Futuristic Fall Protection Now J. Nigel Ellis Ph.D., CSP, P.E., CPE

> www.FallSafety.com 1.800.372.7775

> > ASSE PDC Las Vegas

26 June 2013

Fall Deaths #1

33-36% work fatalities are Falls (14%)
Fall exposures are in the billions
Fall Protection (FP) equipment sales in \$billions over past ten years

• Equipment use has little to no effect on total fall fatalities in USA so far

• Existing codes do not always predict hazards

Goal: No exposure for At-Risk workers

| \mathbf{F} | atalities USA 2011 |
|---|--------------------|
| Total Work Falls* | 666 (13% total) |
| Scaffolds | 68 |
| • Holes | 43 |
| • Ladders | 116 |
| Struck/Falling Obje | ct 219 |
| | 121 (20%) |
| Skylight | 22 |
| • Edge | 50 |
| Roof Surface | 18 |
| Existing Roof Opening | gs 8 |

* CFOI reported by BLS

Construction Fatal Falls in USA

Portable Ladders
Roofs
Scaffolds
Temporary Guardrails



(ref. BLS)

OSHA Act 5(a)(2) means the owner is responsible for its contractor workers third party claims under premises law

Future Concepts Discussed Today:

 Moving from Harnesses (Active) to Railings (Passive) to Elimination
 Safety Professionals closer relationship with Structural Engineers
 Reducing Exposures through Planning and Training including eEducation
 Best Practice v. Codes, Regulations, Standards

Goal: Solutions with No Free Fall

Future Concepts:

- Moving from Harnesses to Railings to Elimination
- Safety Professionals closer relationship with Structural Engineers
- Reducing Exposures through Planning and Training
- Best Practice v. Codes, Regulations, Standards

Goal: Solutions with No Free Fall

Possible Hazards Using Fall PPE:

System doesn't meet work needs
Systems degrade over time eg UV
Workers make up their own systems
Non-compatibility of components



Contractors and Subs need Rigorous Attention <u>beyond good written programs</u> Industry, Construction, Fire-related, rescue-related, military, mountaineering, rope access, parachute, electrical, tree trimming

Rigid v. Flexible Systems

No sag in Rigid Systems
Clients want to limit lower height Falls
Easier to Maintain
Clearance is not a Problem if Rigid

Rigid tips the Balance!



Roof Railings

Slide allowed?











Example: Tower Decommission 2011

100 ft cell tower (2"-4" angle)
<u>Written FP Program excellent</u>
Plan to unbolt 20 ft sections; crane down each, FA lanyard Snaphook with 2" openings
Affidavits from three workers –
"We cut Y-lanyard leg off to save weight": 39 lbs plus bolts
WP lanyard had ³/₄" lanyard hook w/chain link added*

Three Point Control ineffective
 Fatal Fall 8 11 11



Owners Responsibility

 OSHA Multi-Employer Worksites?
 Owner (- General - Sub - Sub) <u>immune</u>?
 Owners should conduct Assessments and enforce contracts for shared safety

Engineering Assessments should be by Qualified Person Structural Engineers

E.g. Quiz for Safety Professional: What is the Capacity of an anchorage?

18 ft. Fall Arrest Clearance Diagram

Design those anchor points above head height!!!



Importance of Three Point Control Engineering (Falls < OSHA Trigger Heights) Holding onto horizontal round bars is reliable at height 1" diameter size is optimum for grip in a fall 15 degree angle on aluminum extension Walk-through Extensions for ladders Reduce Exposures w/proper handholds

Ref: Professional Safety Journal 11/2012 & ISFP 6 27 2013





Fall Hazard Identification and Engineering the Hazards Out

<u>Substitution</u>: use aerial lifts/training
<u>Sequence change</u> to reduce the hazard
<u>Work from Ground with hi-reach tools</u>
<u>Lower the area lighting</u> to reach bulbs

Elimination is key, Practice inventing methods that eliminate Summary: Moving from Harnesses to Railings to Elimination

