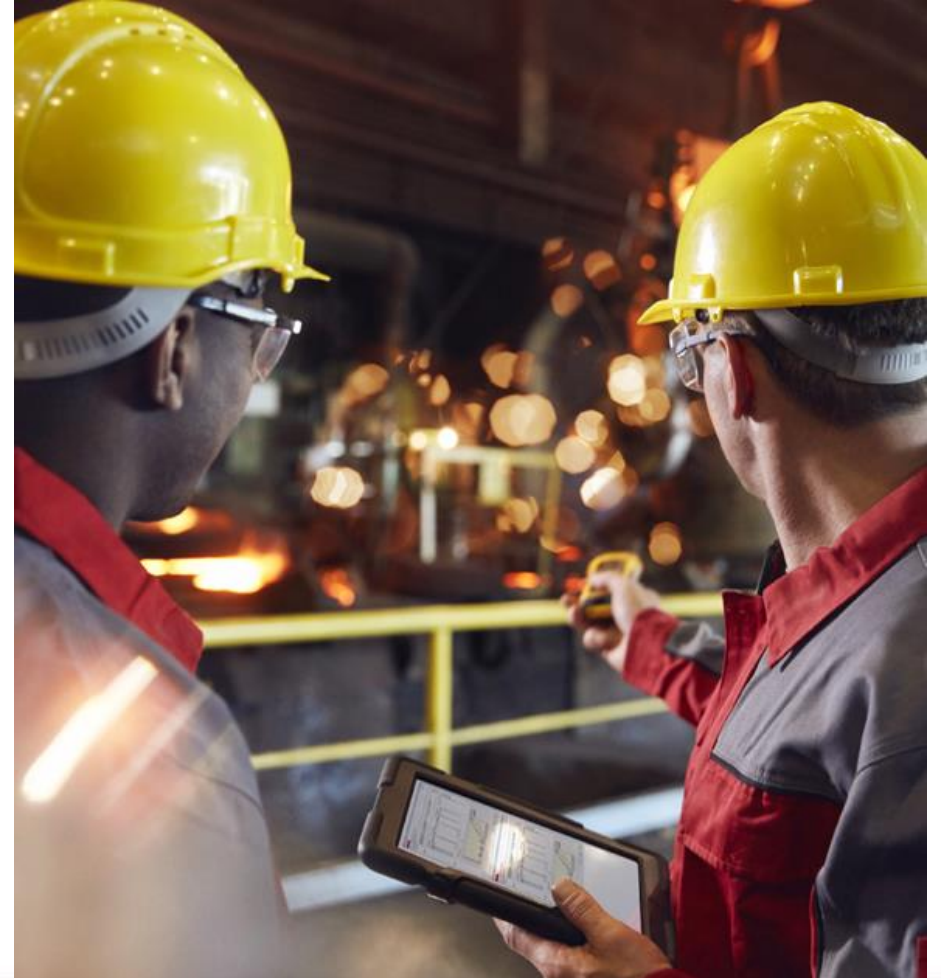
Training

- Nature of Fall Hazards
- Fall Protection Options
- Procedures for installing, inspecting, using, disassembling, storing, and maintaining equipment.
- Limitations and Capabilities of Equipment.
- Employees Role
- Retraining



Fall Hazard Survey

- **Unprotected**
 - Sides or Edges
 - Floor or Roof Openings
 - Wall Openings
- **Triggers**
- **100% Coverage**
- **Fall Clearance**
 - Vertical
 - Swing

