The Gravity of Fall Protections Use: An Analysis of Available Data

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About Me

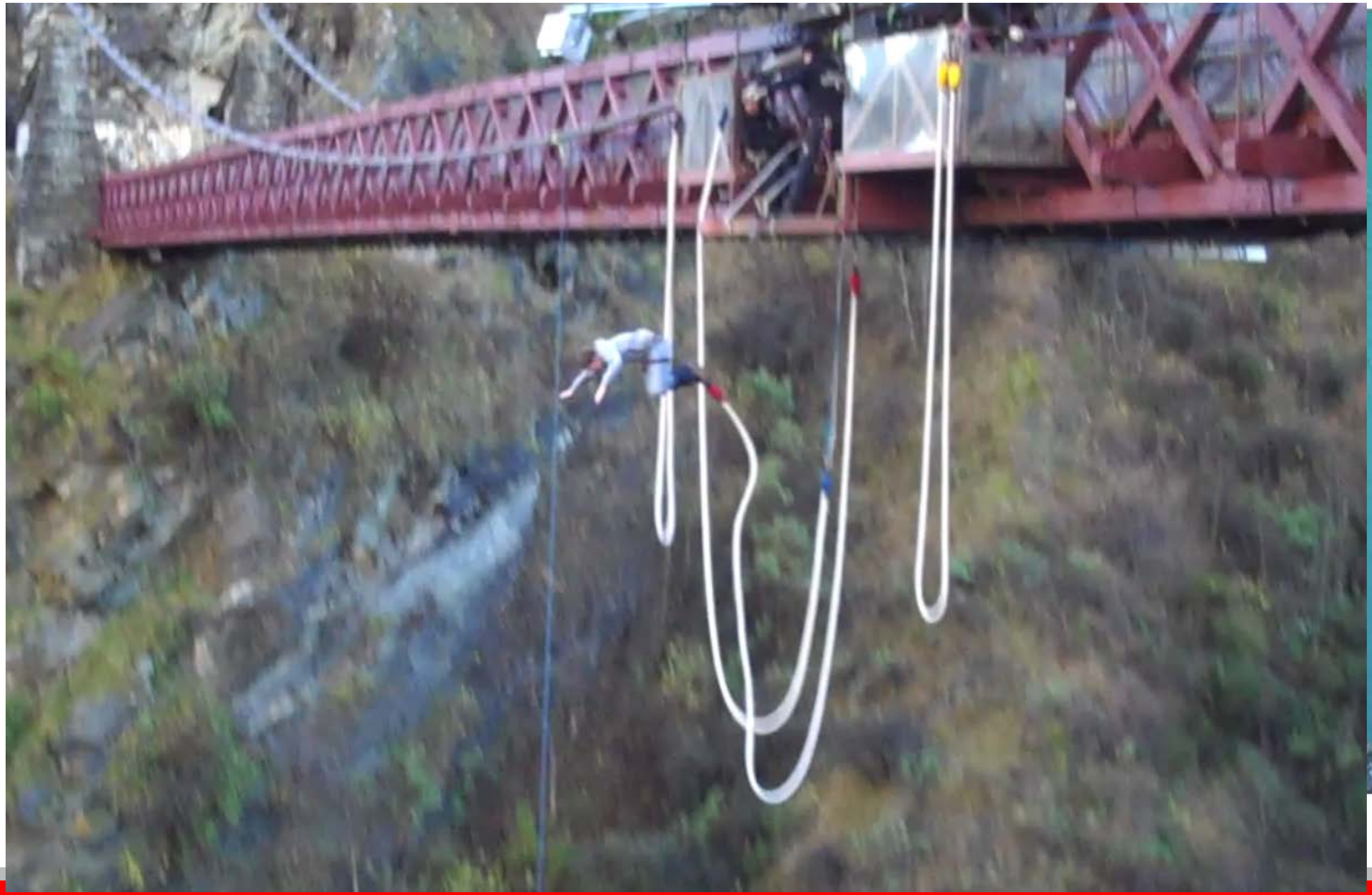
Equipment Design Engineer (2012-2017)

- Developed Installations for use with fall protection and to mitigate fall hazards
- Certified Fall Protection Designer (Gravitec Systems, Inc.)

