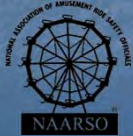


Fall Protection

30th Annual Ride Safety Inspection
Forum
January 2017



Presented by Ken Berryhill and Jeff Alberts

Why have Fall Protection?

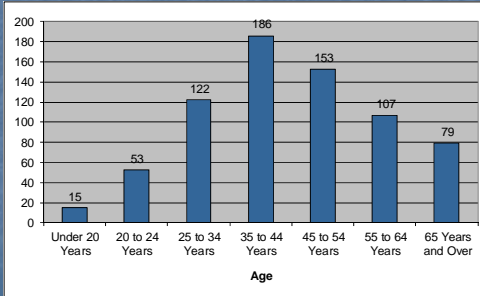
- 648 Fatal Falls in 2015 (13% of all Fatalis)
- #1 Fatality Cause in Construction
- #2 Fatality Cause in General Industry

Fall Factors

- Workers fall because they:
 - Don't recognize the hazard.
 - Have not been trained on safer approaches.
 - Stick with their "old work habits" which seem easier.
 - Rely solely on equipment for protection.



Fall Fatalities by Age



Brain/Muscle Fall Speed/Response Factors

Elapsed Time	Free Fall Distance (inches)	Speed Feet/Second	Human Response
0.1	2	3.3	Unaware
0.2	8	7	Aware
0.5	48 (4 feet)	16	Start to Move
0.61	72 (6 feet)	19.6	Slight Movement

OSHA Standards

- 1926.760 Steel Erection
- 1926.501 Construction
- 1926.502 Fall Protection System
- 1926.503 Training
- 1910.21-30 Walking & Working Surfaces
(Recent Revision effective 1/17/2017)
- 1910.66 Powered Platforms
- 1910.146 Confined Spaces

ANSI Standards

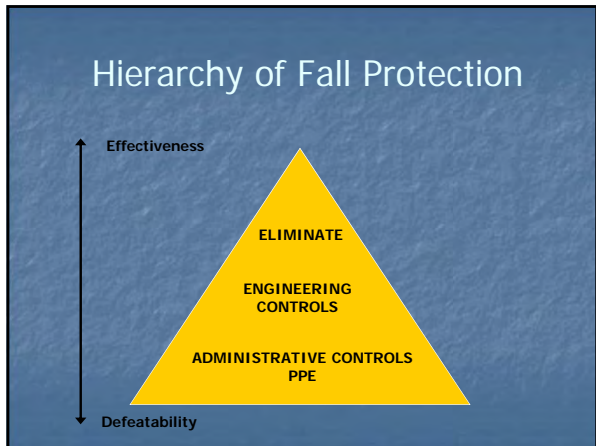
- Z359.0-2012 Definitions
- Z359.1-2007 Personal Fall Arrest
- Z359.2-2007 Fall Protection Program
- Z359.3-2007 Positioning/Travel Restraint
- Z359.4-2013 Rescue
- Z359.6-2009 Design of Fall Arrest
- Z359.7-2011 Qualification/Testing Equip.
- Z359.11-2014 Full Body Harnesses
- Z359.12-2009 Connecting Components
- Z359.13-2013 Energy Absorbing Lanyards
- Z359.14-2014 SRLs
- Z359.15-2014 Single Anchor Lifelines/Arrestors

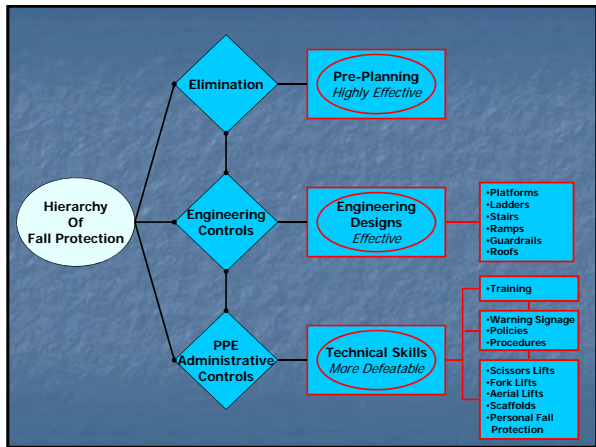
ASTM Standard

- F2291-15 Standard Practice for Design of Amusement Rides and Devices
 - Section 14 Fencing, Guardrails, Handrails, Gates, and Walkways for Amusement Rides and Devices
 - 14.3 Guardrails
 - 14.4 Handrails
 - 14.6 Fencing
 - 14.8 Walkways

When Is Fall Protection Required?