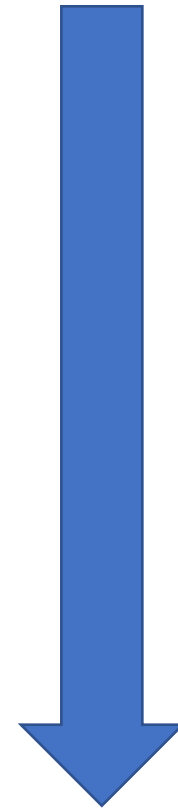
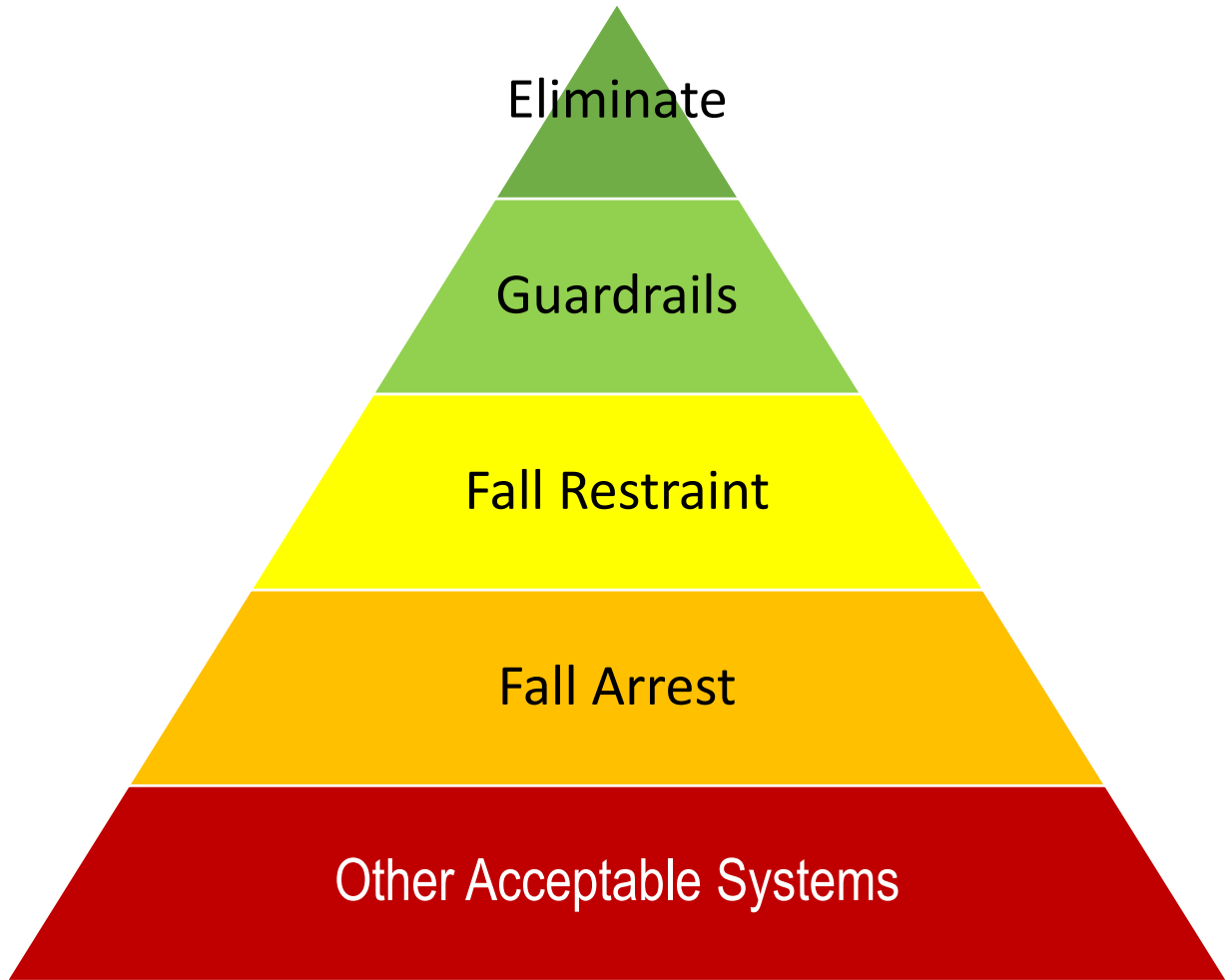


Hazard Analysis - Fall Protection Triggers

Walking/Working Surface	General Industry	Construction
Aerial Lifts	All	All
Dangerous Equipment	All	All
Fixed Ladders	24 ft.	24 ft.
Holes (Including Skylights)	All	All
Scaffolds (Supported or Suspended)	10 ft.	10 ft.
Steel Erection (General)	n/a	15 ft.
Steel Erection (Connectors, Controlled Decking Zone)	n/a	2 Stories or 30 ft.
Unprotected Edge	4 ft.	6 ft.
Wall Opening	4 ft.	6 ft.

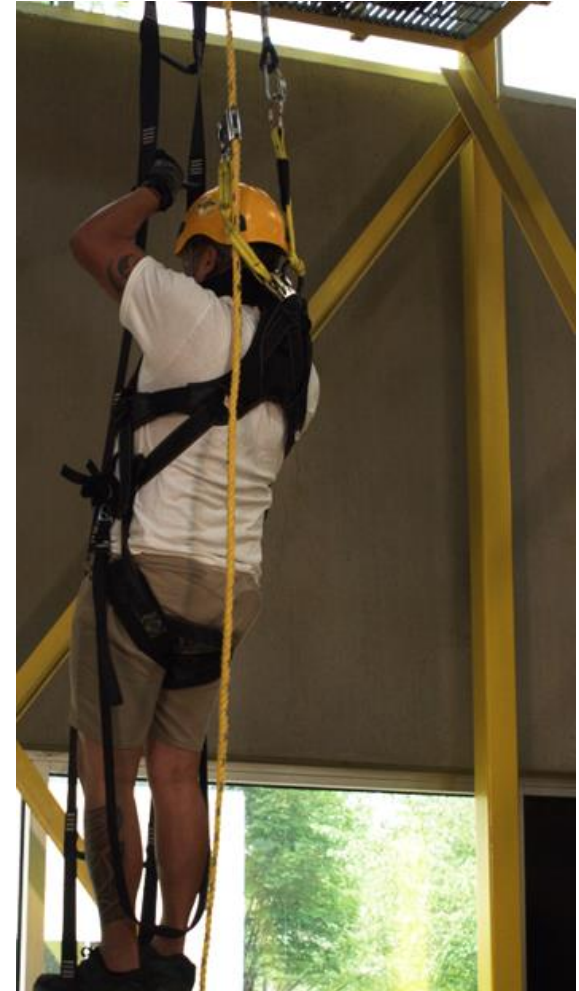
Note: Above table is not all inclusive.

