

Advances in Roof Fall Protection Planning

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What we will discuss today:

- Roofs and their maintenance activities
- Identify Roof Fall Hazards
- Trades on Roofs
- Some incidents
- Some roof fall protection installations
- Safety Standards
- New requirements for Roof Hatch safety
- Feedback from Roofers

What did I miss that you'd like to discuss?

Roof Fall Protection

- A roof is fundamental to human existence in buildings
- A roof may leak and need repair
- A roof is a walking working surface
- OSHA exempts inspectors and estimators but you may not

Your roof is visited often by the trades

Roof Fall Hazards

- Edge of roof
- Fall on and through
- Fall down open roof hatches
- Fall down fixed or portable ladders
- Access dangers climbing over parapet or fire walls
- Slope/Edge/Gable – residential type
- Surface Materials – slip potential
- Stepping into gap between buildings
- Weather – snow removal
- Housekeeping
- Human hazards

More Roof Fall Hazards

- Fixed Ladder (transition to or fall off or foot slides thru)
- Roof Hatch curb fall back
- Skylight curbs/Light Transmitting Panels
- Portable Ladder to upper roof
- Edges (step backwards or step onto extended material)
- Rubber roof bubbles/blisters loss of balance
- Steep Slopes (>8 in 10)
- Trip Hazards (wires, pipes etc. at ankle height)
- Trips on bolts, screws, displaced grates, materials
- Collapse (repairs)
- Fall throughs (eg. stepping down from firewall)
- Smoke Vents (checking opening operation)
- Window Cleaning chair and lifeline rigging habits

The 28 Trades visiting a roof:

- Roofers
- HVAC
- Laborers
- Electricians
- Security
- Telecom (towers/dishes)
- Carpenters
- Plumbers
- Sheet metal
- Landscapers
- Stationary engineers
- Painters
- Chimney/stack maint.
- Window Cleaners
- Cable TV antenna
- Satellite dish
- Siding
- Mechanics
- Insulation installers/pipe wrap
- Cell Phone dish installers
- Maintenance (drainage, patching)
- Glazers
- Millwrights
- Helicopter landing maintenance
- Flagpole maintenance
- Sign/display maintainers
- Environmental air sampler reps
- Firefighters (fire drill or fire)

Crews are 1, 2, 3 or more persons often visiting the first time with your Escort

Most Fatal Falls in USA

- Portable Ladders
- Roofs
- Scaffolds
- Temporary Guardrails

60% +

Explaining the rules and new standards better to employees – yours and your contractors might help

Roof Fatalities USA 2008 Prelim.

■ Total Falls*	680 (13% total)
■ Scaffolds	68
■ Holes	43
■ Ladders	116
■ Roof Falls	121 (20%)
• Skylight	22
• Edge	50
• Roof Surface	18
• Existing Roof Openings	8

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

Access to Roof

- Stair
- Roof Hatch
- Fixed Ladder (interior and exterior)
- Portable Ladder
- Ship's Ladder
- Aerial Lift

Controlled access critical

Director of Maintenance is
in best position

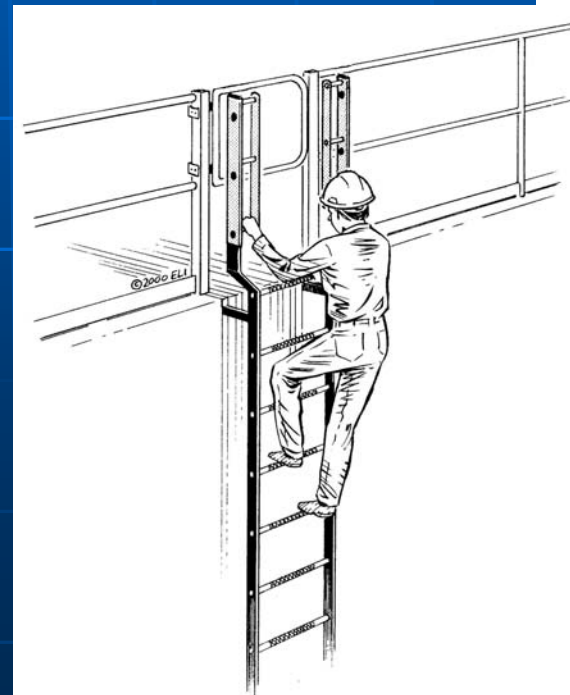
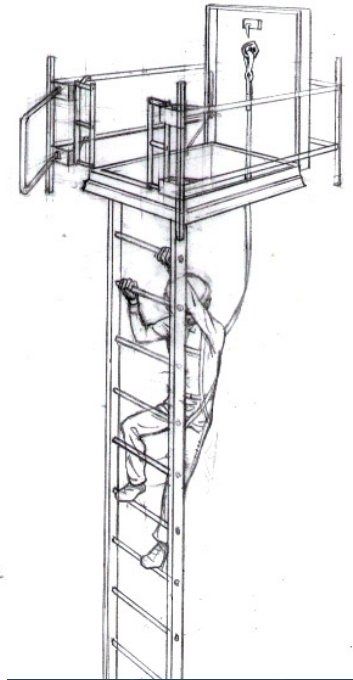


