



# **Working Safer by Design:**

**Expanding Risk Management  
to Risk Prevention**

**TJ Lyons CSP**

**Gilbane**  
FEDERAL

# Prevention Through Design – Moving From Risk Management to Risk Elimination

- Progress through NIOSH/CDC Efforts
- Threats Designed by Professionals
- The Power of Additional Provisions
- Focus on Efficiency not Safety
- Examples
- Stories and Solutions





*ALBANY TIMES-UNION*  
OBITUARY

**Hanson, John J. Sr., 82, of Castleton, NY**

***“....passed away suddenly Friday, October 7, 2011”***



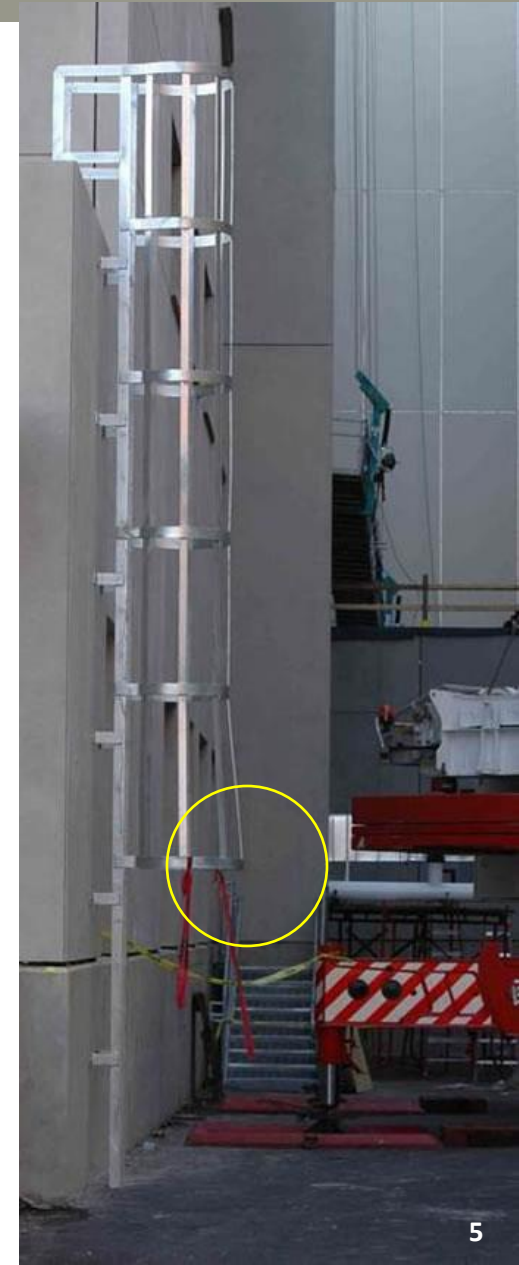
Hanson, John J. Sr., 82, of Castleton, NY

*“...passed away suddenly Friday, October 7, 2011”*

Williamstown, MA – A construction accident at the Sterling and Francine Clark Art Institute left a New York man dead, after he was run over by a piece of construction equipment.