Reduce exposures

 Look for aerial lifts with maintenance record

 Be on Design Team of Owner/architect Fall Equipment masks Fall Hazards

 Look for crane to bring down a 100 ft tower at one time

The Route to Elimination

Future Concepts:

 Moving from Harnesses to Railings to Elimination
 Safety Professionals closer relationship ways

- Safety Professionals closer relationship with Structural Engineers
- Reducing Exposures through Planning and Training

• Best Practice v. Codes, Regulations, Standards

Goal: Solutions with No Free Fall

Why new Fall Arrest Standards may need Engineers

• EA Deceleration limit used to be 42"

• SRL's since 2009: 54" extension

All SRL's since 2012 should be LE (Leading Edge)
EA Lanyard extension 48" since 2009
*12 ft EA Lanyards extension 60" max
Fall distance 18 ft (*25 ft) Note: SRL 2 ft Std Class A

Most lethal exposure is at 15-20 ft

As-Built Drawings by Whom? Calculations in the Field by Whom?

Build Engineer Contacts

 Have a people-oriented structural engineer on hand to act as Qualified Person FP. Note: Can be a consultant • Discuss engineering solutions to hazards • Educate the engineer on safety issues: "what people might do" • Have engineering options to accomplish what contractors might suggest but which is typically non-engineered Cannot do FP by Yourself

You say to Architect/Engineer: "Access ladder must be moved"



installed on interior wall

Roof Hatch Solutions

3

Horizontal Grab Bars ANSI A14.3-2008 Corps of Engineers EM385-1-1(2003) App J

Science: Hold Grab Bars/Rungs only

- Univ. Michigan Biomechanics Lab report*
 - 36 subjects: none could hold onto siderail when step lowered
 - 6 subjects (female students) could not hold their own weight grasping a rung
 - Report available on Ladders at www.FallSafety.com
- <u>Report Summary</u>: On <u>any</u> ladder <u>if falling</u>, never hold the ladder siderails; you <u>will</u> slide & go to ground; preferably hold 1" dia. Rungs optimum grip

Design Walk Through and 1" rungs

*NIOSH (CPWR) funded study 2008-2011

Hold round rungs of any ladder





Cannot hold side rails in a fall. THINK DYNAMICS!

Caged Fixed Ladders

HSE ("OSHA") in UK
HSE withdrew specification for
cages on fixed ladders in 2004 but
without explanation (WAHR)

• Use Ladder Climbing Systems

In USA do we have to experience a death after we recognize a hazard to get action?



Commercial Roof Skylights Eggshells!



Widely Recognized Hazard but little or no action; 60 million unprotected in USA need metal screens Building Owners should require ASTM Skylight Testing to draft E06-51.25 for new dome skylights. Building Owners should screen existing skylights

New Skylight boom coming in western states when building inventory is used up



Why do we refuse to <u>recognize</u> that Skylight Hazards become disasters?





Construction Safety Professional can sell this prevention to the owner \$400/ea installed





Top of Escalator: Belt moves at 18"/second

Unguarded belt

Can <u>you</u> <u>recognize</u> a lethal hazard?



irports and Malls ave free-standing scalators



Stair With Guardrail

In Future, all such stairs will have guardrails



Union Station Washington DC

Agreement on Hazard Recognition

Means and Methods is a legal concept

Designed to protect Designer from construction errors
Designing a safe workplace eg Parapets, Stair well railings is a common goal
Communicating early on with Design Team
The Owner, Construction Manager and the Architect form a safety consensus
Where there is no IBC wording eg Skylight protection.....

Note: no OSHA Violation exists if not witnessed





An engineering subject to discuss
Not a helper laying/lifting a board
Must look at the consequences; what may happen
Floor hole covers must be engineered eg size for 4x4' and loading?

