An Analysis of Ladder Fatalities

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- **Outline**
- Data
- Findings
- Other Information
- Final Thoughts

Data Specifics

- 347 incidents of interest
  - The oldest incident occurred on 10/15/1982 (82-03)
  - The most recent occurred on 9/10/2018 (18KY054)
- Limitations:
  - These are select accidents:
    - 1.6% of all ladder fall fatalities that occurred in the 37 year period covered are included
    - Unfortunately, it is difficult to draw inferences or conclusions about the population
  - We do not have denominator data:
    - Ladder population data are not available
    - Ladder frequency of use data are not available
    - So, we can't, for instance, determine whether one type of ladder is less safe than another.
- What we can do is learn how these accidents occurred and what will prevent similar accidents.
  - This review may pinpoint some weaknesses in your safety program

1982 – 2019 = 37 years of data

Accident Categories

1. Should have used a ladder (12)
    - Incidents in which the investigators indicate that the deceased should have used a ladder or ladder stand
2. Ladder used prior to accident (155)
    - Incidents in which the deceased used a ladder to climb up or down but was not on it or holding on to it when the accident occurred
    - ladder use is ***peripheral*** to accident
3. Ladder accident (175)
    - Incidents in which the deceased was either on a ladder or holding onto a ladder when the accident occurred
4. Ladder otherwise involved in a fatality (5)
    - Incidents in which victim wasn't on a ladder or holding on to it; yet, a ladder was directly linked to the fatality

This is my construct. We'll look at each in some detail.

Findings

Should Have Used a Ladder

- Fell off a scaffold:
  1. Climbed railing, not built-in ladder: railing collapsed and he fell
  2. *Ladder access not provided* when scaffold was erected
  3. *Ladder access not provided*
  4. *Ladder access not provided*

In 2, 3, and 4 they were climbing or descending the frame of the scaffold. It is very taxing to climb and maintain grip on scaffold frames which are 2 feet apart vertically and made of 1+11/16" diameter (frame scaffold) – compared to a fixed ladder with rungs 1 foot apart and ¾" diameter.

If you ever see this, stop it! You may save a life.

- Fell through a roof
  5. Jumped down from elevated platform onto transite roof – to join co-workers - and broke through

- Fell from a vertical steel structural I-beam
  6. He chose to climb down beam rather than traverse walkway to fixed ladder

- Fell from shelving/storage rack
  7. Ladder stand available but not used
  8. A ladder (or stair) was not provided by employer

Should Have Used a Ladder

- Fell from a chair:
  9. Construction project endpoint. Proper equipment (ladder) no longer on site

- Fell from a wagon:
  10. Investigators suggested that fall may have been prevented by a ladder on wagon

- Fell from a semi-trailer while trying to get up onto it:
  11. A safer solution to access the trailer deck would have been a ladder

