Fall Protection Criteria, Systems, Engineering

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Fall Protection Safety Workshop

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Construction products!

What hazards are hidden?

•Prep for 28 contractors on roof? eg.antennas/ cameras/etc

•Parapets?
•HVAC ducts?
•Window Cleaning anchors?
•Overhead lighting?

•Drop ceilings/utilities?
•Lamps in stairways?
•Stair railing heights?
•Skylights?

•Roof Hatches?

What we will discuss today:

1. Update on Falls, Fall Standards & Access
2. Anchor principles and practice
3. Elimination v. Control
4. Suspension trauma
5. Rescue
6. Field Knowledge
7. Multiemployer sites – helping Subs
8. Transportation Stationary Vehicle Falls
9. Fall Management
10. Summary and Challenge

Fatalities USA 2010 Prelim.

- Total Falls* 635 (14% total)
- Scaffolds 44
- Holes 43
- Ladders 129
- Roof Falls 117 (18%)
  - Skylight 20
  - Edge 49
  - Roof Surface 18
  - Existing Roof Openings 9

* **Census of Fatal Occupational Injuries (CFOI) reported by BLS**

1. Fall Protection Standards

- ANSI Z359.0 – Z359.18 replace Z359.1
- ANSI Z359 Equipment stds into A10.32
- 29CFR1926.500 - .503 makes good sense; Construction: read the appendices
- A10.32-2004 Construction out of date
- 29CFR1926.1050-1060 Stairs/Ladders

Q: Does Fall Protection really Work? Selection, Training, Observation, Inspection, Maintenance
What is missing in the Hierarchy of Controls?

a. Access including Ladders

- The trades that are killed most at height are Roofers
- The major tool of death is ladders
  - The reason is poor selection and transition
- Ladder accessory provides walk-through

1926.1050 – 1060 Stairs and Ladders

2. Anchor Principles & Practice

- Competent Persons: Safety-trained mgrs
- Authorized Persons: Safety-trained crew
- Qualified Persons: Structural Engineers

- 5000 lbs experienced Competent Persons
- 2:1 by Qualified Persons (S.E.’s)
- Horizontal Lifelines by Qualified Persons
- I-14.1 Window Cleaning – Anchor designs

Z359.2 and Z359.6 Specifications

b. FP Controls

- Access:
  - Aerial lifts over Ladders
  - Scaffolds over Ladders
  - Administrative Rules
- Fall Arrest:
  - Retractable Lanyards over single Lanyards
  - Y-lanyards over single Lanyards
  - Horizontal Lifelines over single anchors

3. Hazard Elimination or Control

- Educating architects and engineers how to recognize Fall Hazards and Eliminate
- The only answer to reducing fall deaths is Elimination while on the drawing board
- Controls temporarily hide the hazard
- NRCA and Union of Roofers to CM: “Build in your fall protection by design” 2/2/12

Elimination today addresses only the client’s hazards .
INSTALL AND LEAVE POLICY

4. Suspension Trauma

- Hanging in Harnesses too long (20 mins) raises Venous blood pressure
- Releasing Venous pressure is dangerous
- Train harness users:
  - Shift weight leg to leg when suspended
- Train Rescuers to gradually release strap tension

More information: www.FallSafety.com See under: What's New

5. Rescue Considerations

- Do survey for rescue experience
  - Vol. Fire Department members are common
  - Offer extra $ to participate
- Three person rescue crew min. onsite
  - General, Physical and Mental Capacity
- Competent Rescuer; Authorized Rescuers
- Train with Competent Rescuer Trainer
- Rescue equipment Z359.4 compliant/½”
- PrePlan for foreseeable hazards, atriums