Hazard Elimination & Control



Most Effective

Least Effective



Fall Protection - Eliminate



Window Washing



Light Bulbs

Fall Protection - Eliminate



Ground Supported Equipment



Interstitial Space

Fall Protection - Prevent



Parapet

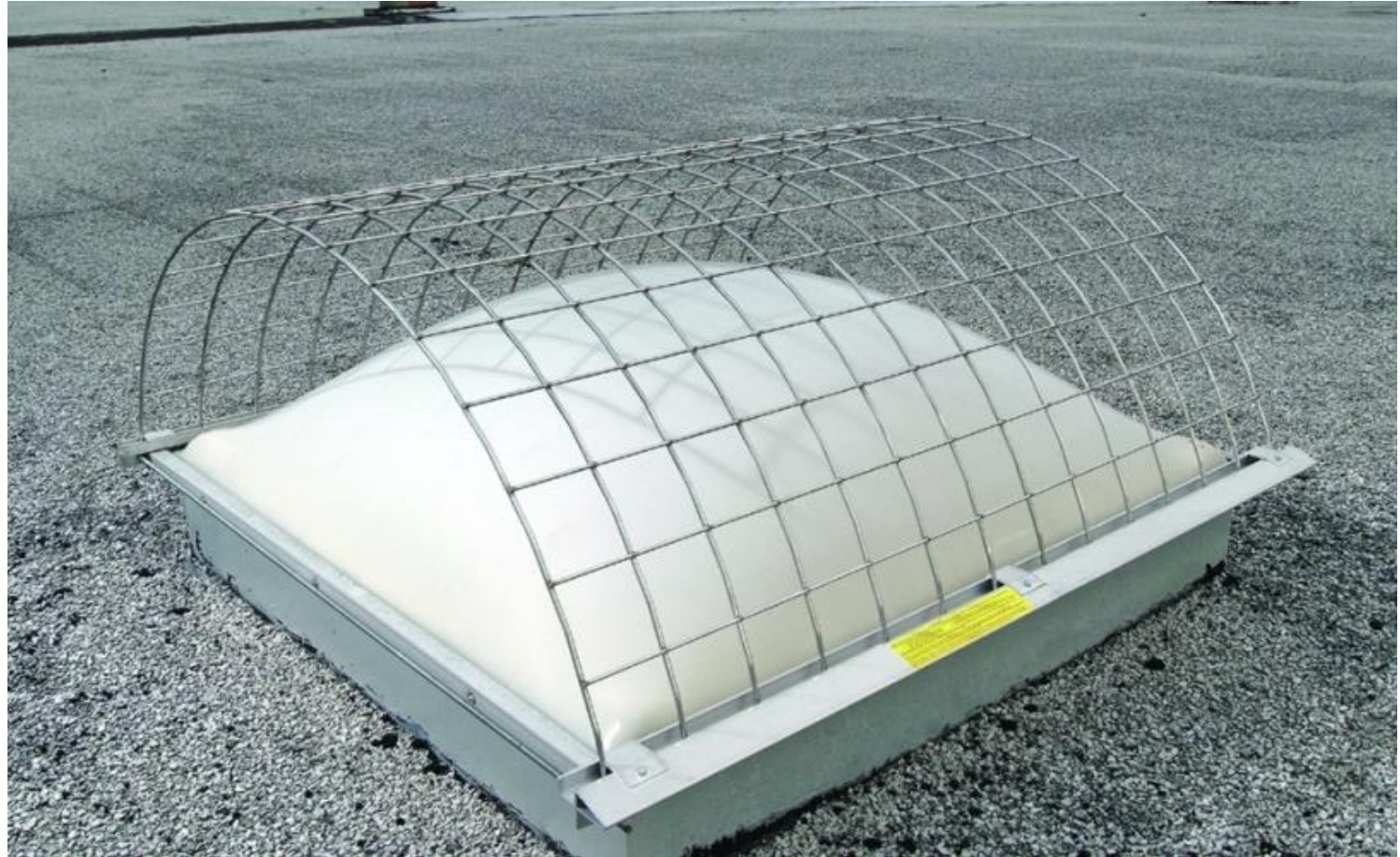


Portable Guardrail

Fall Protection - Prevent



Cover

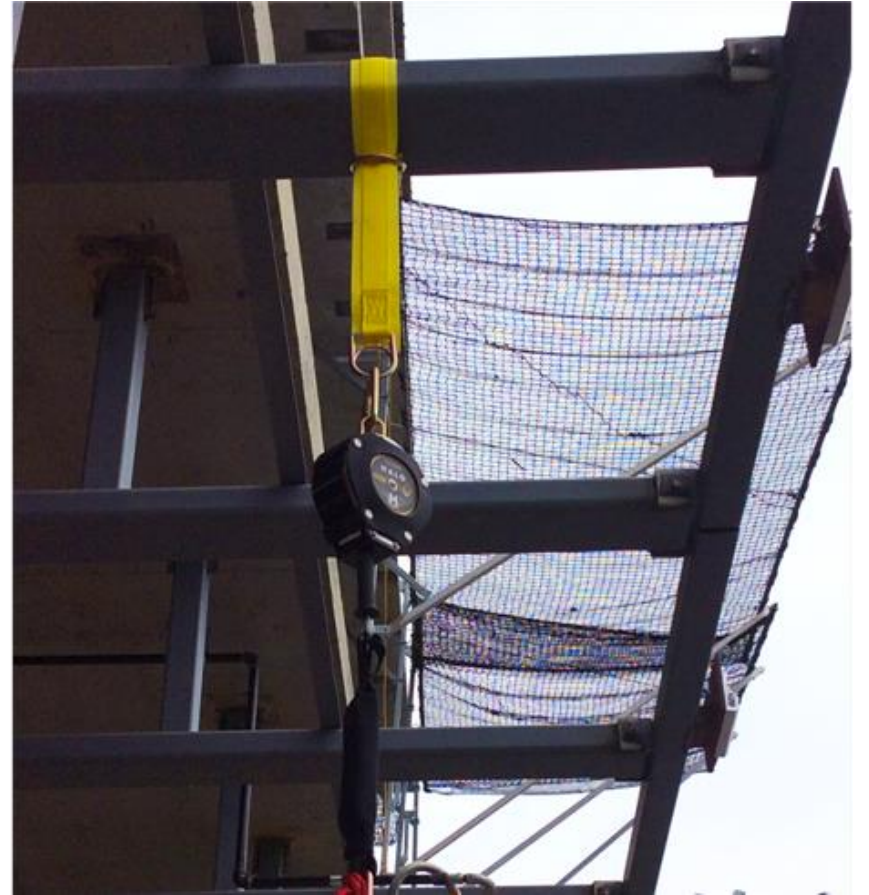


Skylight

Fall Protection – Prevent/Control

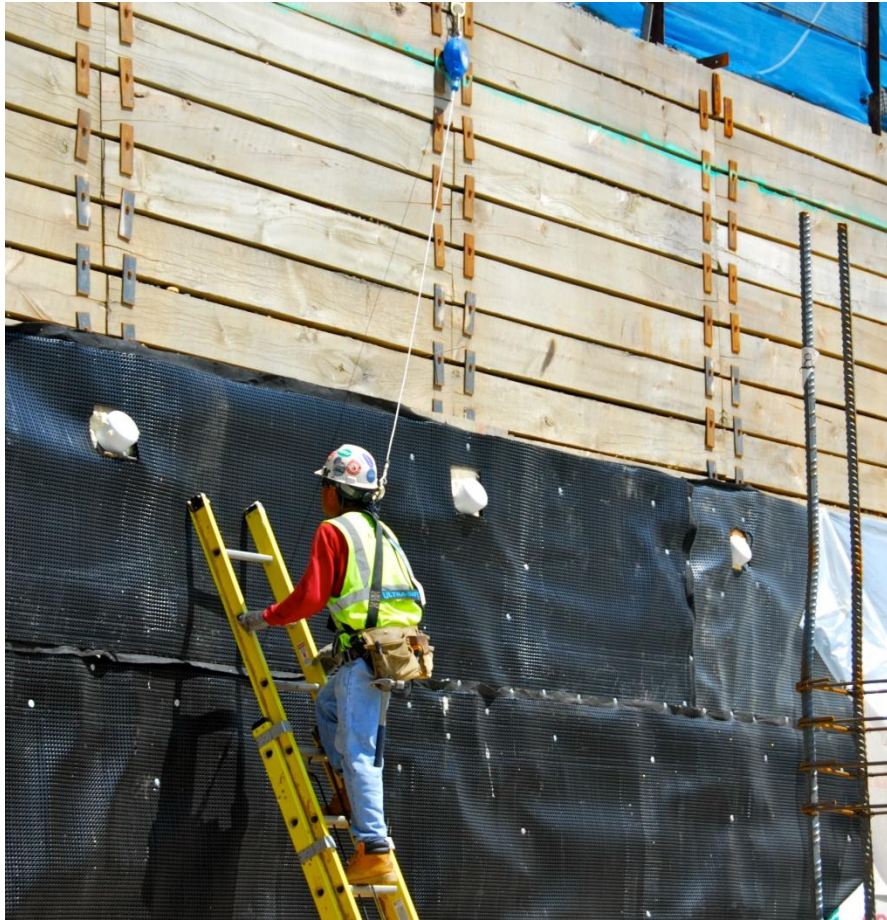


Travel Restraint



Netting

Fall Protection - Control



Fall Arrest - Self Retracting Lifeline



Fall Arrest – 6 Ft. Shock Absorbing Lanyard

Fall Protection - Warn



Warning Line



Safety Monitor

Fall Protection – Specific Requirements



What's Wrong with this Picture?

Ladders OSHA 1910.23

- **Two Categories**
 - Portable
 - Fixed
- **Requirements**
 - 3 points of contact while ascending and descending.
 - Keep belt buckle inside the rails.



Portable Ladder Requirements

- Ladder at 75 degrees (4 to 1)
- Side rails 3ft above upper level
- Secure at top and bottom
- Stable and level surfaces
- Manufacturer recommendations
- Inspect before every use
 - If unsafe tag "Do Not Use" and remove from service.