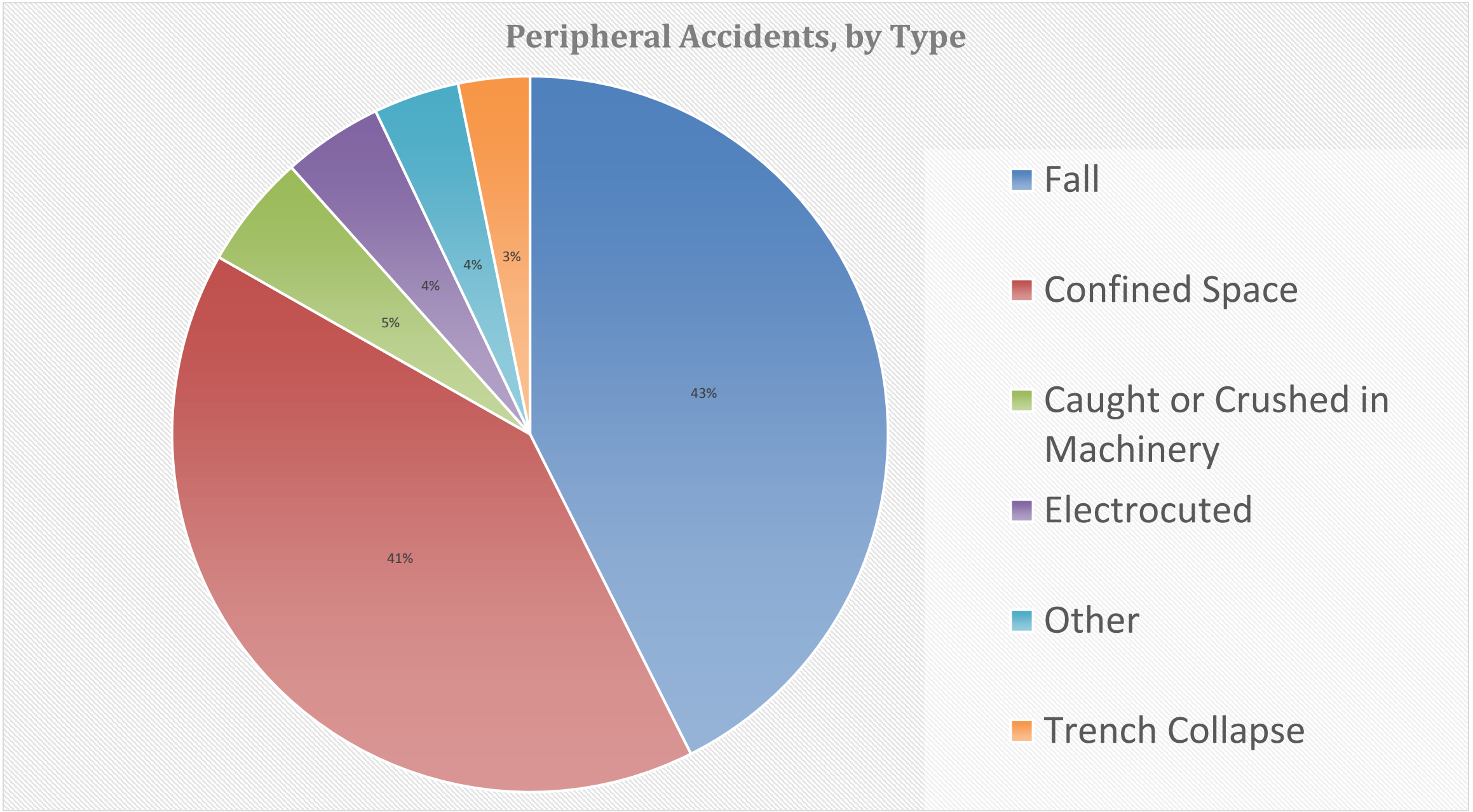
- Crushed by an electrical distribution cabinet he was dismantling:
  12. Stepped up onto the bottom shelf of the cabinet to reach components up high within
      - This caused the cabinet to tip and then fall on him
      - A thorough pre-task analysis might have revealed need of a stepladder or step stool

Ladder Use Peripheral to Accident

- 66 falls:
  - 44 off roof; through skylights, roof panels, or some other roof penetration; or collapse of roof
  - 19 from some other elevated surface
  - 2 from a telecom tower
  - 1 from a suspended scaffold
- 63 died in confined spaces
  - 24 in grain bins/silos
  - 15 in manhole or underground vaults
  - 12 in tanks of one sort or other
  - 9 in other types of spaces
  - 3 in manure pits
- 8 caught or crushed in machinery
- 7 electrocuted
- 6 other types of accidents, e.g.:
  - Decapitated when telecom tower collapsed
  - Trimming palm tree, branches collapsed in and pinned and suffocated victim against tree trunk
- 5 killed in trench collapses

Many of these could have been prevented by pre-planning and understanding the hazards up above and down below.

Your ladder safety training might be enhanced by making mention of these accidents.