- Know your state rules as well as federal!
- Above four feet for General Industry
- Above six feet for Construction
- Above ten feet in Canada
- Above fifteen feet for Steel Erection
- Fixed Ladders >24 feet in length





Guardrails

- Top rail = 42 inches (OSHA 39-45 inches)
- Mid rail = halfway between
- 200 lbs. force in any direction
- Toe board if workers are below









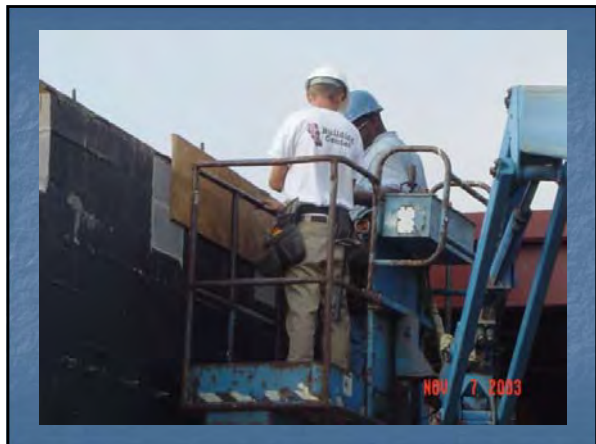






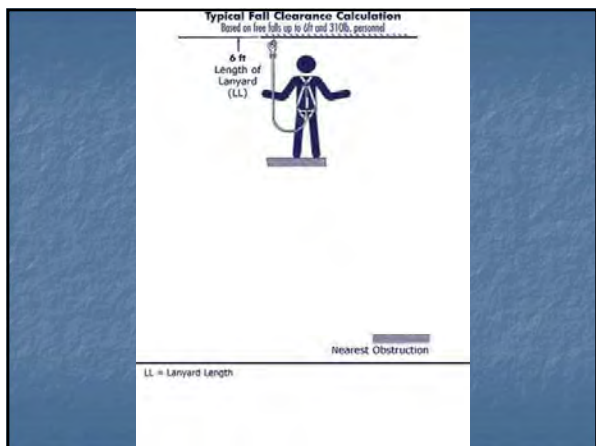


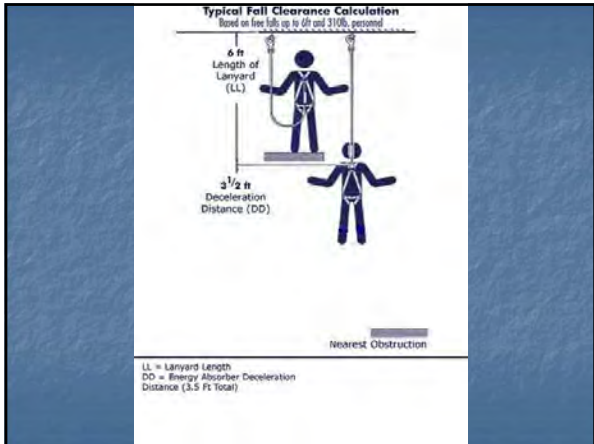


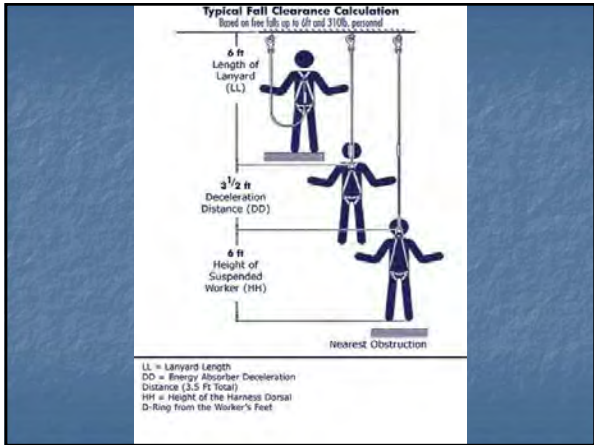


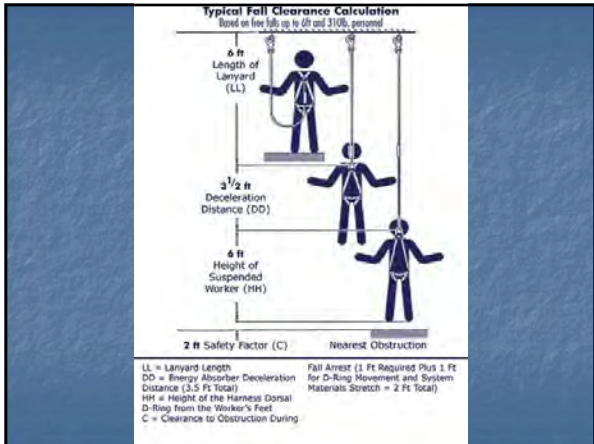
Fall Arrest vs. Fall Restraint

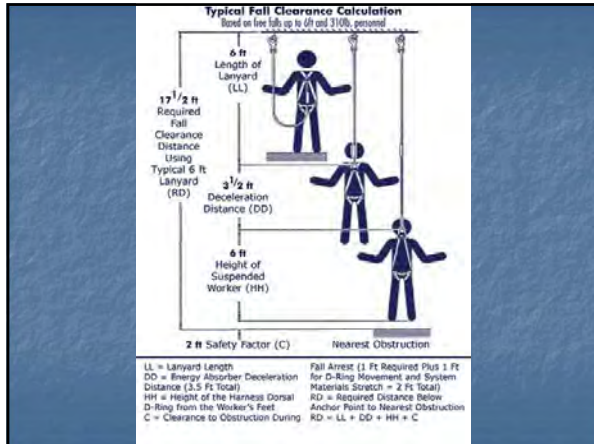
- **Fall Hazard** – Any location where a person is exposed to a potential free fall.
- **Fall Arrest** – the action or event of stopping a free fall or the instant where the downward free fall has been stopped.