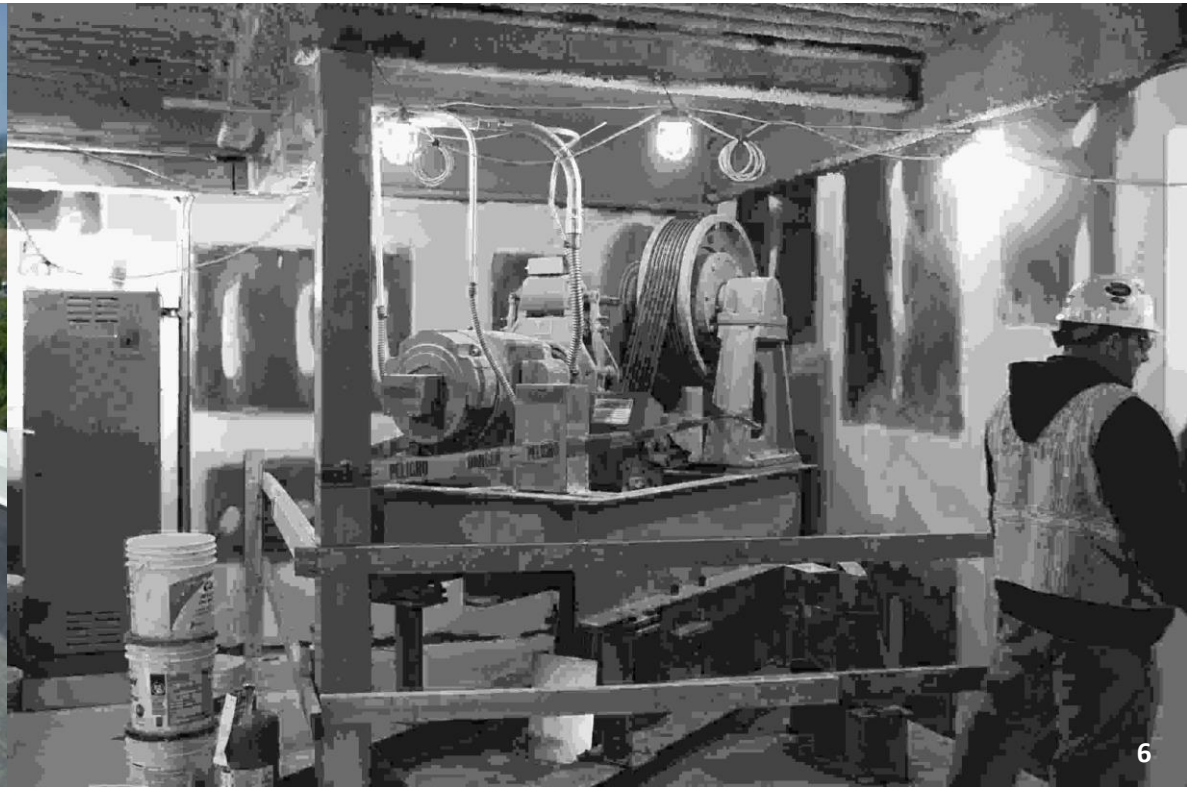
# Designing for Failure



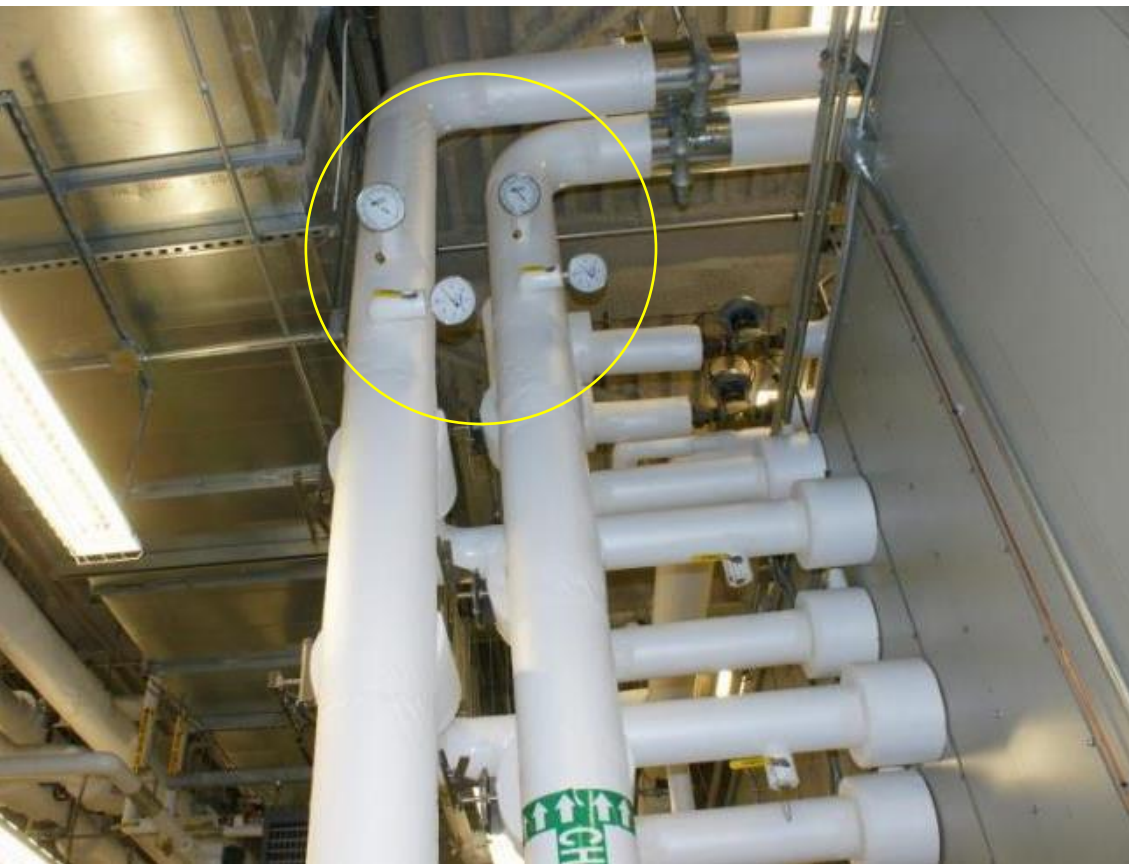


# Designing for Failure

- Designed by professionals
- Owner risk – *Increases each winter or entry*
- Lifetime Threats – It was dangerous during construction



# Designing for Failure



**“Protected” gauges 14’ from floor – unreadable**



**Gauge 7’ from floor – 21” to wall – unreadable**



# Educating Future Designers



Example of a professional barrier