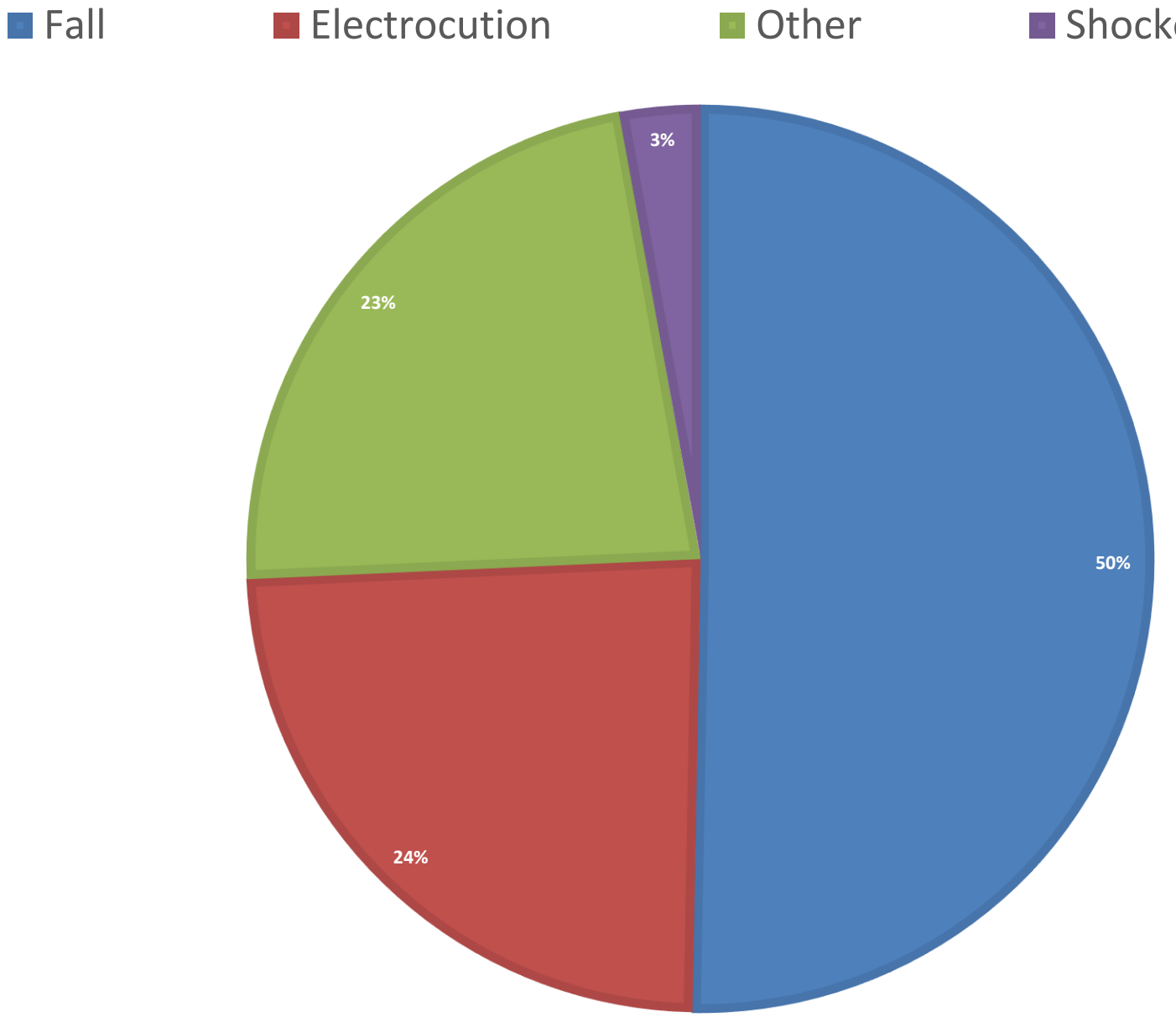

Peripheral Accidents, by Type
43%
41%
5%
4%
4%
3%
Fall
Confined Space
Caught or Crushed in Machinery
Electrocuted
Other
Trench Collapse

Ladder Accidents, by Type of Ladder

Accidents can (and do) occur on/with every type of ladder!

Ladder Type	Number	%
Extension Ladder	58	33.1%
Stepladder	32	18.3%
Fixed Ladder	29	16.6%
Straight Ladder	2	1.1%
Ladder Stand	2	1.1%
Scaffold Made with One or More Ladders	5	2.9%
Ladder on a Scaffold	5	2.9%
Ladder Platform Hoist	2	1.1%
Rope Ladder	2	1.1%
Hook Ladder	2	1.1%
Ladder (step bolts) on Power Pole	1	0.6%
Chain Ladder	1	0.6%
Articulating Ladder	1	0.6%
Ladder on Equipment	5	2.9%
Homemade Ladder	2	1.1%
Ladder Type Not Specifically Identified	26	14.9%
Total:	**175**	**100.0%**

