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

Interior access w/FP

Dangerous!
Ladder may tip

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 knowledgable 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
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?

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
Roof Fall Hazards Recognized

Best Solution: Slideguards and SRL’s

OR....

“Sponge steps”
Residential-type Re-roof

Slideguard

SRL post system = "gap" protection
Portable Ladder Extension

Legal set-up in stds

Slope 4 in 12

3.5 ft

16 ft

12

4

20°

Common Practice Trades-6-24”

Illegal

Slope 8 in 12

12

8

42°

Dialogue with more detail?

OSHA/ANSI A14 compliant, CoG moves around ladder easily

Steeper roof pitch makes it harder to stand unless going over the ladder
1. Holes are hard to see: Cover ASAP

2. Cover and secure before this ........
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
Temporary Covers over holes

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

Cover thickness ¾” min. plywood

Concrete

Joist

Round or square floor hole

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

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

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

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?
<table>
<thead>
<tr>
<th>Recognized Hazard / Solutions</th>
<th>Eliminate</th>
<th>Guard</th>
<th>Safety Factor</th>
<th>Redundancy</th>
<th>Reliability</th>
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<td>Envirom’l</td>
<td>List Hazard</td>
<td>Safety Sol’n</td>
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<td>Artificial Intelligence</td>
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A Tool to recognize ALL Worksite Hazards

David MacCollum: Construction Safety Engineering Principles, 2007
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**: 
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<td>Gravity</td>
<td>Fall</td>
<td>Remove sky light</td>
<td>Fall</td>
<td>Screen or curb at 42”</td>
<td>Fall</td>
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<tr>
<td>Structural/Mechanical *</td>
<td>Collapse</td>
<td>Cover</td>
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<td>Burglar bars</td>
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<td>Radiant Energy</td>
<td>UV Degrad’n</td>
<td>Screen 20 yrs</td>
<td>Crazing</td>
<td>screen</td>
<td>leaks</td>
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<tr>
<td>*Attractive nuisance</td>
<td>sit</td>
<td>screen</td>
<td>Bounce*</td>
<td>Guard rail</td>
<td>stand</td>
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David MacCollum: Construction Safety Engineering Principles, 2007
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?
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

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.
Questions?

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

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