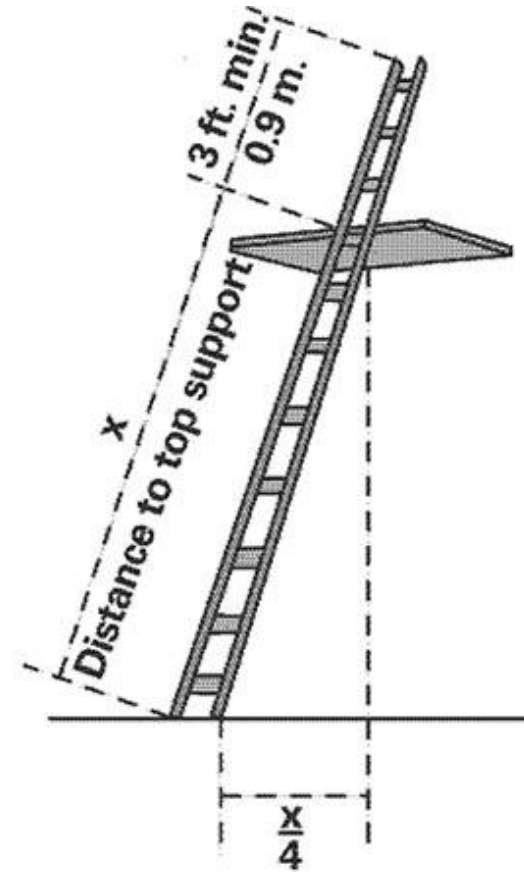


Figure D-1 -- Portable Ladder Set-up

Fixed Ladder Requirements

- Side rails extend 42 inches above landing.
- Rest/Landing Platforms
 - Cages & Wells: 50 ft. max.
 - Ladder Safety System & PFAS: 150 ft. max.
- Ladders extending more than 24 ft.:

Installed	Cage	Well	PFAS	Ladder Safety System
New Ladders < 11/19/2018	●	●	●	●
New Ladders ≥ 11/19/2018	∅	∅	●	●
All Ladders > 11/18/2036	∅	∅	●	●



Guardrail Requirements

- **Top Rail**

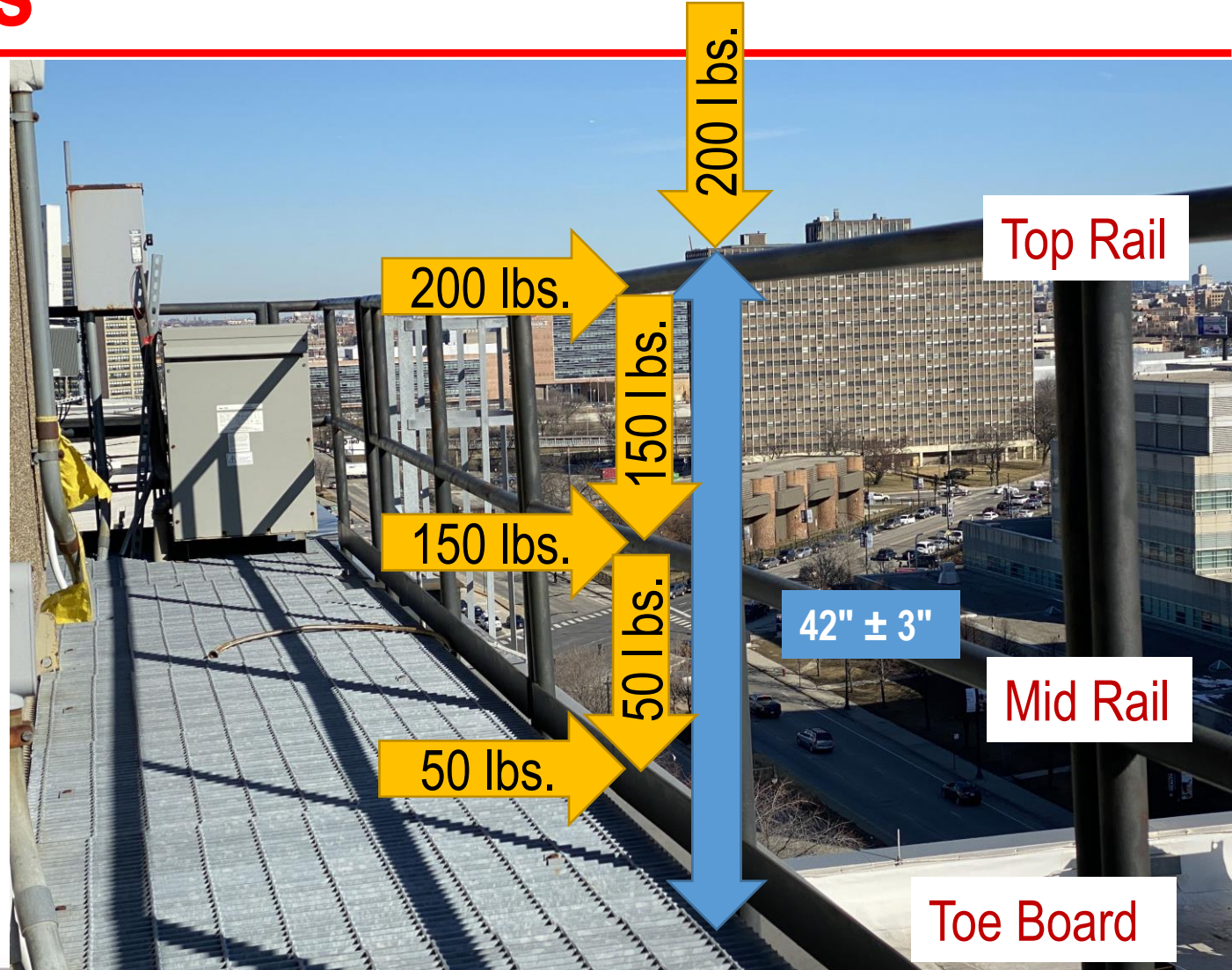
- 42" \pm 3" Tall
- 1/4" Minimum Diameter or Thickness
- 200 lb. Force Outward or Down