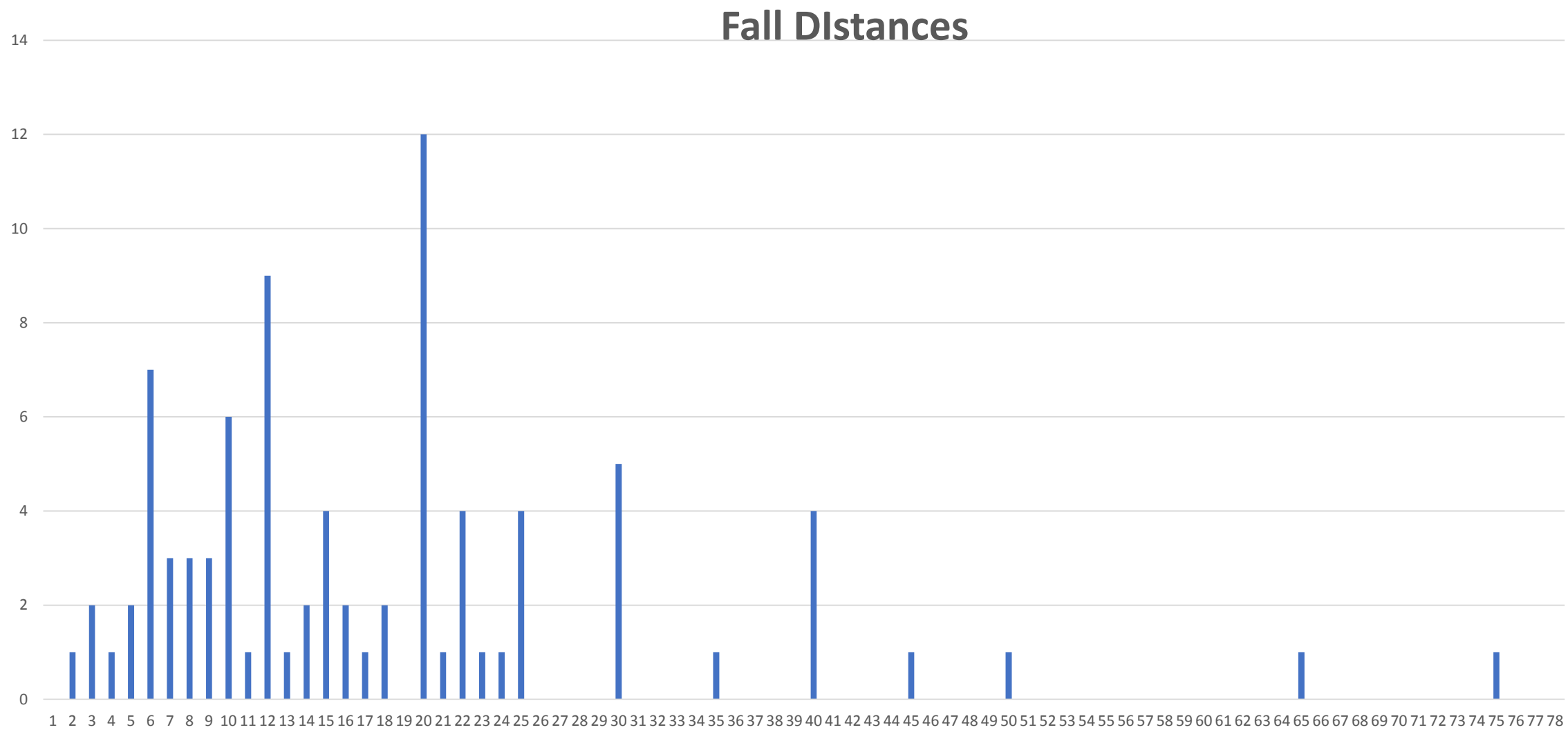
Ladder Accidents, by Type of Accident



Accident Type	Number	%
Fall	88	50.3%
Electrocution	42	24.0%
Other	40	22.9%
Shocked, Then Fell	5	2.9%
Totals:	**175**	**100.0%**

Falls

- 88 incidents with 88 dead (86 men, 2 women)
- Fell from:
  - Extension ladder: 33
  - Stepladder: 19
  - Fixed ladder: 13
  - Straight ladder: 1 (01MI047)
  - Ladder type not specifically identified: 6 (8512, 90MA001, 91WI008, 92CA009, 94MN073, 04NE034)
  - On a ladder on a scaffold: 5 (8827, 94CA013, 98MD016, 06MI117, 15OR12)
  - Scaffold made out of one or more ladders: 4
    - Ladder jack (94WI284, 98MO035)
    - Improvised (9012, 93WI222)
  - Rope ladder: 2 (88-14, AK-95-03)
  - Hook ladder: 1 (91MA006)
  - Articulating ladder: 1 (16-MA-032-01)
  - On equipment (3):
    - (95NE016) – ladder on a printing press
    - (96MN08701) – ladder on removable silo door (on a farm)
    - (98IA048) – stationary service ladder on a combine (on a farm)



Falls beyond 75 feet (one at 90’, one at 100’, and one at 250’) not shown to keep chart width manageable.