*Broken arm during construction  
Future broken arms anticipated*

# Educating Future Designers

## NIOSH Efforts



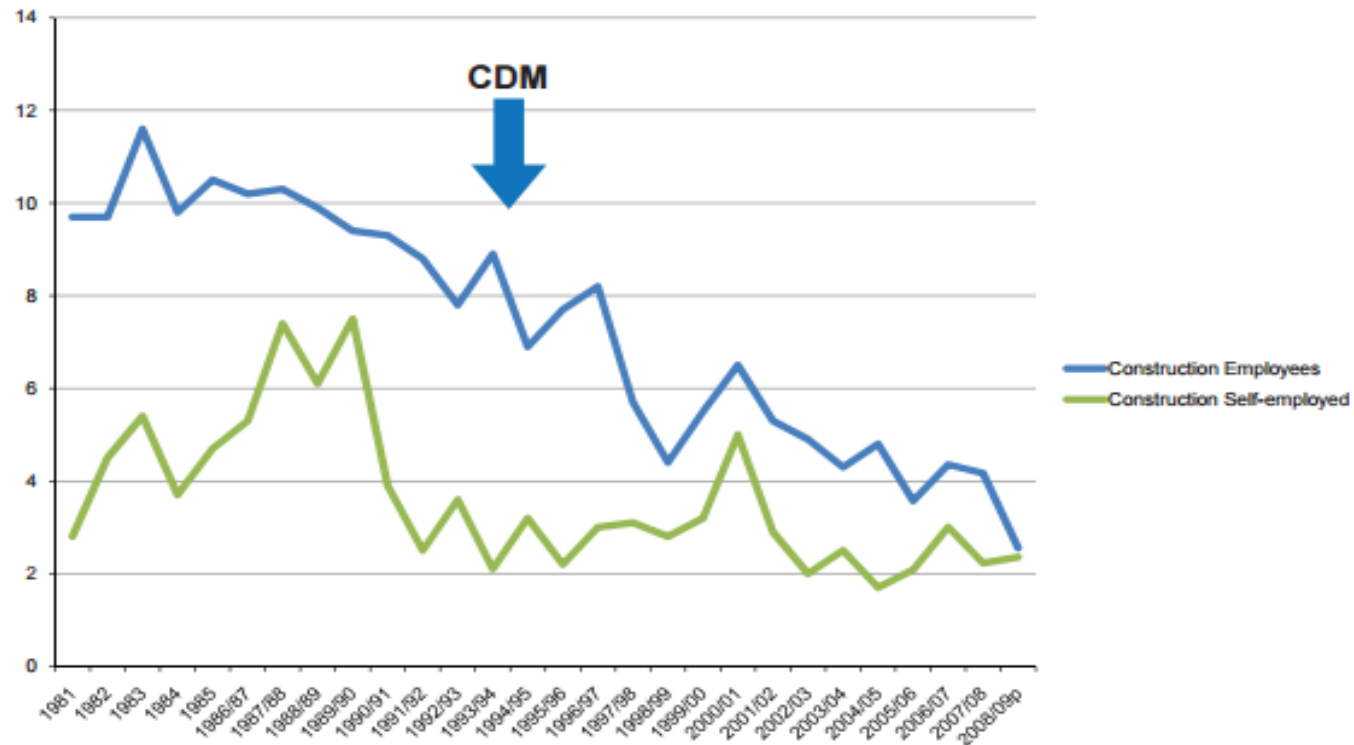
### Learning Objectives

- Explain the Prevention through Design (PtD) concept.
- List reasons why project owners may wish to incorporate PtD in their projects.
- Identify workplace hazards and risks associated with design decisions and recommend design alternatives to alleviate or lesson those risks