Roof Access by ladder



Dangerous!
Ladder may tip

Interior
access
w/FP

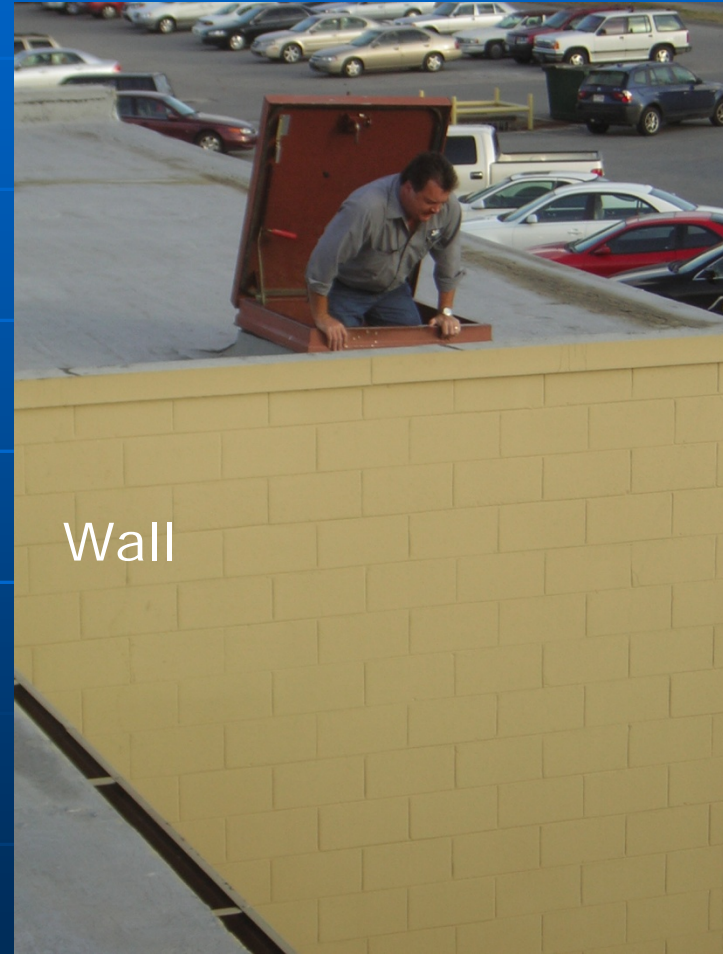


Exterior
access

Access should be moved



Hidden danger at top



Wall

Ladder should be installed on inside wall

What are the hidden dangers on your roofs?

- How do you make invitees knowledgeable of hazards? (including roof maintenance consultants)
- How often are roof escorts trained? Duties?
- Is your Policy to eliminate roof hazards?
- Do you provide walkways from access points?
- Can you really rely on filed contractor safety programs? Or should you test, observe, check
- Do maintenance checklists work for you?
- How do you qualify your roof contractors?
- Do you have safety consultants to help inspect?

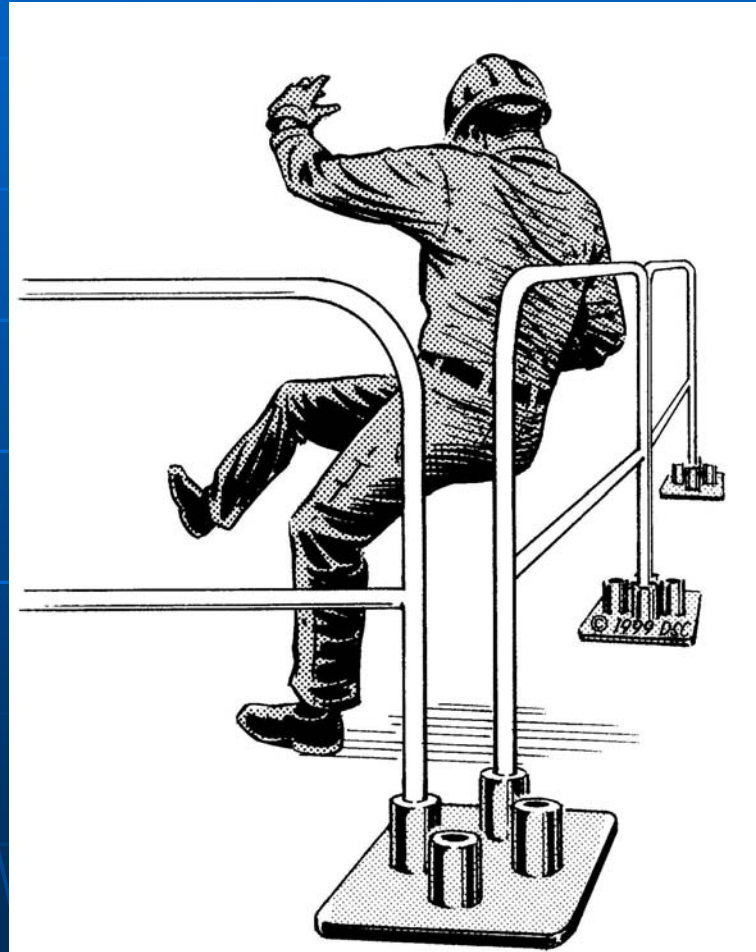
When you sense a hazard, act to prevent; please don't rely on insurance

When does a roof require fall protection?

- Any person on roof to do work (or simply enjoying the view)
- Demolition of a structure (tower)
- Re-Roofing
- Window cleaning
- Snow removal

Railing or waist high parapet
always for non-work visitors

Temporary edge protection



Right angle section avoids tipping

Fixed Ladder and Roof Hatch

- A source of danger is roof access to a ladder through a roof hatch
- Solutions are available:
- www.FallSafety.com



Security Padlocks add to danger

Roof Hatch Solutions



Horizontal Grab Bars

ANSI A14.3-2008

Corps of Engineers

EM385-1-1(2003) App J



ANSI A14.3-2008 Roof Hatches

- Section 5.3.4.3
- "Hatch openings shall be provided with a means to facilitate access and exit from a fixed ladder (i.e. Grab Bars or other such items that can be grasped by the climber)"