Lowest = 2 feet. Highest = 250 feet. Average = 22.4 feet; Median = 15 feet

13 (15%) were 6 feet or less; 28 (32%) were 10 feet or less

What Victims Fell From (Highest Fall Distances)

- 250 feet: Window mechanic fell off a stepladder through a window opening on the 21st floor of a 21-story office building (8949)
- 100 feet: Welder fell from a fixed ladder on the leg of a municipal water tower (92NJ046)
- 90 feet: Owner/operator of a sign company jumped a hook ladder off a billboard (91MA006)
- 75 feet: Elevator mechanic on a 6 foot stepladder on top of an elevator car plummeted down the shaft when the elevator fell (8512)
- 65 feet: Painter fell from a swing scaffold constructed with a ladder inside a municipal water tank (9012)
- 50 feet: Labor foreman fell from a rope ladder inside a municipal water tank (88-14)
- 45 feet: Farmer fell from fixed silo ladder (95MN05101)

Stepladders are up to 20 feet tall. Extension ladders are up to 64 feet tall.
Fixed ladders can go quite high but typically have cages and rest platforms every 20 feet.

Falls

- Job Titles of Victims:
  - ***Air Conditioning Service Technician to Window Mechanic***
  - List of titles: Air Conditioning Service Technician, Brick Mason, Building Contractor, Cable Television Installer, Carpenter (8), Commercial Painter, Construction Foreman, Construction Laborer/Worker (3), Convenience Store Manager (F), Corrections Officer, Courtesy Clerk, Custodian, Driver and Helper, Dry Wall Finisher, Electrician (2), Electrician Apprentice (2), Elevator Mechanic, Farm Worker (2), Farmer (5), Farmer/Handyman, Handyman (2), Hotel Assistant Manager, Hotel Grounds Maintenance Man, Iron Worker, Journeyman Roofer, Labor Foreman, Laborer (4), Maintenance Contractor, Maintenance Man/Apartment Manager, Maintenance Technician, Mason, Mechanic Helper, Millwright, Owner/Operator of a Sign Company, Painter (3), Painter/Independent Contractor, Plumber (2), Pressman, Residential Siding Company Owner (2), Retail Outlet Worker, Rigger, Roofer (5), Roofing Worker/Laborer, School Maintenance/Custodial Worker, Self-Employed General Contractor, Senior Laborer, Service Worker, Sheet Metal Worker, Shipper for a Bakery, Siding Installer, Steel Company Field Superintendent, Stevedore, Tile Setter, Warehouse Manager (F), Welder, Window Cleaner, Window Mechanic

Job titles span virtually the gamut of the alphabet, from “A” to “Z”
Anyone who climbs ladders has some risk of falling off.

Falls

- Ages of victims:
  - 17 - 24 years of age: 6
  - 25-34 years of age: 15
  - 35 – 44 years of age: 21
  - 45 – 54 years of age: 21
  - 55 – 64 years of age: 16
  - 65 and older: 8
  - Age Not Reported: 1

1. Age ranges set to match study by Smith, et. al. (more on this later)

2. The two women who died were 42 and 54, respectively.

Extension Ladder Falls

- 33 incidents with 33 fatalities (all men, ages 17 - 73)
- 22 incidents (67%) with 27 ***Unsafe Ladder Behaviors (ULBs)*** that contributed to the incidents:
  - Selected improper ladder for task (6):
    - Investigators simply state that ladder selected was improper for the task
    - Used top (fly) section of ladder alone (2)
    - Utilizing a conductive (aluminum) ladder in close proximity to uninsulated overhead conductors
    - Used a faulty ladder (i.e., failure to inspect and/or remove defective ladder from service) (2)
  - Improper setup (13):
    - Investigators simply state that ladder was improperly set up (1)
    - Leaned ladder against an unstable top support (3)
    - Ladder not secured in a manner to prevent it from being displaced (2)
    - Ladder was turned around so rungs weren't properly positioned
    - Set extension ladder up from above
    - Improper angle of setup
    - Not following established company policy for ladder setup and use
    - Set ladder up on pitched roof
    - Failure to ensure area around ladder is kept clear of obstructions that could hinder ascent or descent
    - Placed ladder in bed of pickup truck
  - Improper use (8):
    - Overloading ladder (2)
    - Overreach (2)
    - Carrying things up ladder (i.e., not maintaining 3 points of contact while ascending)
    - Working with back to ladder
    - Drinking alcoholic beverages
    - Descended ladder that had begun to extend as crew tried to pull it up out of lower level