**Architecture   Concrete Steel   Mechanical**



# Drop in Fatalities after PtD Regulatory Change - UK



**Figure 5.** Fatal injury rates in the UK before and after the Construction, Design, and Management (CDM) regulations [Gambatese 2013].





**LEED**



LEED BD+C: Core and Shell | v4 - LEED v4

### **Prevention through Design**

Possible 1 point

“Discovery: Perform safety constructability reviews before the completion of schematic design to explore and plan the how safety and efficiency can be optimized during construction.”

# Educating the Owner Don't Buy Hazards



**New High-rise  
New York City –  
Emergency Route**

# Avoiding the “must trust” Design Options Design in the Prevention





# Designed Threats “Armed Hazards” (Dave MacCollum)



# Skylights in US Typically Cannot Support a Person



# The Power of Additional Contract Provisions

- All Powered Industrial Trucks (rough terrain) must be designed to allow operator unobstructed vision to the left and the right.
- In the event the contractor must work on a roof or similar exposure they are required to guard all existing skylights to prevent falls.
- If skylights are installed or replaced they must be designed to support a persons weight.





# Additional Provisions

## Risk Management to Risk Elimination



Photo by Paul Huntley

**ADPROV - All site fencing along a sidewalk or other recognized walkway shall be either driven into the ground or will be self-supporting. Fence bases that project into adjacent walking surfaces are not allowed.**

# PtD During Construction



Conventional pedestrian protection  
(rooftop mechanical upgrades – NYC)



# PtD During Construction Must Answer “What’s in this for me?”



Rooftop barrier instead –  
1/3 the cost (six figures) ✓

Photo by Jeff Hutchens



# PtD During Construction



***ADPROV – Exterior scaffolding will exceed the highest point of any roofline or final parapet/peak height by one level.***