Production Engineer (Current)

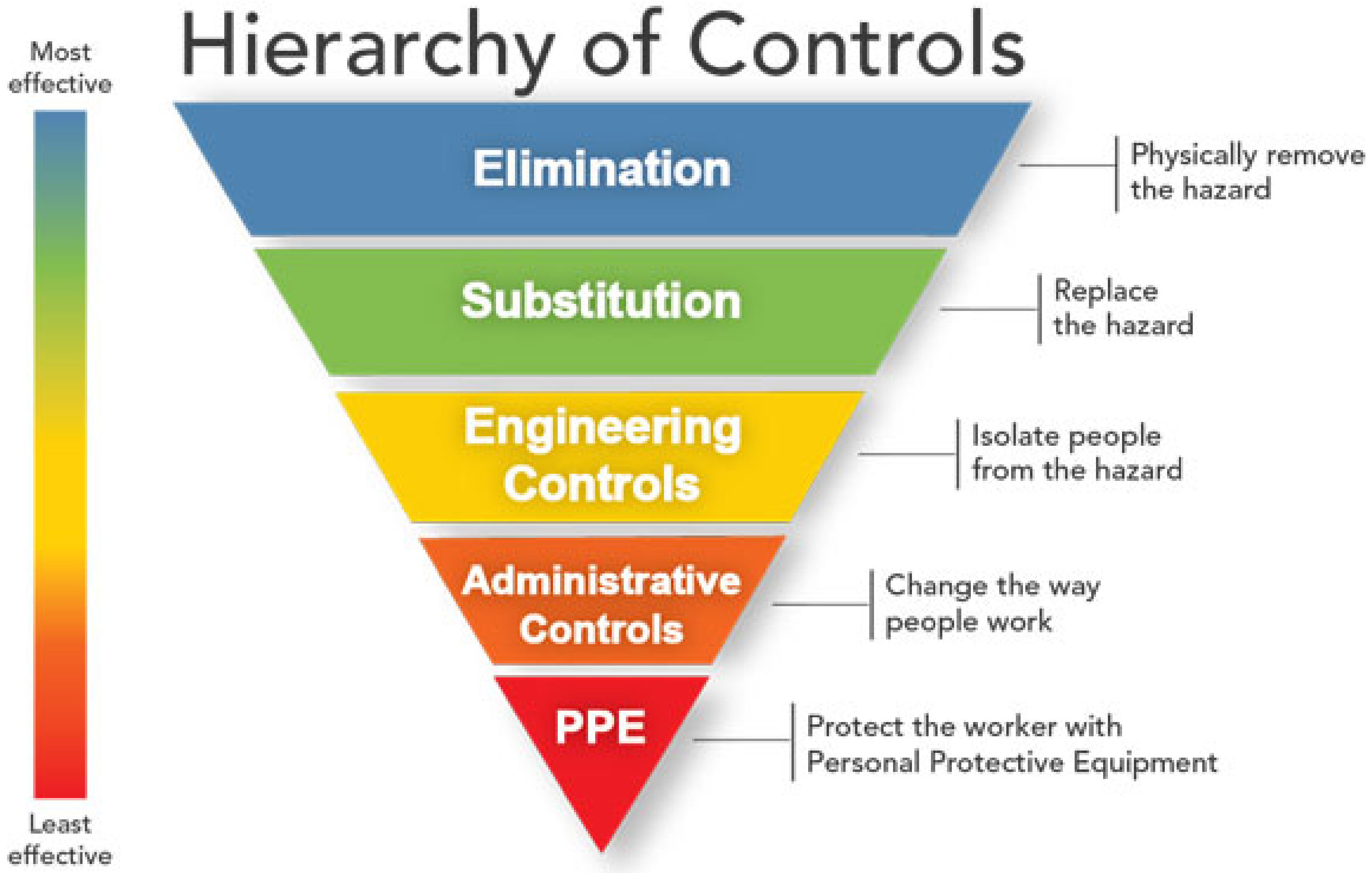
Above all else a safety conscious advocate