We'll take a closer look at Unsafe Ladder Behaviors (ULBs) in a bit. This is my terminology for when a ladder user is violating a safe practice.

Stepladder Falls

- 19 incidents with 19 fatalities
  - 18 men, 1 woman, ages 17-79
- 11 incidents (58%) with 13 ULBs:
  - Selected improper ladder for task (1):
    - Used a faulty ladder (i.e., failure to inspect and/or remove defective ladder from service)
  - Improper setup (5):
    - Used stepladder without opening it up (2)
    - Placed ladder next to floor-to-ceiling window (9-ft high x 56-in wide)
    - Placed ladder next to guardrail such that rail no longer affords fall protection
    - Set ladder up on unstable base
  - Improper use (7):
    - Standing on top step or top cap of stepladder (2)
    - Climbed with material in hand
    - Drinking alcoholic beverages
    - Overreach
    - Stood facing away from ladder
    - Had one foot on lower rung and one on higher rung as he worked from ladder*

***"Most of the decedent's body weight would be on the lower step. By necessity, the foot on the lower step would be on one side of the ladder, near to one of the side rails. This places a side load on the rail reducing the stability of the ladder."**

Fixed Ladder Falls

- 13 incidents with 13 fatalities
  - 12 men, 1 woman, ages 20-62
- 4 incidents (31%) with ULBs:
  - Faulty fixed ladder.
  - Faulty fixed ladder installation.
  - Climbed with wet/ slippery material on footwear.
  - Climbed ladder that wasn't clean and dry.

A faulty fixed ladder points to an non-existent or inadequate fixed ladder maintenance/inspection activity. A faulty fixed ladder installation points to improper design and/or construction. Both of these are the responsibility of the employer.

Have you surveyed the fixed ladders in your facility for compliance with standards and regulations?
Does your facility have a fixed ladder inspection and maintenance program?

Electrocutions

- 42 incidents, 43 fatalities – 43 male
  - 21 were holding ladder
  - 21 were on ladder
  - 1 was likely on ladder
- Job Titles of Victims:
  - ***Billboard worker to Video Store Owner***
  - List of Titles: Billboard worker, Cable TV Installer, Electrical Testing Laboratory Technician, Carpenter (2), Carpentry Foreman, Construction Worker, Electrical Line Foreman, Electrical Testing Laboratory Technician, Electrician (4), Electrician's Apprentice (3), Electrician's Helper (2), Journeyman Electrican, Insulation Installer, Laborer/Day Laborer/Maintenance Laborer (4), Painter (11 – one listed as Painter/Caulker), Power Company Cable Splicer, Roofer (2), Roofer's Helper, Truck Driver, Part-Time Delivery Truck Driver, Tree Care Worker, Video Store Owner

Job titles span virtually the gamut of the alphabet, from "A" to "Z"

If you use ladders to work on or around live electrical circuits (120V and above), you are at risk of electrocution.

Electrocutions

- Ages of victims:
  - 16, 18 (2)
  - 21 (3), 22, 23 (5), 24 (4), 27 (2), 28 (3), 29
  - 31(2), 32, 35 (2), 36, 39
  - 40 (2), 42, 45, 46, 49
  - 60
  - Age Not Reported (7)

Electrocutions

- Ladder contacted uninsulated overhead power line in 24 cases (25 dead):
  - 1980's: 8 cases with 9 fatalities (oldest case occurred 10/15/1982)
  - 1990's: 8 cases
  - 2000's: 5 cases
  - 2010's: 3 cases (most recent case occurred 9/10/2018!!!