- **Fall Restraint** – technique of securing a person to an anchorage using a lanyard short enough to prevent the person's center of gravity from reaching a fall hazard.
















Anchorage


- Certified – Must sustain static loads of at least **two times the maximum arresting force**:
 - Arrest – 1,000 lbs.
 - Restraint – 600 lbs.
- Non-Certified – Must sustain static loads of at least:
 - 5,000 pounds for Arrest
 - 3,000 pounds for Restraint





Body Support

- Part of a Personal Fall Arrest System that shall limit maximum arresting force on an employee to 1,800 lbs.
- Fall Arrest attachment shall be located at the back (dorsal) position.
- 3rd Party Tested
- Suspension Trauma Straps available



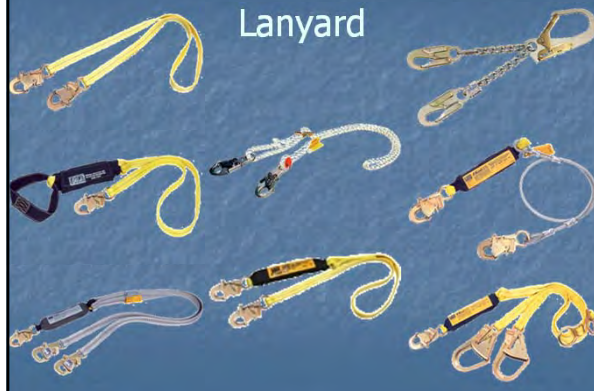
Connectors

- Minimum breaking strength of 5,000 lbs.
- Maximum arrest force shall not exceed 1,800 lbs.
- Must be compatible with connecting device.
- Not allow a free fall exceeding 6 feet.
- Deceleration distance (shock absorber) not to exceed 48 inches.