About Me



Outline of Presentation

- Hierarchy of Controls
- Briefly Discuss OSHA Regulations
  - Baseline of general requirements for Construction Industry
  - Other regulations may govern Marine Construction and Dredging
- Review Common Fall Protection Lanyards and Self Retracting Devices
- Importance of Fall Protection based on Available Data
  - Data Sources
    - Bureau of Labor Statistics (BLS)
    - National Institute for Occupational Safety and Health (NIOSH)
      - Fatality Assessment and Control Evaluation (FACE) Program
- Review Clearance Requirements and Estimated Energies Developed in the Event of a Fall
- Provide Examples on How Manson is Mitigating Fall Hazards



Hierarchy of controls (NIOSH 2016)

OSHA Regulations

Employers are responsible to follow Occupation Safety and Health Administration (OSHA) guidelines and to determine the strength and structural integrity of walking/working surfaces for its employees (CFR 1926.501)

“walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems” (CFR 1926.501)

In 2014, 70% of fatal falls where the height was known occurred at heights above 6 ft (1.8 m) (BLS 2016)

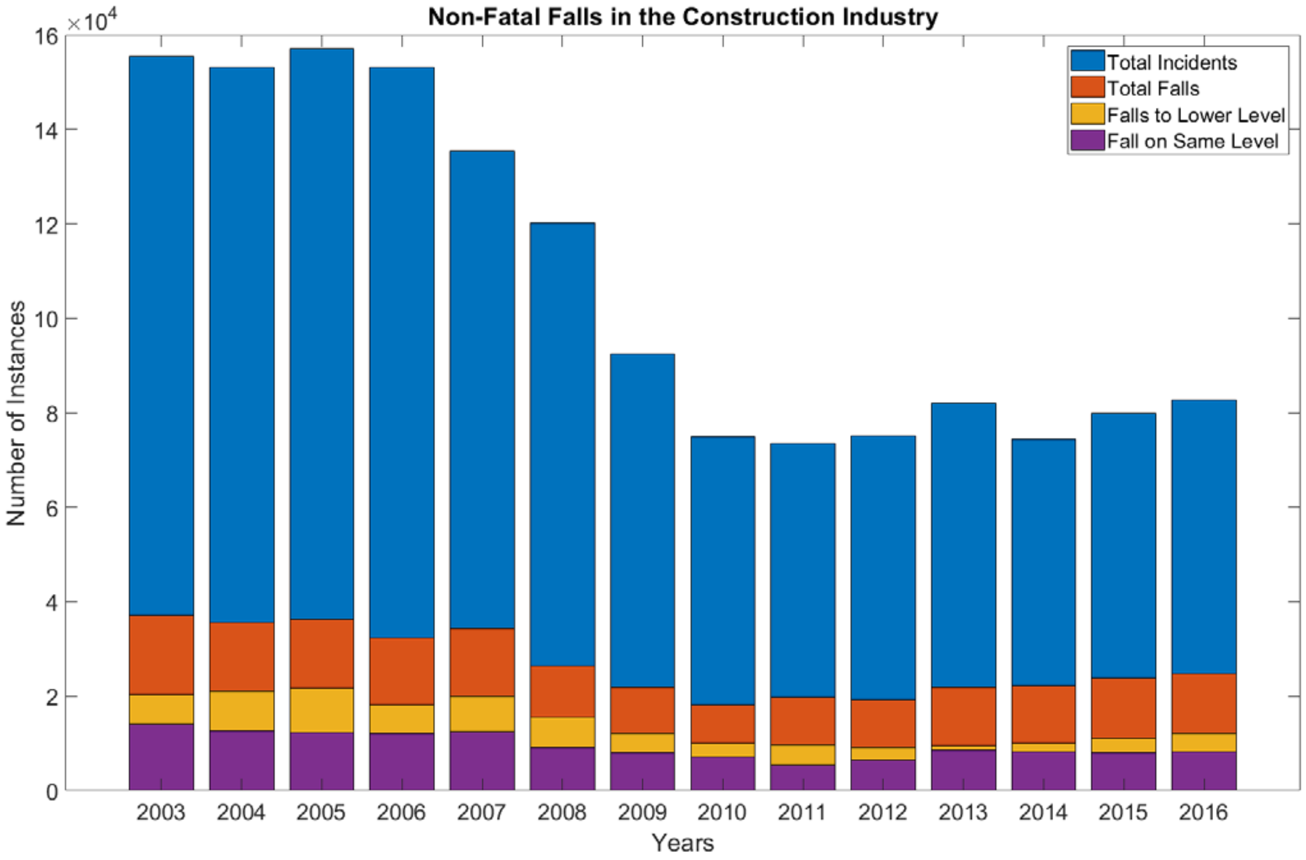
MANSON CONSTRUCTION CO.