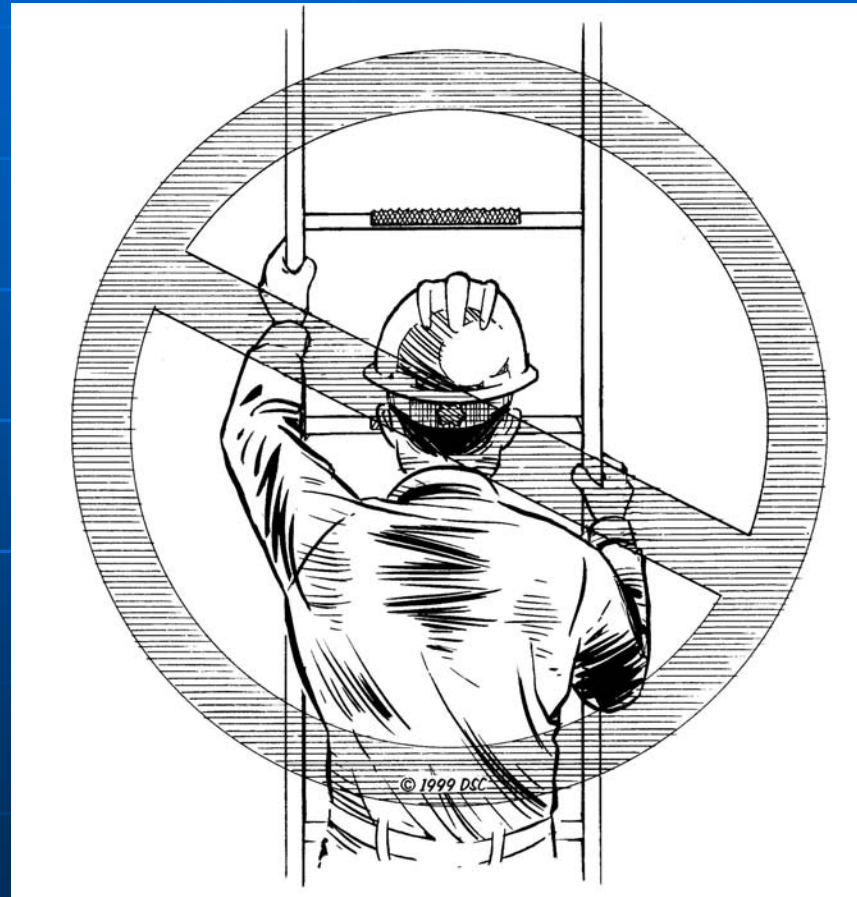
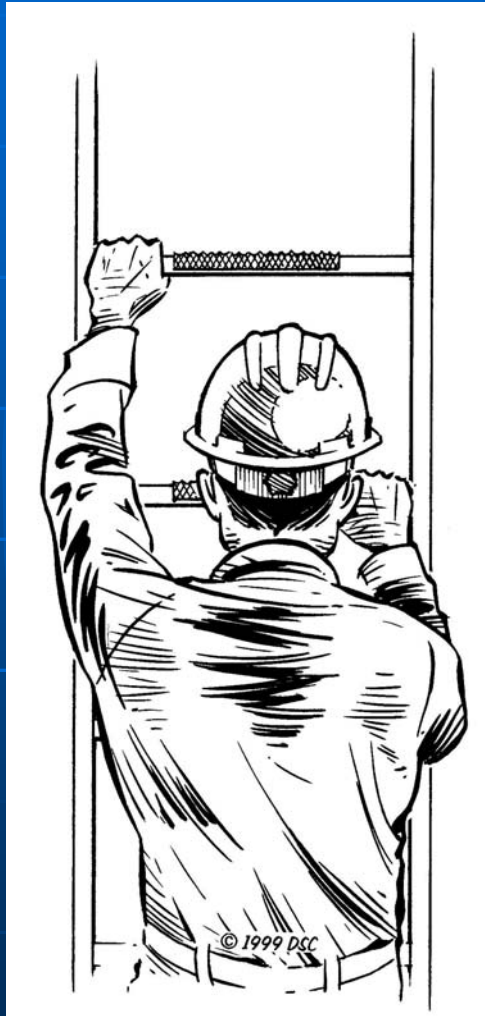
Note: Roof has no edge protection but does have walkways

Why hold Grab Bars/Rungs only?

- Univ. Michigan Biomechanics Lab report*
 - 12 subjects: no-one could not hold onto siderails when flat step pivoted to vertical
 - 2 subjects (female students) could not hold their weight grasping a rung
 - Report available nigel@FallSafety.com or www.FallSafety.com
- Report Summary: On any ladder if falling, never be holding the ladder siderails; you will fall to ground

* Preliminary NIOSH
(CPWR) funded study 2008

Hold round rungs of any ladder



Ladder Rungs and grab bars should be 18" above foot level on oil trucks

Why do we refuse to recognize that Skylight Hazards become disasters?



West Coast



East Coast

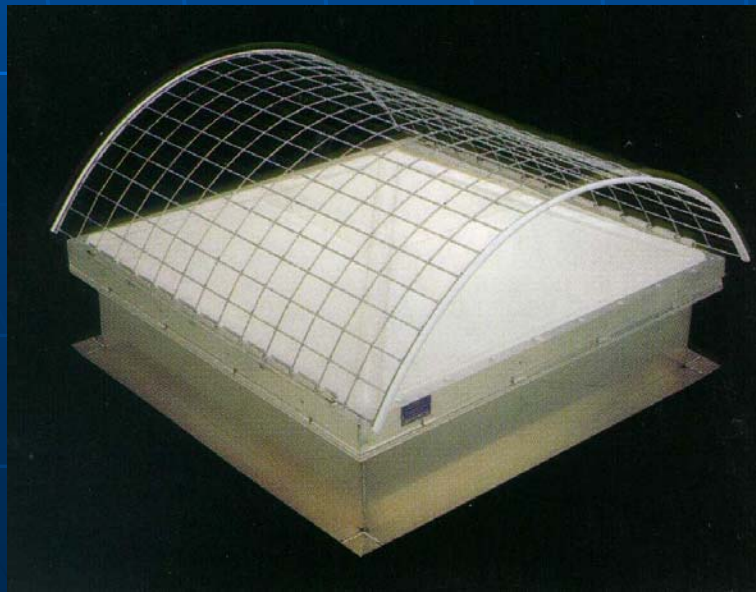
Who will sell this prevention to management? \$400/ea installed