Workers are still being electrocuted due to contacts with uninsulated overhead power lines

- In 7 other cases, deceased (electrician or electrician's helper) was working on energized lighting circuits (typical 480/277 Volt)
  - In 6 cases, deceased was working from a non-conductive ladder
- Faulty circuits (3 cases, 3 dead):
- Other circuits involved (8 cases, 8 dead):

These 7 were knowledgeable craftsmen selecting and using the "right" (i.e., non-conductive) ladders. Lighting circuits are very dangerous!!!

It is safest to de-energize circuits prior to working on (or near) them!!!

Other Ladder Incidents

- 40 incidents with 42 dead (all men)
  - 15 confined space incidents
    - Tanks (3)
    - Grain bin/silo (3)
    - Manhole/Underground Vault (2)
    - Well (2)
    - Manure pit
    - Barge compartment inerted by nitrogen
    - Water tower
    - Drainage system
    - Excavation
  - 12 struck by
  - 6 lockout/tagout incidents
  - 2 pressurized system incidents
  - 2 drownings
  - 1 scalding
  - 1 trench collapse
  - 1 lacerated by a hand-held saw

The difference between these confined space incidents and earlier "peripheral incidents" is that, in these, the victim was on the ladder - he didn't even make it off the ladder; or, got off, realized his predicament, tried to climb out, but fell back down off the ladder.

Read the ones with witnesses to get a chilling idea of how victims are overcome by bad atmospheres in these spaces: Case #'s 85-23, 87-46, 92NJ020, 94MN045, 02MI143, 11CA008

Shocked, Then Fell

- 5 incidents, 5 fatalities, all male
- Ages:
  - 36, 40, 49, 53, and 72
- Job Titles of Victims:
  - Carpenter/Owner of a Small Construction Company,
  - Electrical Substation Mechanic,
  - Facilities Maintenance Foreman,
  - Roofer,
  - Siding Mechanic

In these, the victim died from fall injuries.

You would think that the electrical substation mechanic and the facilities maintenance foreman were knowledgeable of the hazards.
And, indeed, they selected and used wooden ladders.
However, neither tested to verify that the circuits they were working on were de-energized.
Electrical energy is "invisible." You need qualified workers who take a methodical approach and follow all rules w/o deviation.

Unsafe Ladder Behaviors (ULBs)

- Recognized, unsafe behaviors that the investigators identified as contributing to the incident and fatality
- One or more ULBs contributed to 87 (49%) of 175 ladder incidents. Top 4:
  - Using a conductive (aluminum) ladder near overhead uninsulated energized power lines (25 incidents, 26 dead)
  - 2-way tie for 2nd place (5 incidents, 5 dead in each):
    - Using a faulty ladder
    - Using a ladder for other than its intended purpose
  - 4-way tie for 3rd place (4 incidents, 4 dead in each):
    - Placing a ladder on something other than a stable and level surface
    - Working on electrical circuits from a conductive (aluminum) ladder
    - Placing a ladder on top of a mobile scaffold
    - Overreach
  - 6-way tie for 4th place (3 incidents, 3 dead in each):
    - Leaned, rested top of ladder against an unstable surface or object
    - Standing on the 2nd step of a 3-foot stepladder
    - Using a stepladder without pulling it apart
    - Drinking alcoholic beverages
    - Climbing with material in hand
    - Using a Type III ladder for construction work

Enforcement is also needed (e.g., supervision, ESH monitoring of operations)!!!

Faulty Ladders

- Faulty ladders contributed to 5 (2.8%) of 175 incidents:
  1. Two Painters Electrocuted in Ohio (87-28):
     - Painting power poles. One painter on ladder, one on ground holding ladder steady.
     - Top rung of ladder was damaged.
     - Painter may have leaned on damaged rung, causing ladder to slide along crossbar into contact with power line.
  2. Painter Electrocuted When Metal Ladder Contacts a Powerline – Virginia (92-27):
     - 40-foot aluminum extension ladder being used was missing rope used to raise and lower the upper (fly) section
     - If ladder was equipped with rope, and victim had been trained in proper procedure of raising and lowering,
     - Victim may have lowered ladder to a safe height before attempting to move it.
  3. Farm Worker Dies after Fall from Silo Chute Ladder (93WI24001):
     - Rungs were covered with moist cracked corn.
     - Victim was wearing smoot-soled boots.
     - Accumulated layers of corn debris on the silo wall inside the chute decrease clearance between the rung and silo wall.
     - The clearance is only about 5 inches if there is no debris buildup. [NOTE: OSHA reqmt is 7” between rung centerline and wall]
  4. Maintenance Technician Dies After Falling Eight Feet From Ladder (98MN06401):
     - Ladder not constructed in accordance with established safety standards and regulations.
     - Rung vertical spacing of 16 inches exceeded OSHA 12 inch requirement by four inches.
     - Ladder did not have enough clearance [30 inches minimum] on climbing side – there was a pipe 40 inches above top rung and 16 inches out away from it.
     - Investigators theorize greater rung spacing elicited greater force climbing. Then, victim struck his head on pipe above causing him to fall.