Personal Fall Arrest (PFA) Protection

PFA Design Requirements

- "…be rigged such that an employee can neither free fall more than 6 feet (1.8 m); nor contact any lower level" (CFR 1926.502)
- Maximum arresting force an employee can experience is 1,800 pounds (8,000 N) and deceleration distance is limited to 3.5 feet (1.06m) (CFR 1926.502)
- Lanyards must have a minimum break strength of 5,000 pounds (22.2 kN) (CFR 1926.502)
- Recovery plan must be in place

Non-Fatal Falls in the Construction Industry

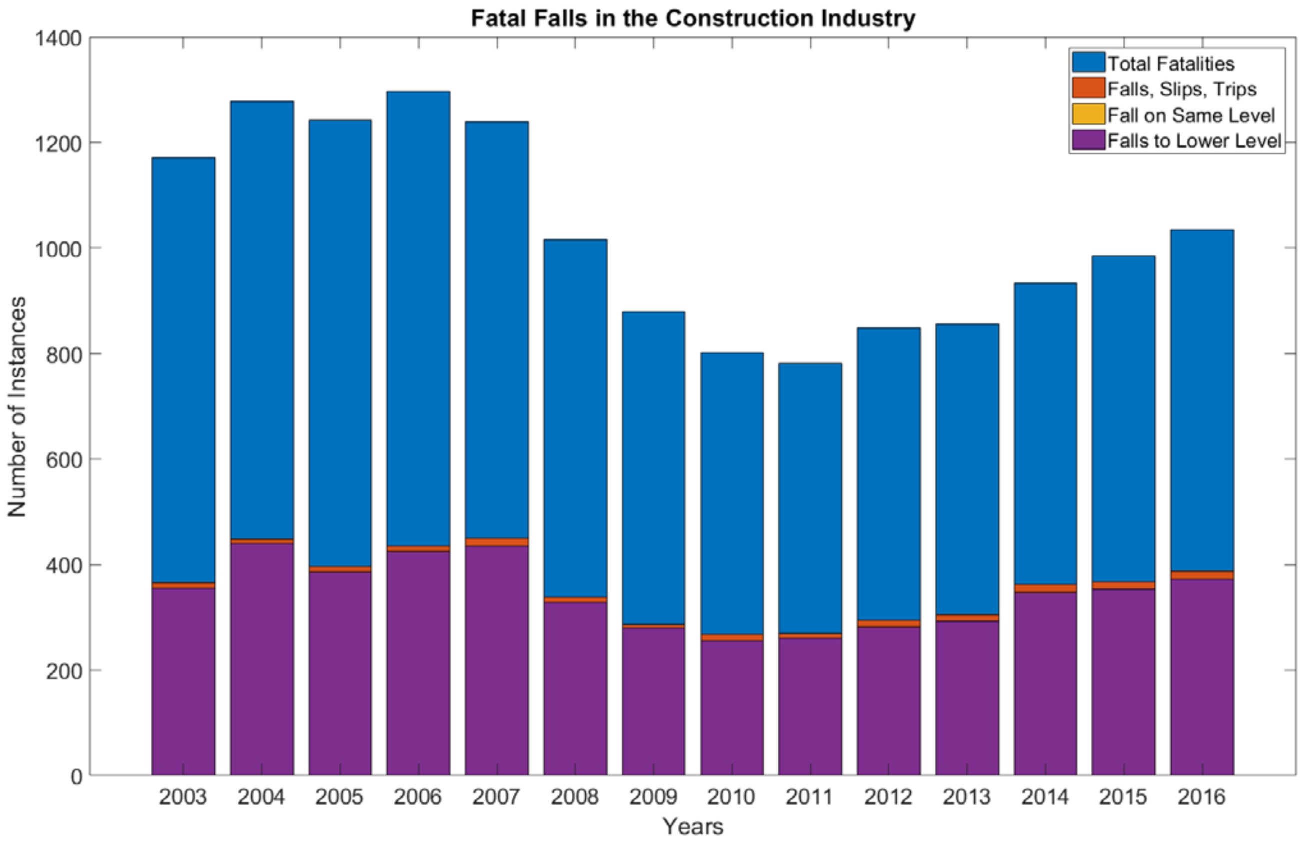


Non-Fatal Falls in the Construction Industry

- Falls are a large percentage of total incidents requiring days away from work
- Regardless of total incidents the percentage of falls remains more or less the same
- Falls to a lower level make up more than 50% of total fall incidents requiring days away from work

Non-fatal incidents in the construction industry with falls highlighted, 2003-2016, BLS

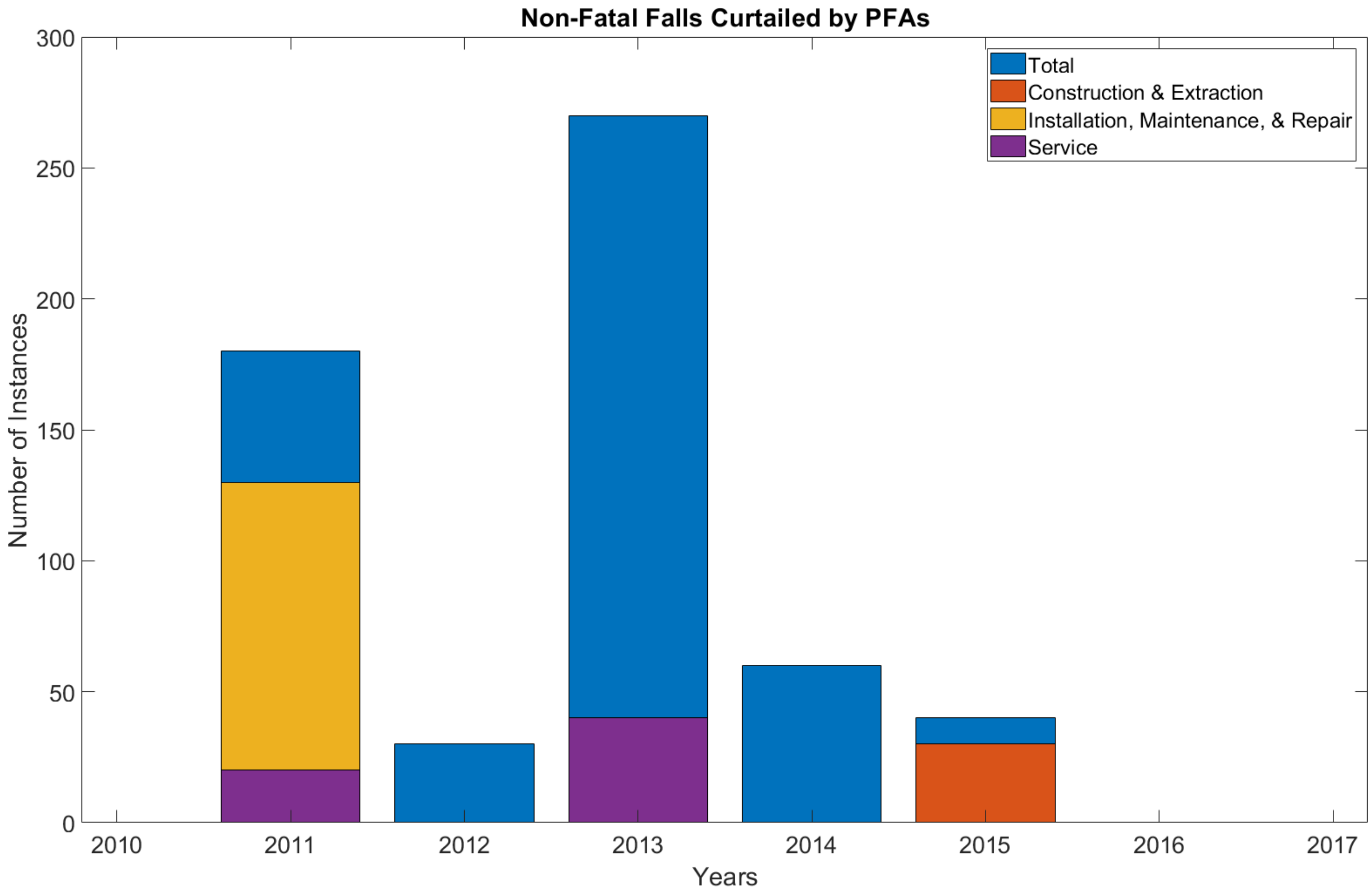
Fatal Falls in the Construction Industry