"1% protected since 1971" Plasteco



OSHA Requirements for Skylights since 1971

- 1910.23(a)(4) & (e)(8) Buildings - mandatory
- 1926.501(b)(4)



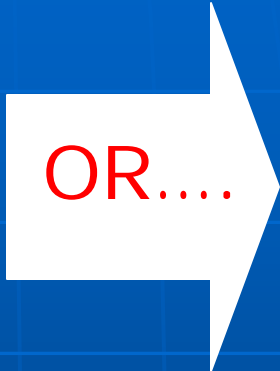
Skylight Change-Out concept to protect your maintenance staff



Patent Pending



"Sponge steps"



**Best Solution:
Slideguards
and SRL's**

**Roof Fall
Hazards
Recognized**

Residential-type Re-roof



Slideguard



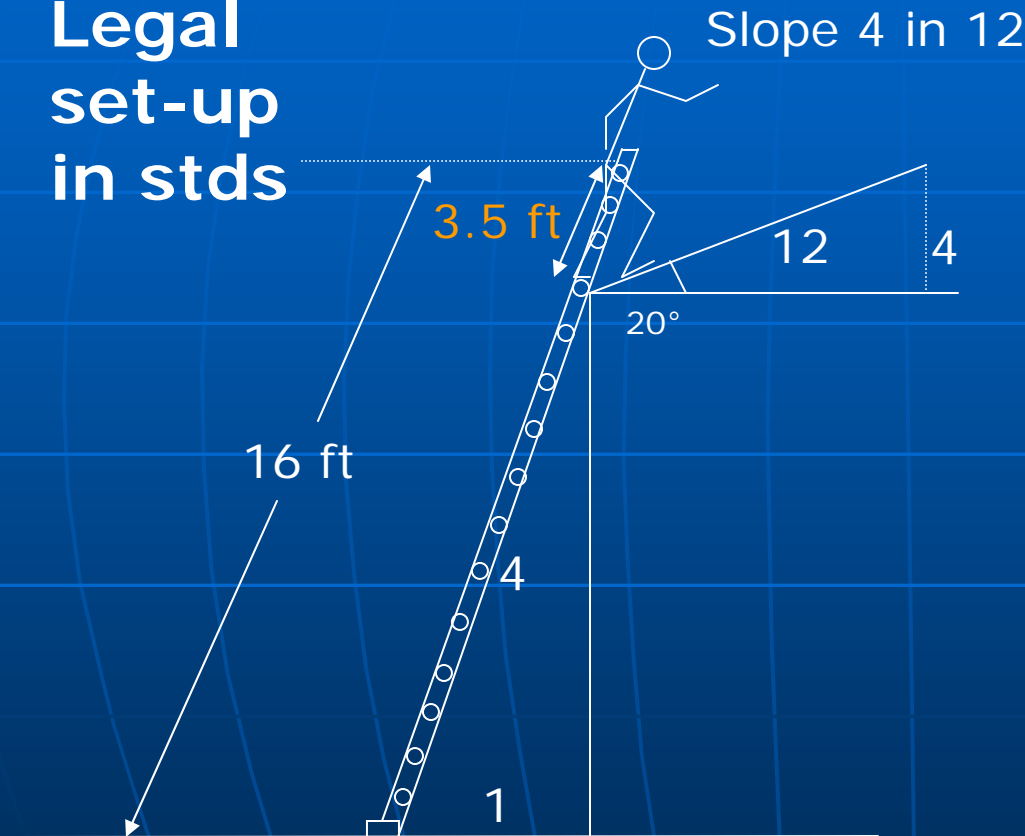
SRL post system =
"gap"
protection



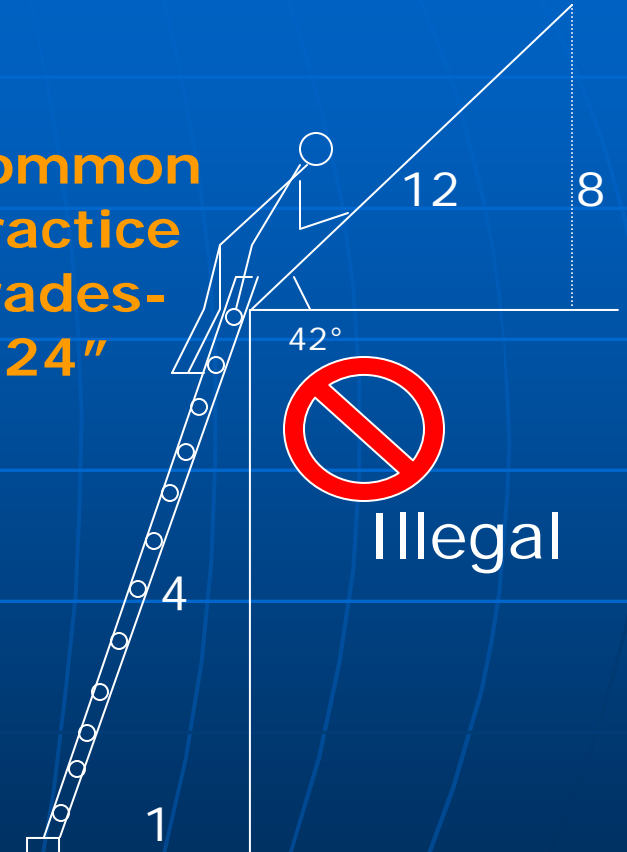
Portable Ladder Extension

Slope 8 in 12

Legal
set-up
in stds



Common
Practice
Trades-
6-24"