- **Mid-Rail**

- Midway between top edge and walking/working surface.
- 1/4" Minimum Diameter or Thickness
- 150 lb. Force Outward or Down

- **Toe Board**

- 3 1/2" Tall Minimum
- 1/4" Above walking/working surface maximum
- 50 lb. Force Outward or Down



Hole Cover Requirements

- **< 4 ft. above lower level (6 ft. Construction)**
 - Covers
 - Guardrails
- **> 4 ft. above lower level (6 ft. Construction)**
 - Covers
 - Guardrails
 - Travel Restraint System
 - Personal Fall Arrest System
- **Covers**
 - Support twice weight of employee, tools, and materials.
 - Secured in place
 - Color coded or marked "Hole" or "Cover"



Fall/Travel Restraint

- **Anchorage**
 - Rated for 3,000 lbs. per attached.
 - Design by a qualified person with a safety factor of 2.
- **Body Support**
 - Body Belt
 - Body Harness
- **Connector**
 - Lanyard - Prevents worker from reaching edge.



Fall Arrest ABCD's

- **Anchorage**
 - Rated for 5,000 lbs.
 - Designed with 2 to 1 factor of safety by a qualified person.
- **Body Support**
 - Body Harness, body belts are prohibited.
- **Connectors**
 - Lanyard & Connections
- **Deceleration Device (On Lanyard)**
 - Arrest fall within 3 1/2 ft.



Self-Retracting Lifeline

- **Class A**
 - Max. arrest distance of 24 inches.
 - Typically weighs 1 to 3 lbs.
 - Typically extends 6 to 9 feet.
- **Class B**
 - Max. arrest distance of 54 inches.
 - Heavier
 - Typically extends up to 200 feet
- **Class R**
- **Class LE**



Horizontal Lifelines

- **Qualified Person**
 - Design
 - Catenary
 - 2:1 Safety Factor
 - Supervise installation
 - Supervise use.



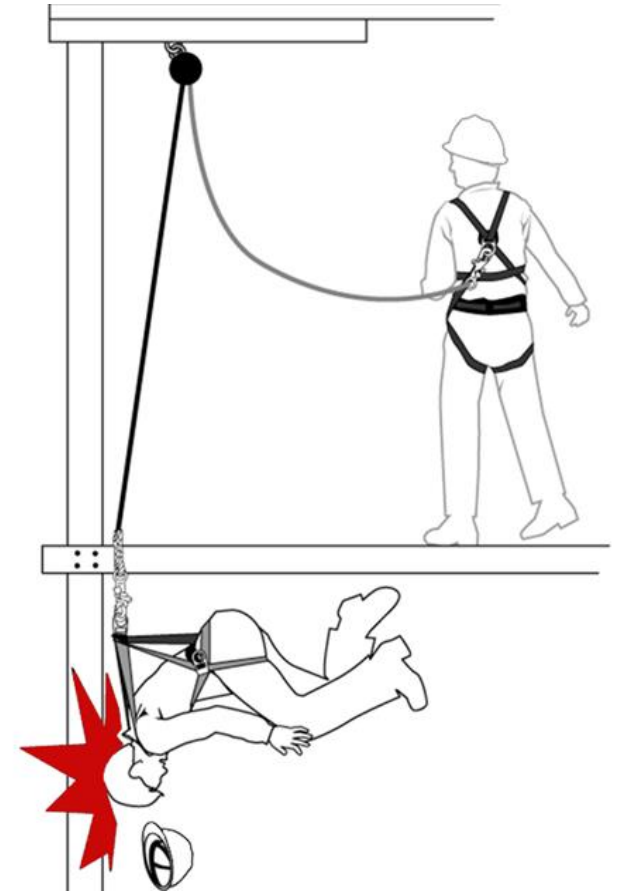
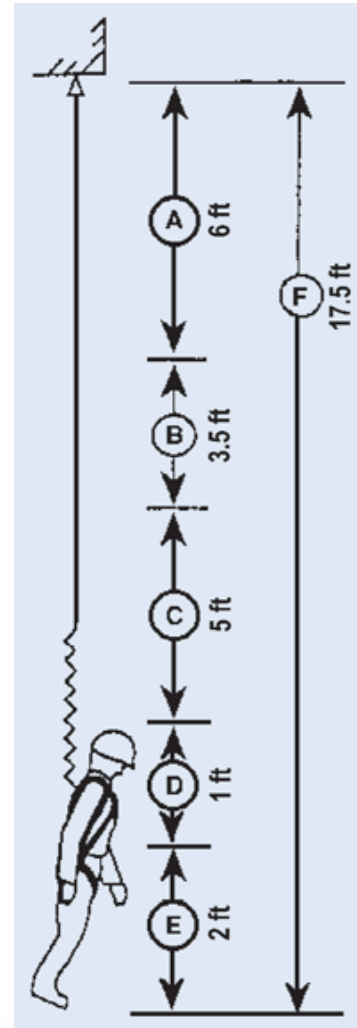
Clearance