Ref: Tower Instructor EFSS,
www.FallSafety.com see Courses: Rescue

6. Field Knowledge

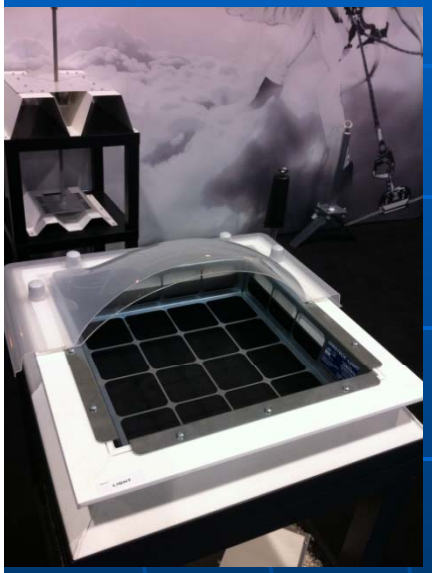
a. Skylights

- A tragedy producing 20-50 deaths/yr
- Plastic skylights have short lives
- Immense market in green construction
- Testing: 300 lbs weight (12” dia. punch bag filled with lead shot); 3ft. Drop*

*Draft ASTM Standard E06.51.25

Solution: Selection after a fall .

Alternative:

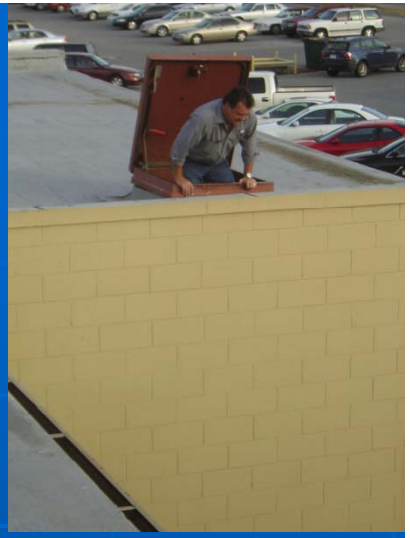


Grill laser cut

By Innotech

Arched screens for Plastic Skylights

b. Roof Hatches



Walk in, Walk out

"Install and Leave Policy"

Walmart , Sam's Club, Dover DE 2/ 1/12

Ellis Ladder Improvements
eli@FallSafety.com

c. What to hold at heights (if you fall):

Rungs yes

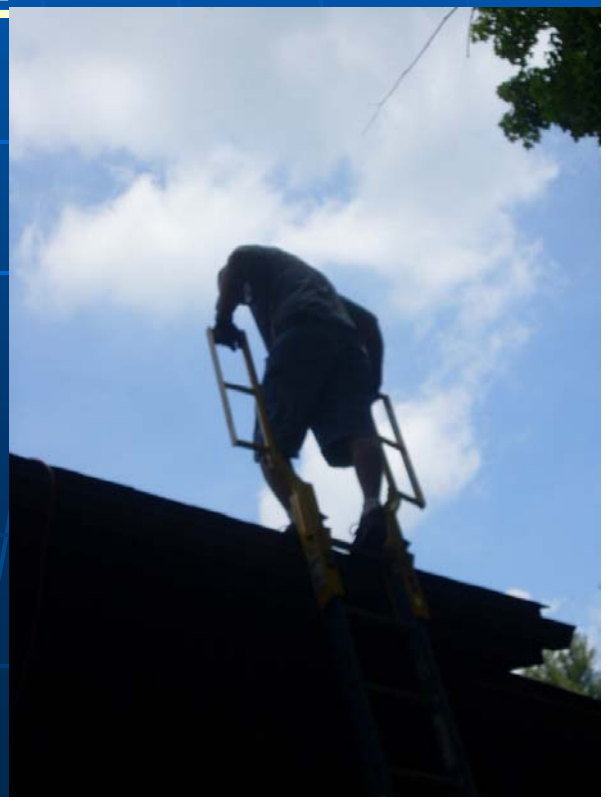
Side rails – not reliable

Young, Justin G. et al, ***Biomechanics of Hand/Handhold Coupling and Factors Affecting the Capacity to Hang On***. Doctoral Dissertation, Department of Industrial and Operations Engineering, University of Michigan, Ann Arbor, December 2010.