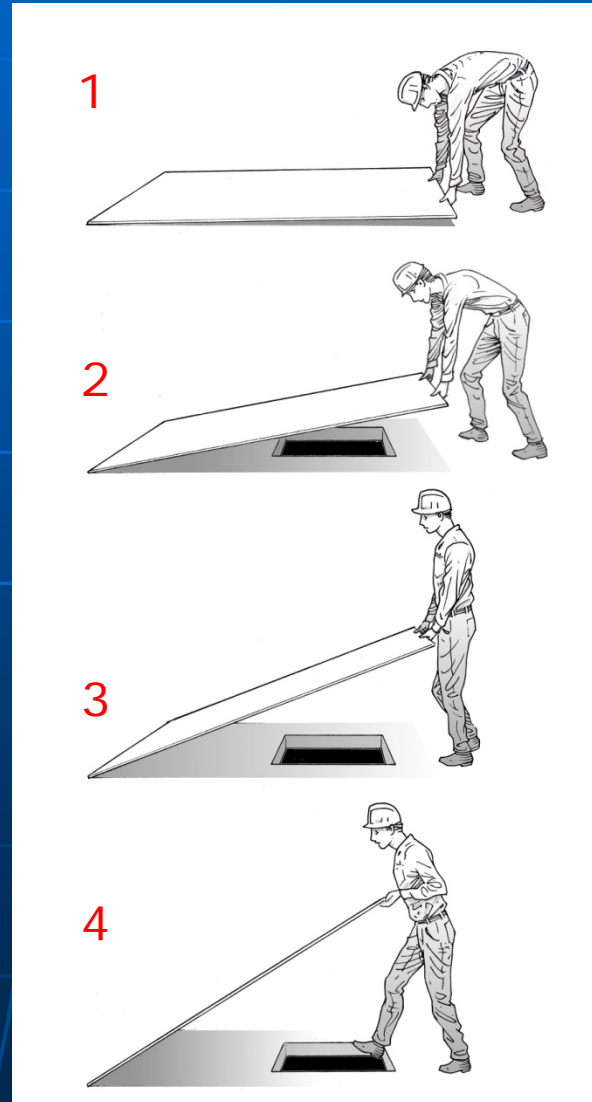
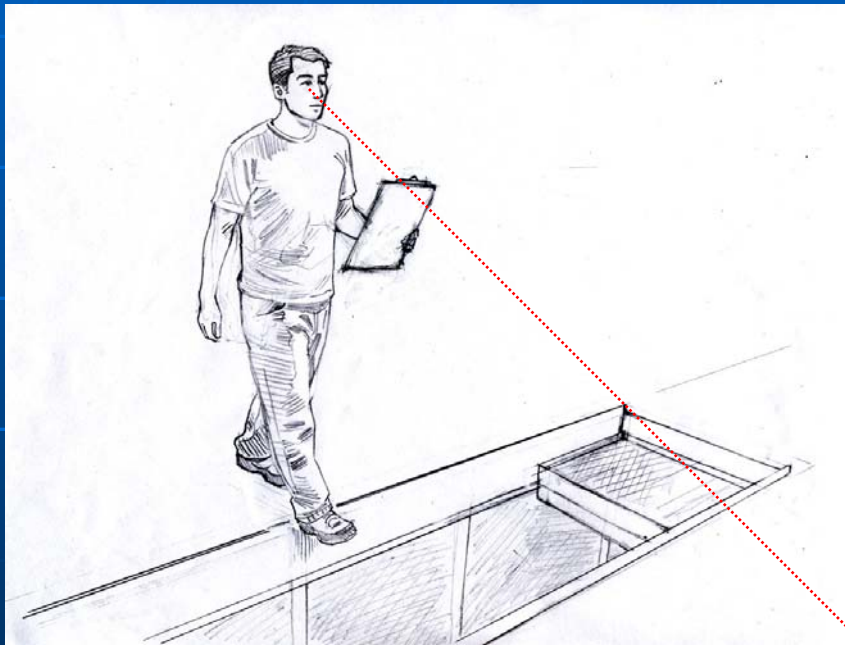
OSHA/ANSI A14
compliant, CoG moves
around ladder easily

Dialogue with
more detail?

Steeper roof pitch
makes it harder to
stand unless going
over the ladder

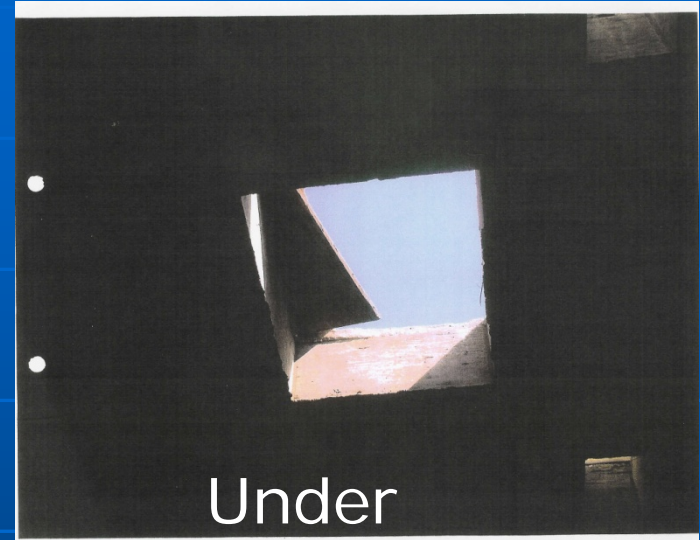
1. Holes are hard to see: 2. Cover and secure before this