Snap Hooks



Lanyard



Self Retracting Lifeline (SRL)

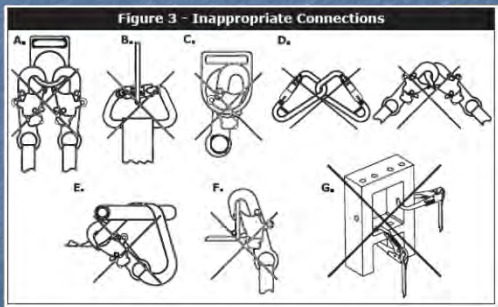


Carabiner

- Self locking type with a self closing, self locking gate that remains closed and locked until intentionally unlocked and opened for disconnection.



Incompatible Connections



Traveling Show Issues

- How do we tie off when nowhere is provided?
- How do we use equipment when its not possible?
- Examples....

Bumper Car/Scooter Scenery



Gravitron Signs

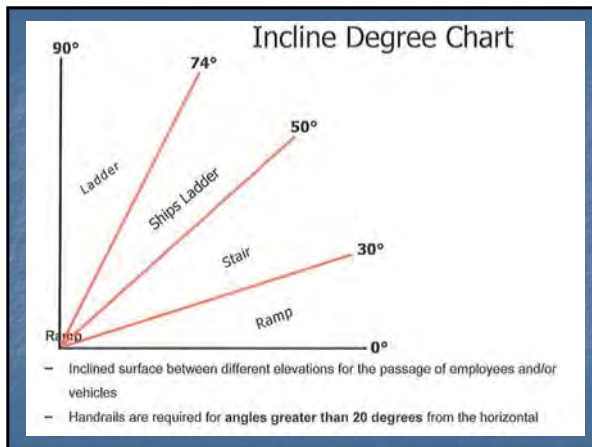


Super Loops



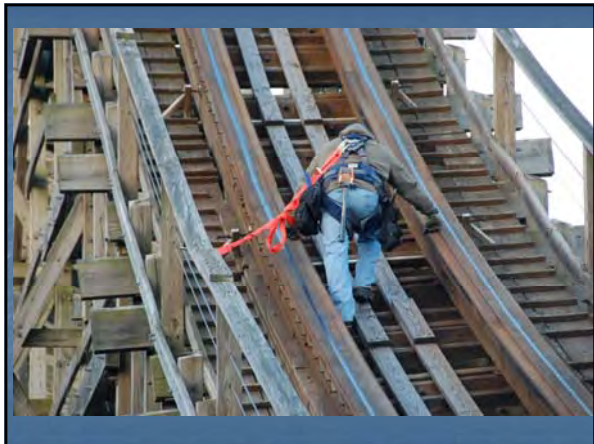
Wacky Worm













Fixed Ladders

ASTM F2291 - 15

- 14.8.3 Walkways elevated 48 in. (1.2 m) or more above the adjacent floor or ground level shall be protected by fall protection systems. Designs for these fall protection systems shall be based on an analysis of the hazards associated with the location, function of the equipment and the activities performed. Fall protection for walkways may include one or more, or a combination of the following, or other appropriately designed measures not listed below.
 - 14.8.3.1 Stationary guardrails on all sides of the walkway
 - 14.8.3.2 Temporary guardrails
 - 14.8.3.3 A Structural Barrier installed at or below the work level such that they would protect against a fall greater than 48 in. (1.2 m) from the elevated walkway. The Structural Barrier shall:
 - (1) Provide a continuous barrier, which shall extend from the edge of the walkway for a distance of at least 48 in. (1.2 m) measured perpendicular to the direction of travel of the walkway. The barrier width can be extended depending on the configuration of the barrier and the hazard analysis.
 - (2) Be made of elements that may include the ride track or other structures.
 - (3) Be designed such that any gap within the structural barrier shall reject a 12-in. (300 mm) sphere.
 - (4) Have sufficient strength to withstand the applicable load based on the installed configuration with no permanent structural deformation.

ASTM 14.8.3.3

FIG. 29 Cross Sectional View of Structural Barrier