Hold Ladder Side Rails at your peril

d. Three Point Control:
Analysis and Recommendations

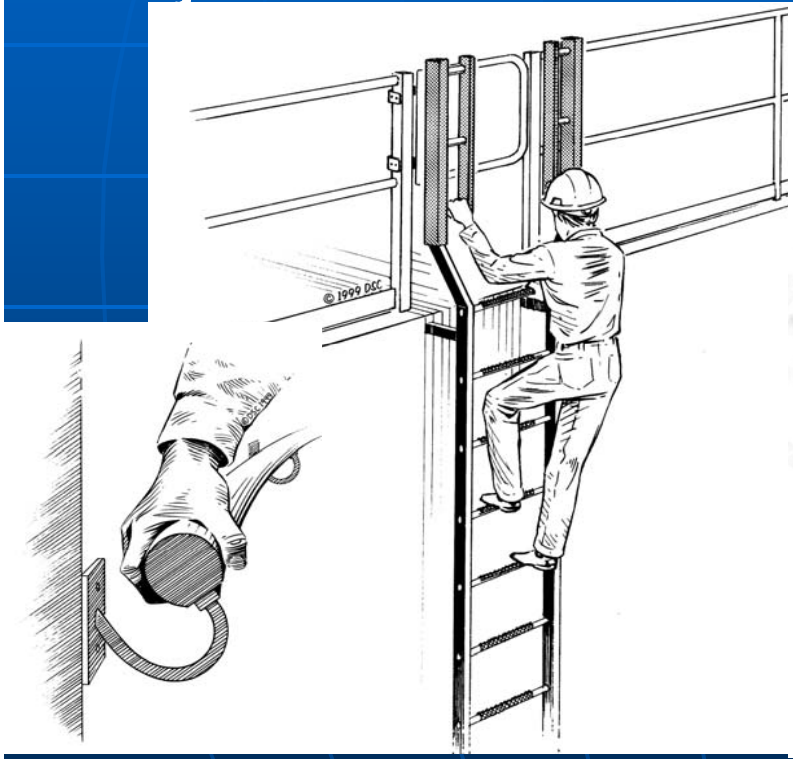
White Paper
www.FallSafety.com/whatsnew.cfm