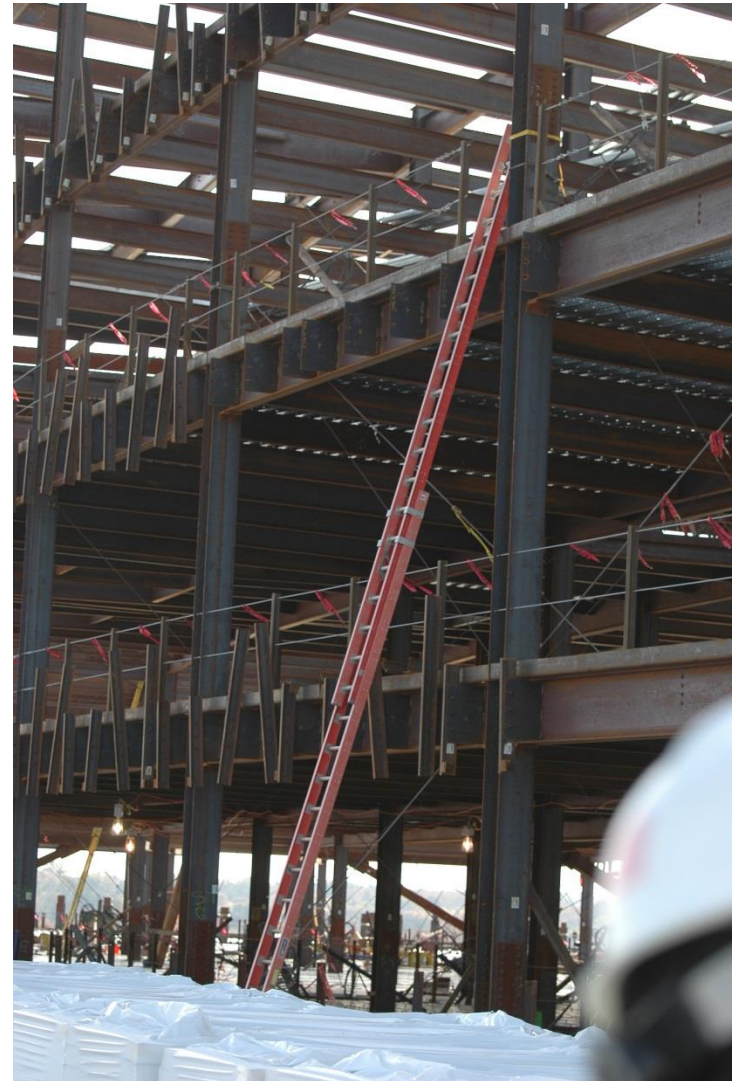
# PtD During Construction

## Must Answer “What’s in This for Me?”



“While falls remained the leading cause of death, 43% of fatal falls in the last decade have involved a ladder.

**20% of all fatal falls involved ladders and 81% of fall injuries treated in U.S. emergency rooms involved a ladder”**





## WORKING SAFER BY DESIGN



“Couldn’t we drop a rope?”



“Just Take the Stairs.” ✓

**ADPROV – Prefabricated stairs or stair towers are to be used in lieu of job made or extension ladders.”**

# The Ladders Last Story

**No ladders (Shell Oil) –**  
*“Not only can we eliminate  
763 excursions at height –  
we can save a week on schedule”*

# Doing the Math



**3 hrs. 23 min. to assemble –  
Failed Insp. (\$157.50)**



**38 minutes for task –  
No assembly hazard (\$22.50) ✓**



# “If not ladders...”



# Prefabricate, prefabricate, prefabricate...



**“We actually did it 30%  
faster than planned.”**  
*Alan Max Construction*





# Field Study – Impalement Protection



Protection often removed to work



# Field Study – Impalement Protection



Lacing – High in labor, no protection

# Field Study – Impalement Protection



**Covers – High in labor, handling and fabrication hazards, *then, protection removed during worker activity***



# Field Study – Impalement Protection



Conventional caps and manufactured systems – knocked off, or materials/covers/lumber stolen, require maintenance and storage, *then removed during activity.*



# Preventing through Design Risk Elimination



## What does OSHA say?



Question 3(a): Does the bent-over rebar present an impalement hazard that must be guarded under §1926.701(b)?

**Answer: “No; the end of the rebar in these pictures has been bent over to the point where it points downward, thereby eliminating the impalement hazard.”**

# Answering “What's in this for me?”

<b>*16' – 2 rows of 24 (48) Impalements (initial cost)</b>	<b>Candy-Cane</b>	<b>Carnie Cap</b>	<b>Wood Trough</b>	<b>Rebar Cap</b>
Device or fasteners	\$0.51	\$12.04	\$1.00	\$60.00
Lumber needed		\$13.04	\$42.16	
Labor (55/hr.)Install/Remove/Store or assemble	\$0.35	\$21.84	\$15.90	\$25.48
Total Cost	\$41.28	\$46.92	\$59.06	\$85.48
<b>Cost per impalement protected</b>	<b>\$0.86</b>	<b>\$0.97</b>	<b>\$1.23</b>	<b>\$1.78</b>
	0.00%	12.00%	43.00%	106.00%

**ADPROV – The “Get Bent” approach will be incorporated into the design of rebar incorporating a radius or right angle termination to eliminate impalement hazards.**