1. Vertical Fall

- A. Free Fall: 6 ft. max.
- B. Deceleration Distance: 3 ½ ft.
- C. D-Ring Height: 5 ft.
- D. Harness Stretch: 1 ft.
- E. Safety Factor: 2 ft.
- F. Total Clearance Required: 17 ½ ft.

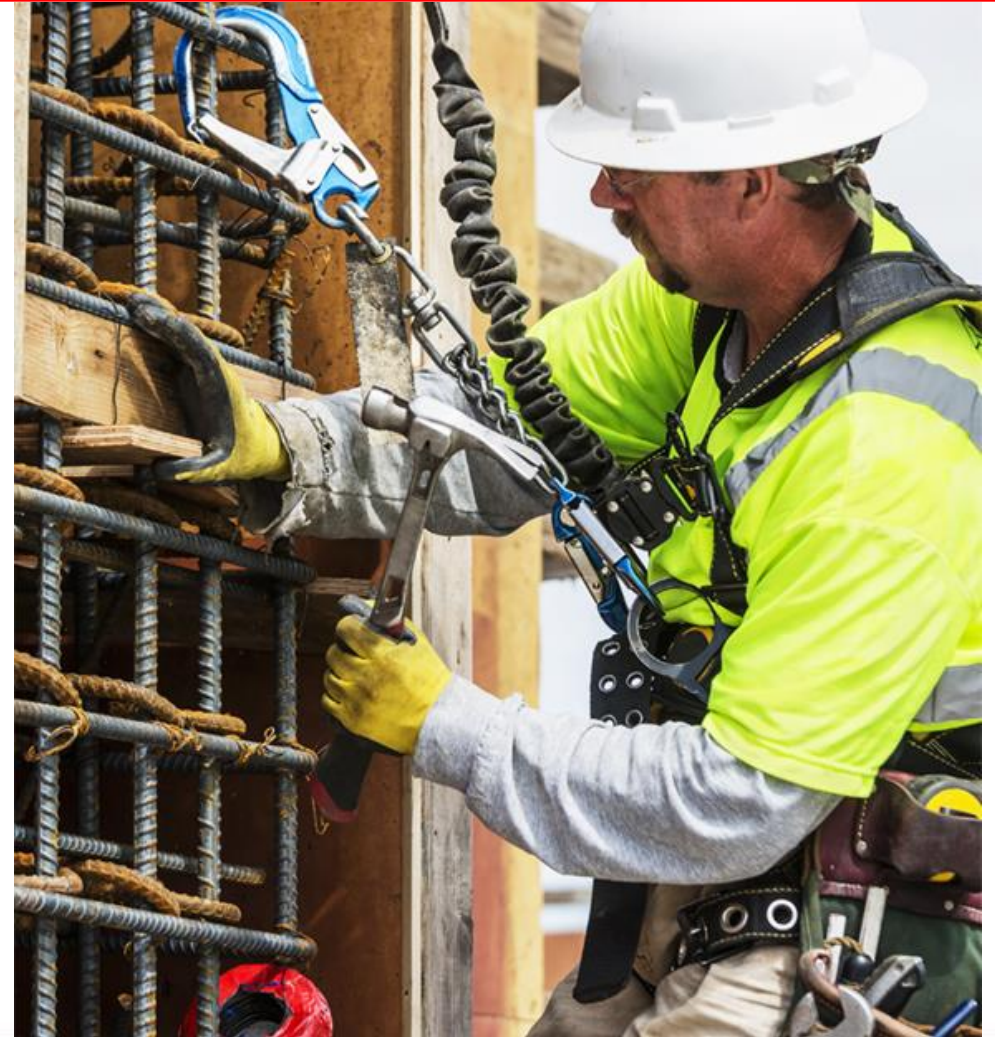
2. Swing Fall

- A. Pendulum affect



Positioning System

- **Free fall < 2 feet.**
- **Anchor Load Rating (Greater of)**
 - 2 x Impact Load
 - 3000 lbs.
- **Connecting Assemblies**
 - Rated for 5,000 lbs.
 - Proof Tested for 3,600 lbs.
 - Inspected prior to each use.
- **Additional fall protection required**



Safety Net Requirements

- **Installation**

- ≤ 30 ft below WWS
- Sufficient clearance below net

- **Mesh openings**

- ≤ 36 in²
- ≤ 6 in per side and on center

- **Strength**

- Border Rope $\geq 5,000$ lb. breaking strength
- 400 lb. Sand-bag drop ≥ 42 in

Vertical Distance from WWS to Net	Minimum Horizontal Distance
Up to 5 feet	8 feet
More than 5 feet up to 10 feet	10 feet
More than 10 feet	13 feet