Example:

Remember when closing a ladderway hazard: Ladder Swing Gate not the same as Chain & Hook Summary: Safety Prof'ls and Structural Engineers together

Work together to improve solutions

Network with a Structural Engineer

Network with a friendly Architect

Educate in Fall Protection – Great Shortage of Qualified Persons in FP The Route to Elimination

Future Concepts:

 Moving from Harnesses to Railings to Elimination
 Safety Professionals closer relationship with Structural Engineers
 Reducing Exposures through Planning and Training; eEducation
 Best Practice v Codes Regulations Standards

Best Practice v. Codes, Regulations, Standards

Goal: Solutions with No Free Fall

| Use this Grid to recognize Aerial Lift Fall Hazards | | | | | | | | | | |
|---|--|---|---|-------------------------------------|---|--|--------------------------------------|---|---|--|
| Recognized Hazard / Solutions | Eliminate | | Guard | | Safety Factor | | Redundancy | | Reliabil ity | |
| | List Hazard | Safety Sol'n | List Hazard | Safety Sol'n | List Hazard | Safety Sol'n | List Hazard | Safety Sol'n | Admin PrePlan | |
| Gravity | Fall out while reaching | Restrain | Fall while step up on midrail | Screen up to 42" | Fall while transfer | Wishbone connect, follow procedure | Fall hazard and rescue | Guardrail <u>&</u> PFAS, training | Train to stay if rocking | |
| Structural/ Mechanical | Collapse due to bearing failure | Regular maintain check the certs | Ejection: By Auto impact at base | PFAS and self- rescue | Collapse boom or tip over | Check outrigrs fully out & PFAS | Bucket inverts | Restraint <u>and</u> PFAS & rescue method | Inspect Strength report | |
| " | Lean on controls near ceiling | Lock-out & design of controls | Duck under rail: head injury | Use swing gate access | Lift does not respond to controls | Bleed hydraulics and/or descent device | Anchor Pt too low in bucket | Anchor Pt on bucket at 5 ft <u>and</u> or boom | Train: instrns for proper use | |
| " | Walk mast | Prevent access | Tip over | Outrigger s | Stalls w/ load & angle | Higher capacity lift | Tip over | Guard <u>and</u> PFAS | Add alarm & warnings | |
| Biological | Attack by bees | Remote distance tools | Attack by bees | PFAS Control Descent | Descent not fast enough | Increase descent speed | Attack by bees | Add suit and headgear | | |
| Electrical | Touch power line | Keep 10' distance per OSHA & alarm | Touch while on ground | Training stay away or jump | Conduct'n | Use insulated remote tools | Other hazards | Increase insulated equip't tools | | |
| Safety | Profes | ssiona | and E | Engine | eer Fu | iture | Plann | ing To | ol | |

Planning & Training by <u>Engineer</u> & Safety Professional



Horiz'l Lifeline: snow removal over edges

Training for Winter Snow Removal by Safety Professional & Engineer

Harness suspension training

FP eTraining or eEducation?

Live Training: 1. Classroom: Regs/Stds
 2. Hands on harness etc

 Safety Professionals prefer Live Training BUT recognize need for 1-2 new crew education with <u>same exam</u> for eEducation as Live Training

 FP eEducation prediction by speaker – it will catch on for emergency back-up classroom training under Competent Person control & OTJ

No Choice except eEducation in emergency

Summary Planning and Training:

 Training: two parts – classroom and field
 Consider back up plan to do classroom training by eEducation course if emergency need to deliver service on time

Field training must be done live by a Competent Person
Do not have to wait for OSHA: Be Pro-active!

> Every Project requires FP Planning and Training

Future Concepts:

 Moving from Harnesses to Railings to Elimination

- Safety Professionals closer relationship with Structural Engineers
- Reducing Exposures through Planning and Training

• Best Practice v. Codes, Regulations, Standards

Goal: Solutions with No Free Fall

Codes, Regulation, Standards

ANSI Z359 Code
I910.23 Guardrails
ANSI A14 Ladders
I926.20/21, Sub M FP
ANSI A10 Constr'n
I926.1050-1053 Ladder
ASTM E06 Skylight
I926.450-454 Scaffold
IBC Codes
I926 Sub CC/DD Crane

Can Safety Professionals manage updates/ interpretations in these standards; Can Organizations afford to buy them and implement them?

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)



Z359.2 Managed Fall Protection Program

For all ladders





OSHA has not addressed; why wait

Best Practice Scan Justin Young thesis: link FallSafety.com

News: Large Snaphooks

 Z359.1 and Z359.12 (Revised Snaphook gates 3600 lbs v. the old 220/350lbs)

Nose 2600 lbs?