# The Warm Mix Asphalt Example

## Engineering Prevention Ahead of Regulation



Fumes before Modification



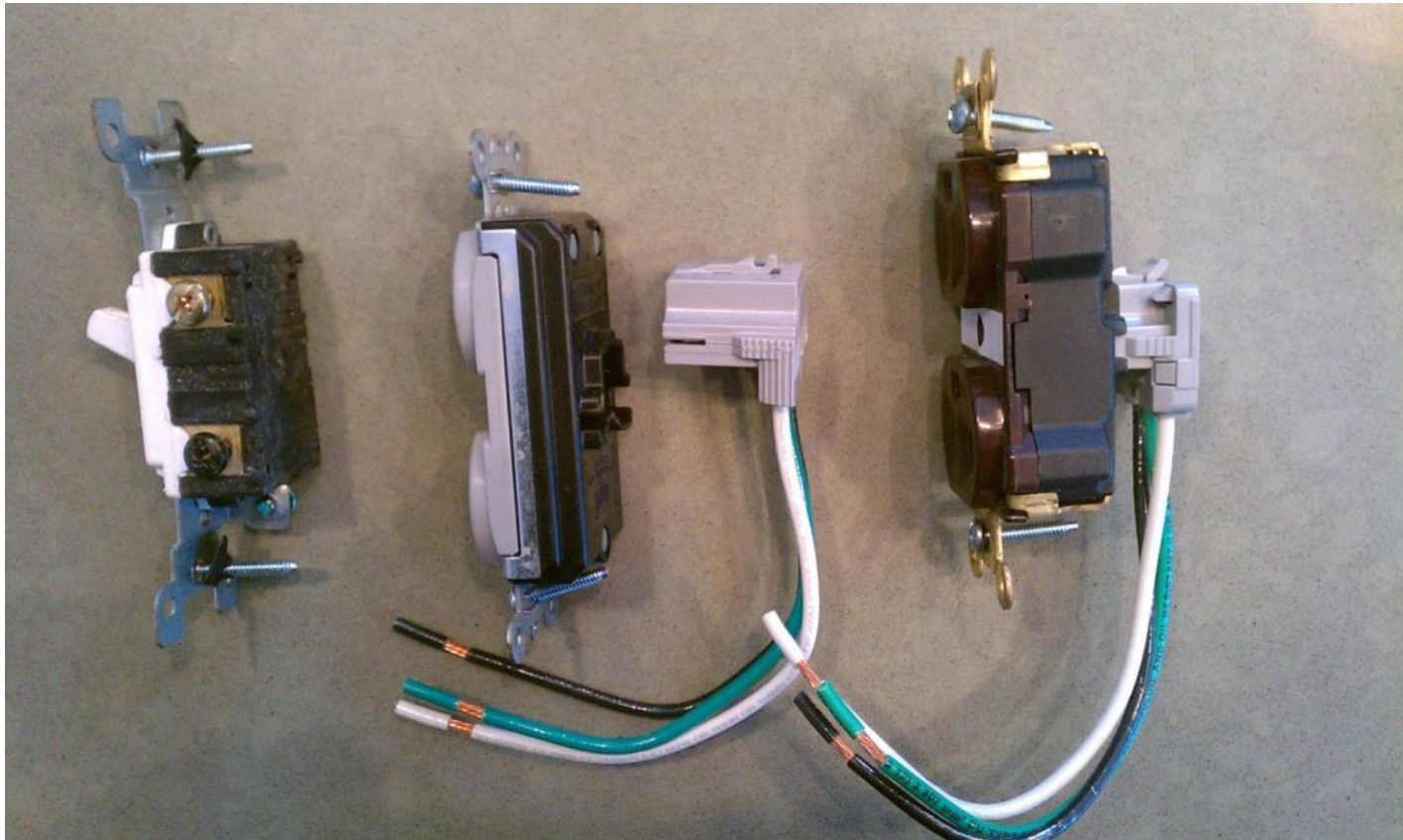
Redesigned

### Hot Time for Warm Mixes (*Engineering News Record* 2/10/2014)

Warm-mix asphalts (WMA) and re-cycled materials in asphalt (RAP) are the hot tickets on road projects according to a survey by the National Asphalt Pavement Association under contract to the Federal Highway Administration. A survey of 1,141 U.S. asphalt plants found they produced about 86.7 million tons of WMA during 2012 construction – almost a quarter of all asphalt mixes. **This marks 416% increase since a 2009 survey.**