Fatal falls in the construction industry, 2003-2016, BLS

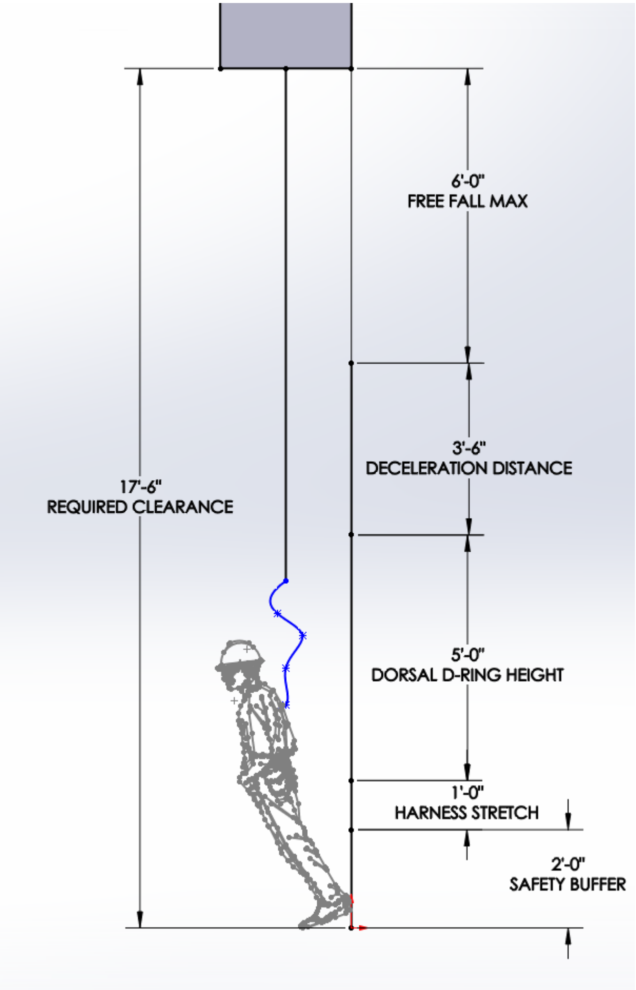
Fatal Falls in the Construction Industry

- Falls are a large percentage of fatal incidents
- Falls to a lower level make up more than 90% of total fatal falls



Non-fatal falls curtailed by personal fall arrest systems resulting in injury, 2011-2017, BLS

Clearance Required



Fall height clearance requirement (EPP 2007)