Cover ASAP

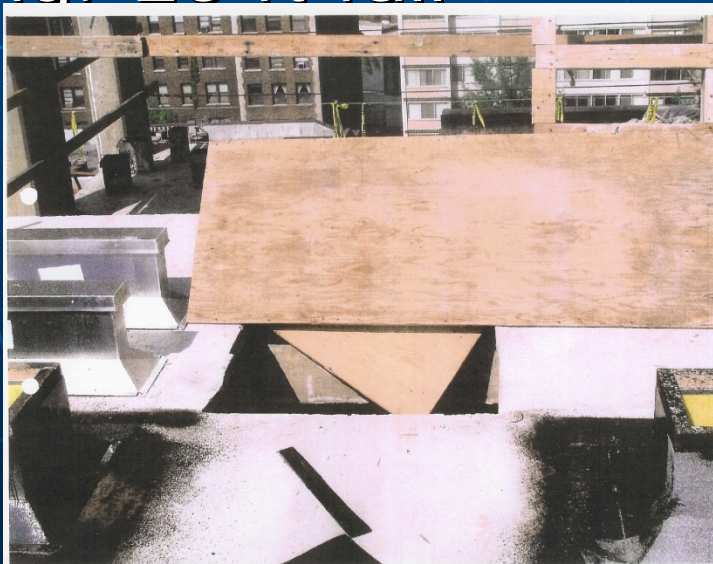


Roof Hole at Construction site

- Washington DC
- 10 story building roof
- WaterProofer Torchdown work
- "No Fire!" instruction
- Fell through roof hatch opening: 25 ft fall



Under



Front

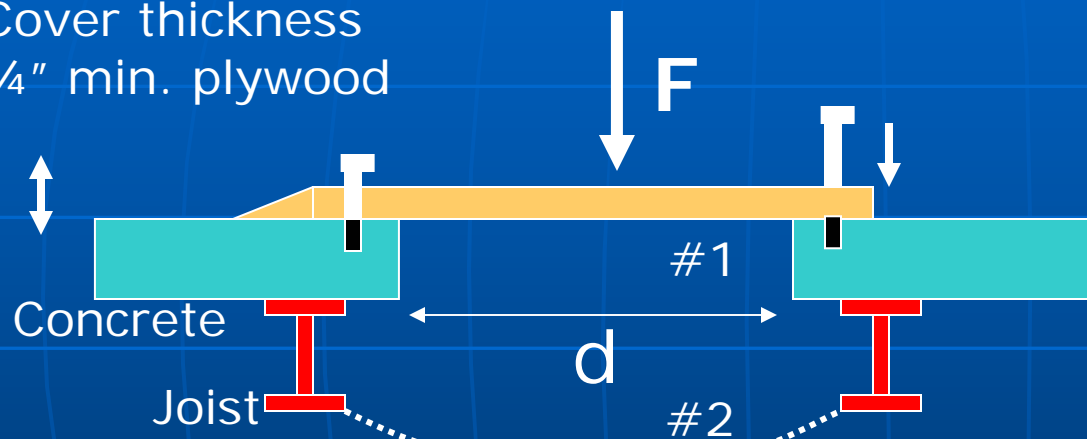


Side

Temporary Covers over holes

Static & Dynamic Force F
(human and/or vehicle impact)

Cover thickness
 $\frac{3}{4}$ " min. plywood



d min 2" OSHA 1926.500
 $d > 3"$, $< 12"$ Leg breaker
 $d > 12"$ body fall through

Proposed impact test:

Skylight: 267 lbs 95%ile
w/conical lead wt bag
30" fall height **proposed**

"Bobcat" must be crawler

Roof or floor openings for
HVAC, plumbing, chutes etc.
And Noise / dust barrier?

One piece Plywood up to 4 ft
dimension. If > 4 ft then 2x4"s
and nailed plywood up to ?"

Round or square floor hole

Marking clarity: DANGER! Hole Cover
Covers are usually trip hazards

Walk-in Hole Danger: Demo a loose liftable cover

WARNING! Holes and Hole Covers

- An engineering subject of discussion
- Not a helper laying/lifting a board
- Must look at the consequences

How do you recognize all the fall hazards?

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
Envirom'l									
Structural/ Mechanical									
Electrical									
Chemical									
RadiantEnergy									
Biological									
Artificial Intelligence									

Hazard Matrix Recognition Tools

- Left column: All known spec. hazards by category eg Structural/Mechanical: Collapse; Human or Artificial Intelligence is computer software reliability and wiring
- Horizontal Row: **Means of control of hazard**:
 - **Eliminate**: By work sequence or re-design out
 - **Guard**: Prevent with barrier or travel limit
 - **Safety Factor**: Increasing cable diameter
 - **Redundancy**: Two means of protection
 - **Reliability**: Cycles to failure; conditions: Plan

Environmental Hazard Exposure example:

- Gravity: Specific known/observed hazard is falling onto & through a skylight while walking a roof. Reduce incidence by adding a metal screen good for 20 years (SS?)
- Water:
- Wind:
- Lightning:

Use Tool to recognize Skylight Fall Hazards

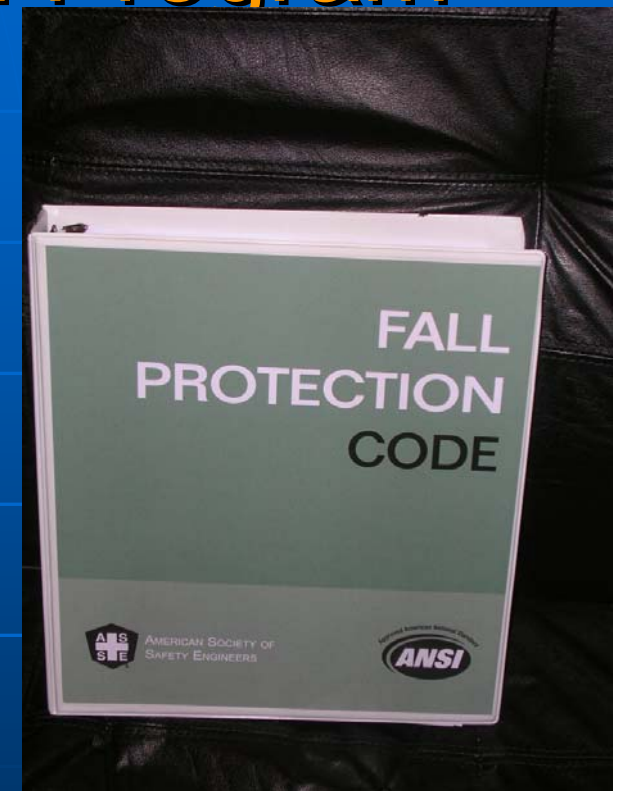
Recognized Hazard / Solutions	Eliminate		Guard		Safety Factor		Redundancy		Reliability
	List Hazard	Safety Sol'n	List Hazard	Safety Sol'n	List Hazard	Safety Sol'n	List Hazard	Safety Sol'n	Admin
Gravity	Fall	Remove sky light	Fall	Screen or curb at 42"	Fall	Strong skylight	Fall	Guardrail & cover	Planning & surveys
Structural/Mechanical *	Collapse	Cover	collapse	Burglar bars	collapse	Test for 97%	Fall Through	Screen & bars	Inspect Strength report
Radiant Energy	UV Degrad'n	Screen 20 yrs	Crazing	screen	leaks	Test for 20 yrs	Exposure to replace	Use change-out tool	Test Miami Dade 5 yrs
* Attractive nuisance	sit	screen	Bounce*	Guard rail	stand	screen	Two falls	both	Add warnings

Degradation of Components

- Lanyard Snaphooks – OSHA compliance is now a hazard if you buy 220/350 lbs gates instead of 3600 lbs gates (ANSI Z359.1-2007)
- Skylights – plastic uv deterioration – cannot protect except with metal screens – despite mfrs assurance – no skylight is adequately tested for human impact
Note: Skylight term includes metal building translucent light panels

New ANSI Z359.2-2007 Managed Fall Protection Program

- Written Policies, frequent Surveys and Job Duties
- Fall Protection Procedures and hours of Training for Trainer
- Recognizing, Eliminating and Controlling Fall Hazards
- Rescue Procedures and Training
- Incident Investigation rigor
- Evaluating Program Effectiveness (Program Administrator)



Bally's AC open Roof Hatch?