Image by Walcom

Work Zones on Low-slope Roofs

- **All Work Zones**
 - Guardrail
 - Safety Net
 - Travel Restraint
 - PFAS
- **≥ 15 ft**
 - Designated Area
- **Safe access to work zones**



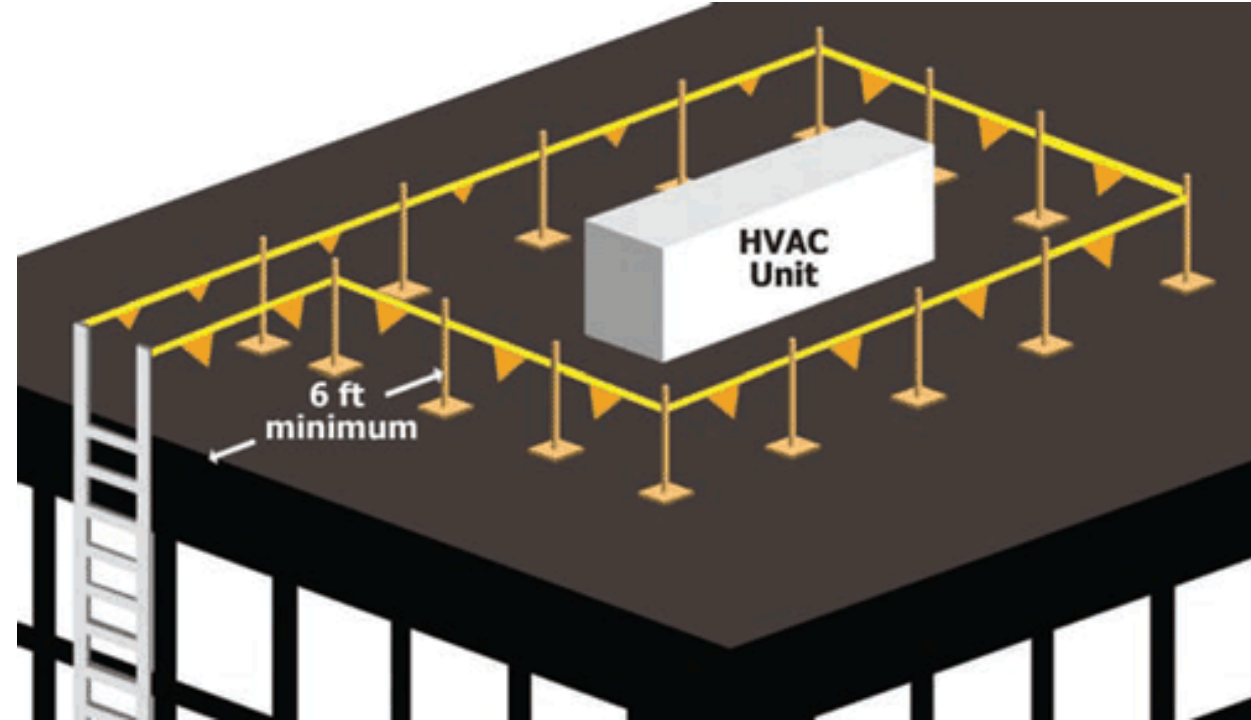
Work on Low-slope Roofs - Temporary and Infrequent

- **Temporary**
 - Simple Task
 - ≤ 2 hrs to complete
- **Infrequent**
 - Performed on occasion
- **< 6 ft.**
 - Fall protection required
- **6 ft to 15 ft**
 - May use designated area
- **≥ 15 ft**
 - No fall protection needed with work rule.



Designated Area Requirements

- **Remain within Designated Area**
- **Access Path**
 - Formed by two warning lines
 - Block path when not in use
- **Warning Line**
 - Rope, Wire, Tape, or Chain
 - 200 lb. Minimum Breaking Strength
 - ≥ 34 in ≤ 39 in above WWS
 - Visible ≥ 25 ft and within DA
 - Flagging ≤ 6 ft apart



Davits & Outriggers

- **System performance**
 - Greater of 2.5 x rated load
 - Or stall load of hoist
- **Outrigger Lateral Stability**
 - Use $\geq 44\%$ rated hoist load
- **Outrigger direct connection to building.**



Rope Descent System Requirements

- **Limited to ≤ 300 ft unless**
 - Not feasible by other means
 - Other means pose greater hazard
- **Anchors**
 - Rated to 5,000 lbs.
 - Certified by 11/20/2017
- **Body Support**
 - Harness, Lifeline, PFAS
 - Bosuns chair ≥ 300 lbs.
- **Connector**
 - Min. Rating $\geq 5,000$ lbs.
 - Proof Test to 3,600 lbs.



Industrial Rope Access

- **IRA technicians exempt from:**
 - 300 ft rule
 - Using designated anchors
- **IRA Technicians can ascend and descend**
- **More training than RDS.**



Protection from Falling Objects OSHA 1910.28(c)

- **Head Protection (Hardhat)**
- **Guardrail with Toeboards or Screens**
- **Canopy Structures**
- **Barricade area into which objects can fall**



Learning Objectives

- **Fall Protection**
 - Why
 - OSHA Regulations
 - ANSI Standards
 - System Requirements

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Questions?

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