Clearance Required

$$Fall\ Energy = W\ *H$$

H – the Total height fallen

W – Weight of the Worker

$$Arrest\ Energy = \ F_{PEA}(X_{PEA})$$

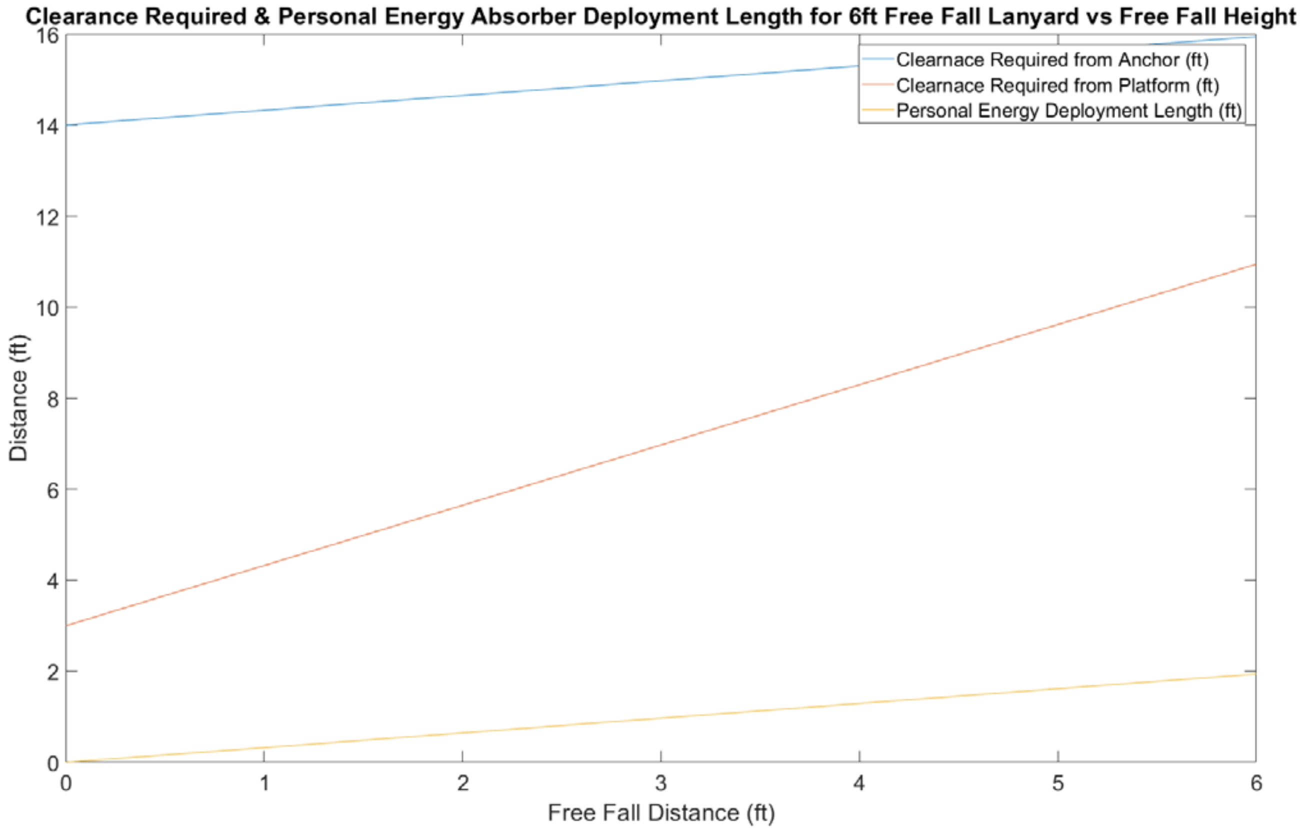
F_{PEA} - Deployment Forces of the Personal energy absorber