3600 lbs Gate

>5000 lbs

OSHA supports 3600 lbs gate strength. What is a gate supposed to go over?

OSHA News on Snaphooks:

U.S. Department of Labor

Occupational Safety and Health Administration Washington, D.C. 20210 Reply to the attention of:

MAR 1 9 2013

J. Nigel Ellis

306 Country Club Drive Wilmington, DE 19803 Dear Mr. Eths: Nigel

Thank you for your December 21, 2012, letter to the Occupational Safety and Health Administration (OSHA). You have a specific question regarding OSHA's enforcement policy in regards to the new snap hook gate compressive strength requirement in ANSI A10.32-2012, Remember 10-11 Protection Used in Constraints and the Use of the Use of the Safety and Health

Personal Fall Protection Used in Construction and Demolition Operations. This letter constitutes OSHA's response only to the requirements discussed and may not be applicable to any question not delineated in your original correspondence. Your question has been paraphrased below.

Question: Does OSHA plan to update the current enforcement guidance on snap hook gate compressive strength requirements published in Letter of Interpretation #20100427-9737, dated September 30, 2010?

Response: No. OSHA has no immediate plans to change its enforcement policy for snap hook compressive strength requirements. However, OSHA has rescinded Letter #20100427-9737 signed by Ben Bare, Acting Director, Directorate of Construction, on September 10, 2010 because ANSI revised its standard and removed the exceptions for construction. ANSI now requires snap hook gates used in construction meet the 3600lb compressive strength criteria; the same as general industry. When ASSE publishes the updates to ANSI A10.32-2012 and ANSI Z359.1-2007, Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components, OSHA will reevaluate its enforcement policy.

Thank you for your interest in occupational safety and health. We hope you find this information helpful. OSHA's requirements are set by statute, standards, and regulations. Our letters of interpretation do not create new or additional requirements but rather explain these requirements and how they apply to particular circumstances. This letter constitutes OSHA's interpretation of the requirements discussed. From time to time, letters are affected when the Agency updates a standard, a legal decision impacts a standard, or changes in technology affect the interpretation. To assure that you are using the correct information and guidance, please consult OSHA's website at <u>http://www.osha.gov</u>. If you have further questions, please feel free to contact the Directorate of Construction at (202) 693-2020.

Sincerely,

Jim Madd

James G. Maddux, Director Directorate of Construction

Gate compression 3600 lbs 2281bs
10 March 2013

Distributors/Reps and Consultants

- Knowledge from Mfrs
- Free
- What is the Question:
 - Technical
 - System
 - Standards
 - Product Fit

 New breed of FP specialist includes:
 Safety Engineering
 Human Factors
 Structural Engration

- Structural Engrg
- Training to Best Practice
- Installation

Mfr training to product
 As-built drawings
 use and compliance
 No Conflict of Interest!

Summary: Best Practice

Follow Codes

Aim toward VPP (Voluntary Protect'n Program)

- Exceed Minimum Requirements
- Meeting Standards does not guarantee Safety
 Manage the Risk

The Route to Elimination

Futuristic FP starts Today!

 Hierarchy of Fall Protection elimination of the hazard by sequence, substitution or engineering design is seriously #1
 Include contractors, add structural engineer
 Future of Fall Protection is in Reduced Exposures for all under your control
 Determine degree of oversight

Hazard Recognition Team to oversee all work at height

Your Fall Protection Program: Will it reduce exposures? QUESTIONS?

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

4th ed. " 600 p. 2012, ASSE

www.FallSafety.com

An Educational Web Site for high work

efss@FallSafety.com

YOUR FEEDBACK IS IMPORTANT! Complete your online session evaluation utilizing any ONE of the following methods:

Enter in this URL on your web-enabled smart

phone:

- Access the survey directly from your Safety 2013 conference app.
- Have a QR code reader app installed on your smart phone? Scan the Survey Central QR CODE to be taken directly to the Survey Central site.
- Wait to receive the link by email at the end of each day