# Prevention through Material Design

## Example – Plug-tail receptacles



# “What's in this for me?”

P&S PlugTail Cost Comparison to Conventional Wiring Device				
	Conventional Device	5362	P&S PlugTail Device	PT5362
	Labor Rate/hr	60.00	Labor Rate/hr *	45.00
	Devices/hr	10	Devices/hr **	30
	Device Cost	2.50	Device Cost ***	4.00
	# of Devices to be installed	1000	# of Devices to be installed	1000
Labor only:	Labor Rate/Device	\$6.00	Labor Rate/Device	\$1.50
	Labor Only Total Cost	\$6,000.00	Labor Only Total Cost	\$1,500.00
			Labor Cost Savings with PlugTail	\$4,500.00
Device only:	Device Only Total Cost	\$2,500.00	Device Only Total Cost	\$4,000.00
			Device Cost Savings with PlugTail	\$-1,500.00
Device & Labor	Labor & Item Cost per Device	\$8.50	Labor and Item Cost per Device	\$5.50
	Total \$	\$8,500.00	Total \$	\$5,500.00
	Total Hours	100	Total Hours	33.3
			Total Cost Savings with PlugTail	\$3,000.00
			Total Time Savings with PlugTail	66.7
			Recalculate	Reset
			Print	



# PtD by Litigation – *Avoid the next Claim*

## Powder-actuated Tools and Lead

### Results:

“Researchers are continuing to investigate lead exposure associated with these tools.... Numerous manufacturers have been notified of the findings and some are willing to help address the issue. “

INGREDIENTS AND EXPOSURE LIMITS				
Ingredients:	CAS Number:	TLV:	PEL:	STEL:
Nitroglycerin	00055-63-0	0.46 mg/m <sup>3</sup> (S)	NE	0.1 mg/m <sup>3</sup> (S)
Nitrocellulose	09004-70-0	NE	NE	NE
Lead styphnate	15245-44-0	0.05 mg/m <sup>3</sup> *	0.05 mg/m <sup>3</sup> *	NE
Barium nitrate	10022-31-8	0.5 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup>	NE
Tetracene	00109-27-3	NE	NE	NE

**Abbreviations / Symbols:** \* exposure limit for metallic lead. **NE** = None Established. **NA** = Not Applicable. **(S)** indicates exposure should be controlled for the cutaneous routes including the mucous membranes, eyes, and skin. Airborne exposures as well as direct contact must be considered.

**Hilti Clean-Tec cartridges.**  
Lead and heavy metal free.

Hilti DX cartridges for direct fastening tools offer extremely reliable power and top quality with the added benefit of Clean-Tec environmental improvements.



**ADPROV – Powder-Actuated Tools. Only lead-free charges to be used or alternatives like gas-powered tools.**

# PtD by Litigation – Makes the Case

## \$1.5 Million Award in Table Saw Injury Lawsuit

In March 2010, a jury awarded Carlos Osorio \$1.5 million in damages he suffered after using a table saw. He filed a table saw lawsuit after his lawyer saw a demonstration of the SawStop®, a safety device that can detect when the blade comes in contact with flesh, and stops the blade. The table saw lawsuit was filed against One World Technologies, Inc., the makers of Ryobi table saws.

Osorio injured his hand while using a Ryobi table saw while laying hardwood flooring. He required five surgeries, which totaled more than \$384,000 in medical expenses. In the lawsuit, Osorio asked for only \$250,000 in damages. The jury decided that to award Osorio \$1.5 million instead.



WORKER – FINGER AMPUTATIONS BY TABLE SAW	COST
Direct Cost to Business Region	\$504,846.00
Total Profit for Project	\$3,309.00
Cost of one SawStop® Table Saw	\$1,779.00
Additional Sales Needed to Recover Injury Cost	\$16.8 Million

**ADPROV – Contractor must utilize the SawStop® table saw or similar technology.”**

# The Challenge

**Owners** – When soliciting A+E support, examine their experience in PtD *or their reluctance*. Score their design safety experience and see some examples.

Require specific elements be incorporated into the work by your A+E firm when designing and creating the specifications.

Define the additional provisions you want incorporated by your General Contractor when designing the work so they are included in the specifications.





# The Challenge

**Insurers** – Educate your insured on approaches to eliminate hazards when planning their projects.

Require the insured to eliminate hazards using contractual obligations when designing or constructing the building.

When an insured's skylights fails from hail storm, care enough to replace with ones that will support someone's son or daughter.

Educate your field folks on spotting design errors, advocate their sharing of PtD Best Practices with Owners and Contractors when inspecting facilities or worksites.



# The Challenge

**General Contractors** – Educate and monitor the subcontractors and their work to ensure hazard elimination in the additional provisions are understood when planning and bidding.

Share the efficiencies of PtD elements with contractors in regard to increase profit and schedule.

Recognize and reward contractors who develop and incorporate PtD approaches in their work.