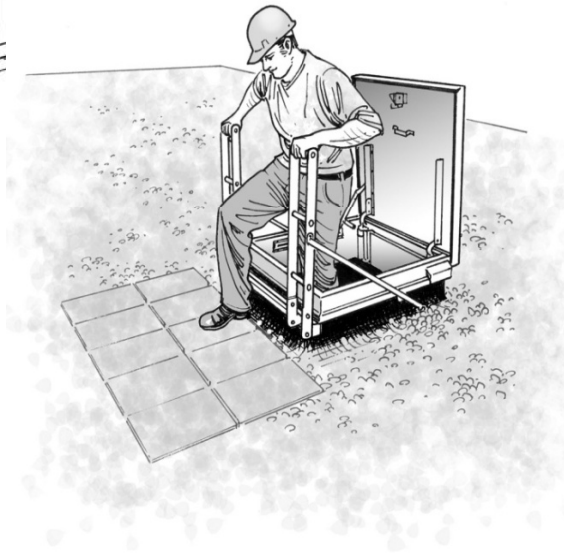
Three Point Control

Must Hold Engineered Horizontal grab bars, rungs

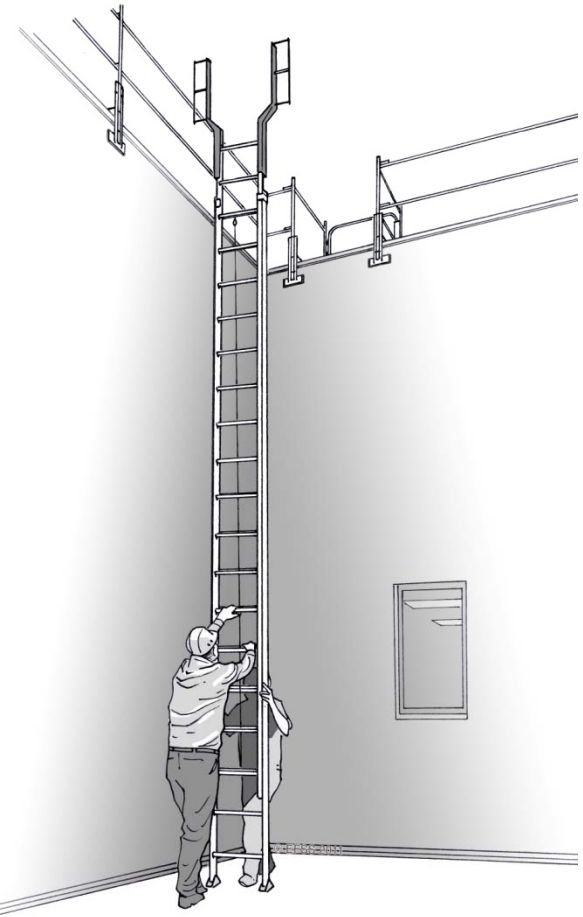
- Ladders: the product w/greatest fall injuries



Two stair rails held



Fixed Ladder Horizontal Grab Bar (Rung) Ext'n



Roof Hatch Walk in/out

e. Portable Ladder Walk Thru

extension fits to each side rail

Falls from accessing upper levels with ladders: 3 ft extension solved; no step-around ladder hazard

RaptorSafety.com

UP

DOWN

f. Consider new methods of Access and Fall Protection

- Platform Nets

Pioneer: Dr. Marco Einhaus, www.bg-metall.de

www.isfp.org to see his recent paper
Welding flash hazard addressed with inspection procedure

Platform Nets

Walking working surface
Access and FP

eg S. African World Cup Soccer stadiums built this way in 2009

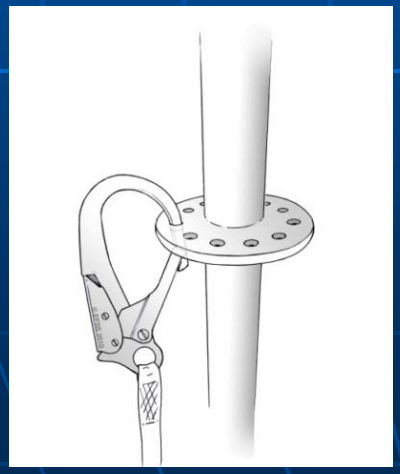
This is not like chain-link fencing

g. Snaphook Gates: Check Equip't Now!

- Post 2007 Gates 3600 lbs min.
- Pre 2007 Gates 220 lbs (Two Hundred Twenty)
- Gates get bent due to incompatibility
- Employers should make all anchors compatible w/snaps Note: Weak nose still exists

Weak nose

Weak gate



Z359.1-2007

Weak nose?

Strong gate

Weak nose

Weak gate

Nose opens

Z359.1-1992(R1999)

What about Snaphooks?

- Z359.0 through Z359.4 all new in 2007except for Z359.1 Snaphook gates 3600 lbs v. 220/350lbs)
- Z359.2 Managed Fall Protection Program:
  - fall protection planning
  - minimum training

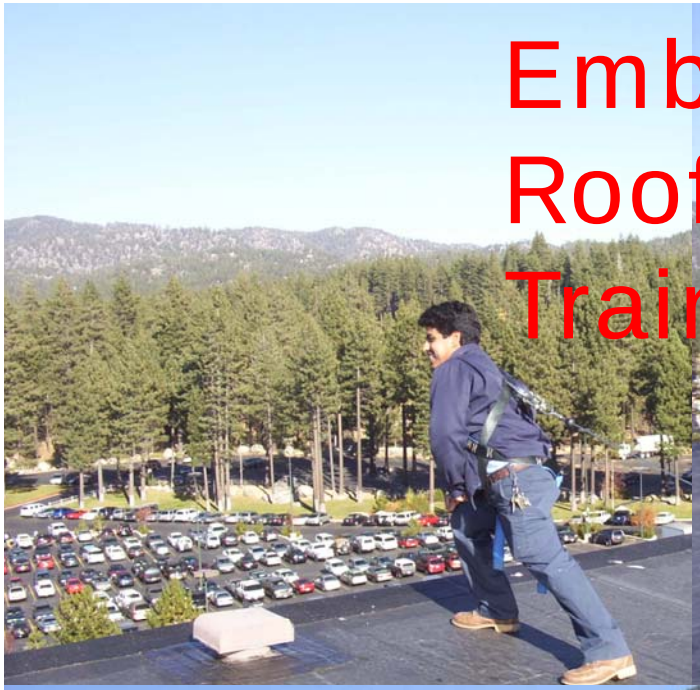
Ellis Recommendation:

- A10.32 “old”: Don’t use this Std!
- Use only Z359.12-2009 compliant snaphooks

7. Multiemployer Sites

- Summit Construction case is benchmark for GC or CM duty
- One CM person onsite is sufficient
- Help Subcontractors create anchorages
- Criteria for anchors: create templates or refer sub to structural engineer
- Training

Embassy Suites Reno Roof Fall System Training



Harness suspension training

8. Transportation: Stationary Vehicle Falls

- OSHA Alliance Construction Roundtable: Steel Construction Flatbed Unloading
- First Draft Design Solution available

BLS 2010:
76 work fatalities from Stationary Trucks and Trailers

9. Fall Management
Design-Based Safety

- Dave MacCollum: “Construction Safety Engineering Principles” McGraw Hill 2007

- A Hazard has three modes:
- Dormant – No people around
- Armed – People around
- Active – Fall onset: Too Late to Stop

Matrix: Multiple Solutions

A Tool to recognize ALL Worksite Hazards

Recognized Hazard / Solutions	Eliminate		Guard		Safety Factor		Redundancy		Reliability
	List Hazard	Safety Sol'n	List Hazard	Safety Sol'n	List Hazard	Safety Sol'n	List Hazard	Safety Sol'n	Admin
Natural	Human Factors. Falls								
Structural/ Mechanical									
Electrical									
Chemical									
RadiantEnergy	Fire								
Biological									
Artificial Intelligence									

Natural Hazards include Gravity

Use Tool to recognize Skylight Fall Hazards

Recognized Hazard / Solutions	Eliminate		Guard		Safety Factor		Redundancy		Reliability
	List Hazard	Safety Sol'n	List Hazard	Safety Sol'n	List Hazard	Safety Sol'n	List Hazard	Safety Sol'n	Admin
Gravity	Fall	Remove sky light	Fall	Screen or curb at 42"	Fall	Stronger skylight	Fall	Guardrail & cover	Planning & surveys
Structural / Mechanical *	Collapse	Cover & secure	Collapse	Burglar bars	collapse	Test for 97%ile male weight	Fall Through	Screen & bars	Inspect Strength report
Radiant Energy	UV Degrad'n Firefighter Access	Screen 20 yrs or Less than 12" gap	Crazing at screw holes	Screen And Replace	leaks	Test for 20 yrs, Replace	Exposure to replace	Use change-out tool	Test Miami Dade 5 yrs
*Attractive nuisance	Sit on	screen	Bounce* Trampoline	Guard rail	Stand on	screen	Two person	screen	Add warnings
*Burglar entry	Burglar access	Secure access & grill	Fill opening	Add grill	Screws remove	Larger w/tool	Two hazards	Screen & bars	Evaluat burglar method
*Maintain skylight/screen	Replace skylight	Use change out tool	No barrier	Use net frame	Weak structure	Alum. Ribs in skylight	Not enough protect	Add PFAS to Burglar B	Design screen limited opening

10. Summary & Challenge

- Sell additional safety to leave in place that your crews can use
- Work with the Design Team to promote Hazard Elimination methods from the start
- Remember you and architect are working for the same client & have same interests
- Hazard Elimination by design v. harness systems costs are equal after est. ten years

Q & A

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- Fall Protection Educational web site www.FallSafety.com ref: Archives/What's New