X_{PEA} - the extension (deployment length) of the personal energy absorber

$$H\ = h + \ X_{PEA}$$

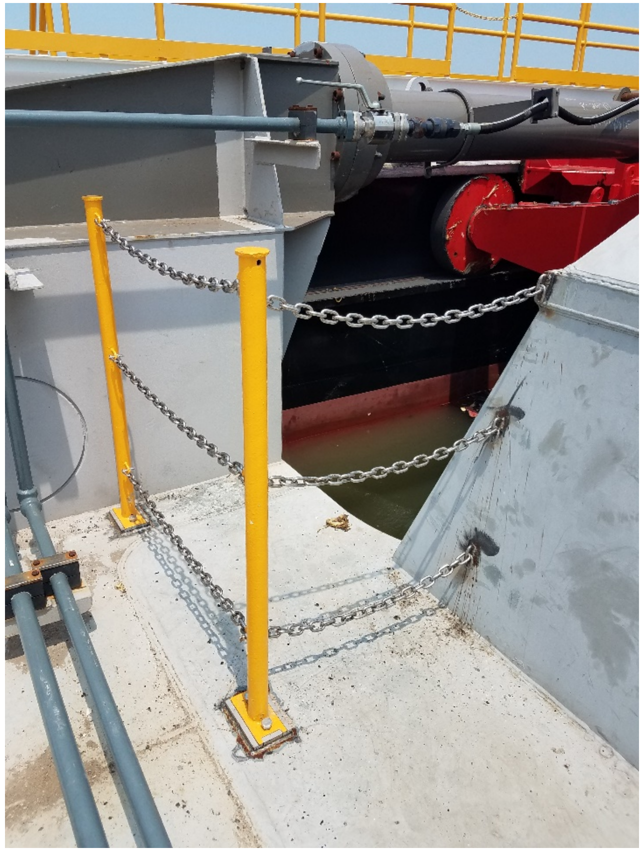
h – free fall Height

$$X_{PEA} = \frac{W(h)}{F_{PEA} - W}$$



Required Clearance for a 220 lb (100 kg) worker using a 6 ft (1.8 m) lanyard for a free fall up to 6 ft (1.8 m)

R.M. White



Glenn Edwards – Fall Protection Locker

Glenn Edwards – Machinery House

Conclusions

Slips, Trips, and falls are a leading cause of fatalities and incidents requiring days away from work

OSHA PFA regulations can be difficult to meet dependent on the job site / location

Future Research

- There is a gap in information from in order to compare falls to the effectiveness of personal fall arrest systems
- Review available data more focused on dredging and marine construction

Through the use of the hierarchy of controls other solutions can be found to grant access to height

Deployment of Energy Absorbers

Arrest Energy

- Equal to the force that stops the fall times the distance the force acts

$$Arrest\ Energy = F_{PEA} * X_{PEA}$$

$$F_{PEA} = \text{Deployment force of the PEA}$$

X_{PEA} = the extension of the personal energy absorber

Maximum Free Fall Distance

$$h_{max} = \frac{(F_{avg} - W)x_{max}}{W}$$

h_{max} - maximum free fall allowed, ft

F_{avg} - average deployment force of PEA, lbs

W – Weight of worker, lbs

x_{max} - maximum extension of PEA, ft

Fall Energy

$$Fall\ Energy = W\ * H$$

H – the Total height fallen

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F_{PEA} - Deployment Forces of the Personal energy absorber

X_{PEA} - the extension (deployment length) of the personal energy absorber

$$H = h + X_{PEA}$$

h – free fall Height

$$X_{PEA} = \frac{W(h)}{F_{PEA} - W}$$

NIOSH FACE STUDY

Fatal Falls in Construction, by Height				
Years	Less than 6 feet	6-15 feet	16-30 feet	More than 30 feet
1982-1992	1.9%	13.9%	39.8%	44.4%
1993-2003	2.3%	24.0%	43.3%	30.4%
2004-2014	2.7%	48.7%	29.7%	18.9%

Fatal Falls in Construction, by PFAS Status				
Years	Present, in use	Present, not in use	Not present	Unknown
1982-1992	7.3%	22.0%	60.6%	10.1%
1993-2003	4.0%	25.7%	49.1%	21.1%
2004-2014	7.3%	14.6%	58.5%	19.5%

Dong, 2017