Harrah's AC 2008



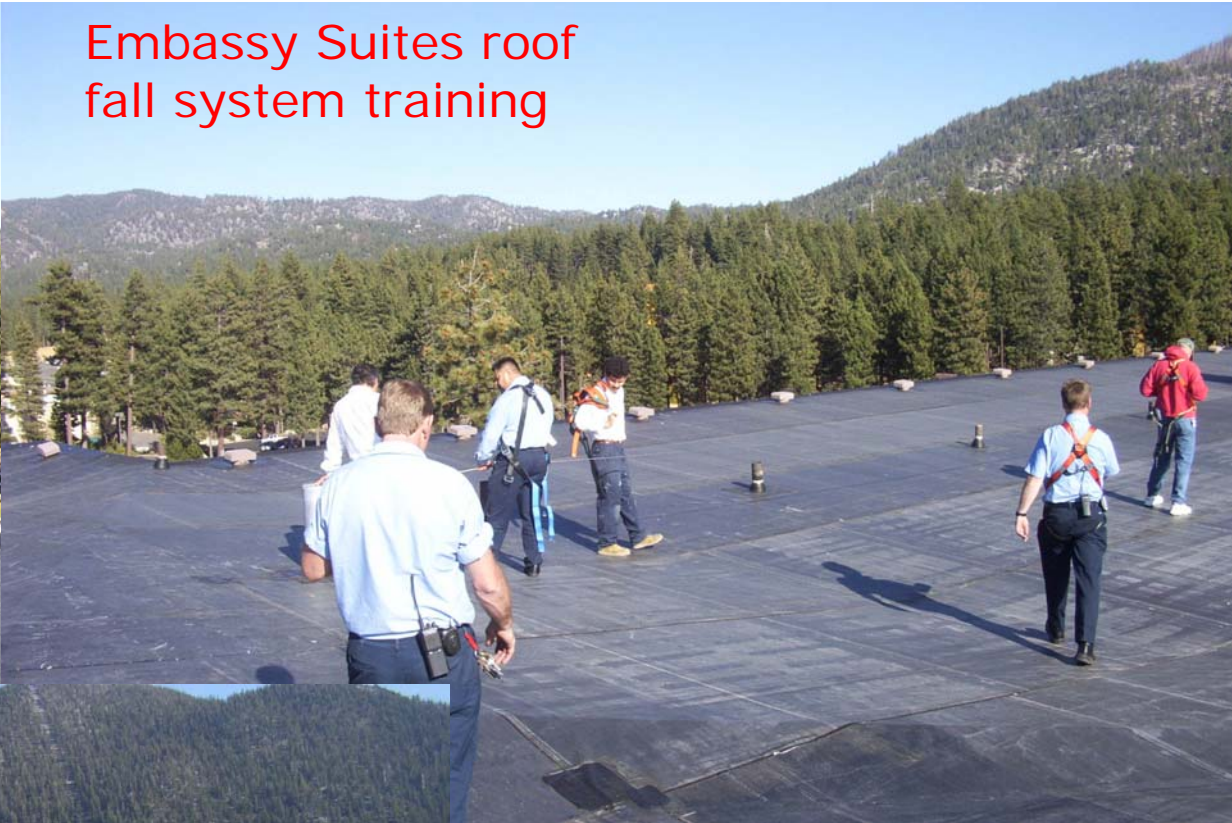
Monumental Skylight Pool Roof

Embassy Suites Lake Tahoe 2008



HLL for snow removal over edge

Embassy Suites roof
fall system training



Harness
suspension
training

Stock answers may not be the whole answer:

- Can you spot failure modes? FMEA
- How will people behave w/a set-up?
- Effect of Cones? Caution Tape?
- Portable ladders? Common Usage
- Ask: Can you eliminate as first choice?
- Can you dialogue (train) better?
- Can you make time to observe the work?
- Will you inspect and (if nec'y) stop the work?

Who will be ready to support you?

Fall Hazard Identification and Engineering the Hazards Out

- Substitution: use aerial lifts
- Sequence change to reduce the hazard
- Work from Ground with hi-reach tools
- Lower the area lighting

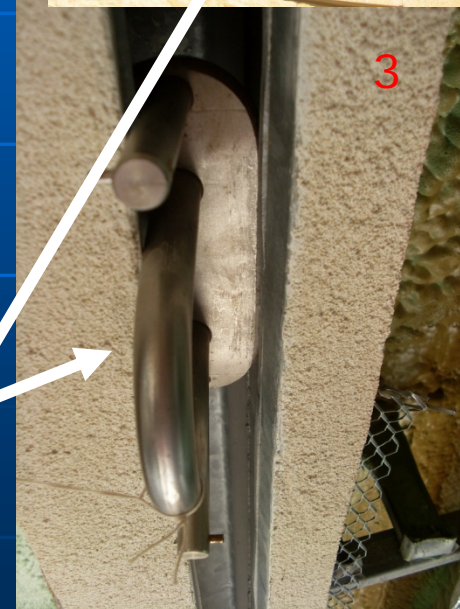
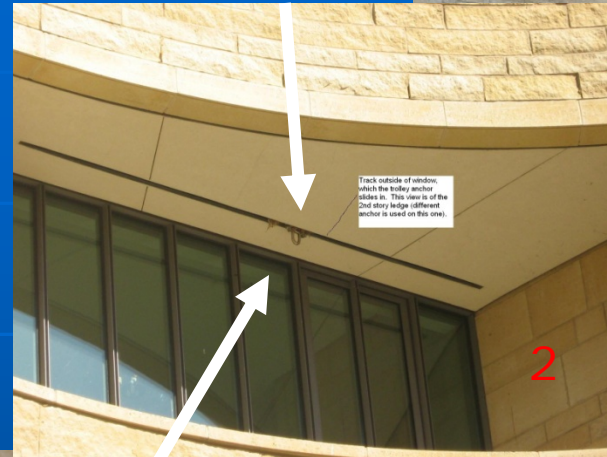
Elimination is key,

Be practical but stay outside the nine dots

Window Cleaner Foreman Fatality

- New Facility 2008
- Window cleaners trained for descent device use
- "Always use independent lifeline"
- Ends up with both lines attached to sole anchor
- Slider pulls out of track
- OSHA citation dropped

Track System,
one anchor



Future: Must do Independent inspection

Owner must Establish Rules for Safety & Health with Roofing Contractors

- Control Access to roof (minimum interaction with guests)
- Adequate ground area traffic control
- 9 am – 5 pm has consequences (7-3)
- Break room, portajohns and cooler

The Importance of Hotel "Proper Bid Specs"

Feedback from Roofers:

- Sufficient set up areas for hoists & to avoid contact with visitors, employees and autos
- Early start as possible – winter best
- Provide break room, cooler, & toilets on roof & ground
- Follow advice of roofing contractor rep!
- Tear-off? Expect vibration/debris on top floor
- Owner pre-arranges anchors for edge fall protection; screens over all skylights; show Str. Engr report on roof
- Owner to provide safe ladder access through roof hatch
- Warning lines and monitors give false sense of security
- **Put in bid spec** as alternative; ask for site-specific safety plan, get safety for you plus safety for them
- Announce watch-dog knowledgeable in OSHA regs

John Barnhard, Pres. United Union of Roofers,
Waterproofers & Allied Workers 10 9 09

Before, During and After the Fall

- **Before the Fall:** Authorized Worker Application training; Pre-plan per Z359 anchors; Watch and act
- **During the Fall Hazard Exposure:** proper means of fall protection; two methods if feasible; include contractors and warn of roof hazards
- **After the Fall:** Proper investigation into cause; “we must improve”; “we must learn”; “we must prevent”; and overcome the silence that normally follows incidents

Your job is to Identify Hazards & Find Controls; Communicate those Controls effectively, and Follow Up with deadlines

What is the Risk of falling?

- Risk is an insurance or behavior- based safety term. Ask:

What is the Hazard?

Hazards are a design-based safety term,
Then we can give ourselves permission to
recognize eliminate or control the fall
hazards that produce 20% of the death
and serious injury from falls in the USA

Your Fall Protection Program

Questions?

J. Nigel Ellis: Author,
"Introduction to Fall Protection"

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www.FallSafety.com

An Educational Web Site for high work