Notice the interplay between factors which results in these accidents.

Faulty Ladders

5. Warehouse Manager Killed in Fall From Wooden Ladder (04NE016):
   - 130’ x 300’ warehouse was originally built to hold grain. Exact age is unknown.
   - Company had owned it since the late 1980’s.
   - Access to the overhead was gained by either of two permanently installed offset wood ladders.
   - Rungs are 2 x 4’s nailed to the wall with two nails on each side securing rung to side rails.
   - Employers should conduct a safety inspection when buildings are purchased to identify and correct hazards.
   - A safety inspection may have identified these ladders as hazardous.
   - In this incident, the top rung pulled completely away from the side rail.
   - Victim fell 40 feet

Here’s a conundrum you need to consider: in order to inspect this fixed ladder, your inspector needs to climb it!

In two other cases, faulty ladders were noted (04NE034, 05MI163); but, it’s difficult to see how those faults contributed.

Pay particular attention to wooden fixed ladders! Ensure that a competent person regularly inspects these!!!

Ladder Safety Training

- Investigators recommended training in 41% of incidents
- My belief is that ladder safety training may have made a difference in 26% additional incidents
- In 5 cases, investigators determined that the victim had been trained! (9322, 96CA01501, 97NE019, 98CA00601, 07CA005)

Training alone isn't enough. Enforcement is also needed (e.g., supervision, ESH monitoring of operations)!!!

Child Labor Laws

- 13 incidents resulted in the deaths of 14 children (i.e., < 18 years of age) - 13 boys and 1 girl
  - Violation of child labor laws were cited in 6 of these
    - Case #'s 98-16, 2001-04, 2001-07, 2004-08, 2007-10, 18KY054
    - Law basically says you cannot employ youth in high hazard occupations (e.g., roofing)
  - 4 other cases involve farm youth:
    - Case #'s 8946, 95MN045, 99NE028, 03WA038 (2 dead)

Depending on the type of farm, farmers may be exposed to a certain number or well-recognized high hazards.

The June 2019 edition of NSC's Safety+Health magazine has an Editor's Note by Melissa J Ruminski and an article by Barry Bottino on teen workers which discuss protecting these individuals and provide links to additional information.

Ladder Otherwise Involved in a Fatality

- Victim wasn't on ladder or holding on to it at time of death:
  1. 21- and 30-year old males died when a flammable atmosphere inside an elevator car they were solvent stripping ignited. They had carried a ladder into the car and one was entangled in it trying to escape the burning car. (92MO04601 and 92MO04602)
  2. 56-year old truck driver died when a front-end loader weighing 65,000 pounds being transported on a 50-ton lowboy trailer broke free from its securing chains and rolled onto the cab crushing him. The victim used chains to secure the loader. One chain appeared to have been improperly attached to the loader's maintenance ladder. (02MI040)
  3. Construction project - installing a fixed ladder. A 39-year-old welder was killed when he fell 20 feet from a personnel platform on a forklift he was working from. (03IA021)

Ladder Otherwise Involved in a Fatality

- Victim wasn't on ladder or holding on to it at time of death:
  4. A 69-year-old propane transport driver died when his loaded cargo tank transport semi-trailer truck rolled backward and over him. The investigators believe he was first struck by the cargo tank ladder. (11WA013)
  5. A semi-truck driver (D1) hauling a flatbed trailer was traveling in the right lane on a four lane interstate. Several minutes ahead was a pickup truck hauling an extension ladder that fell out onto the travel lanes. The semi came upon the ladder and cars swerving to avoid it. To avoid striking the cars or ladder, the semi driver swerved to the right, over-corrected to the left, drove across the northbound lanes, over a cable barrier, then into the southbound travel lanes. Another 46-year-old semi-truck driver (D2) traveling in the right southbound lane pulling a 53' trailer struck the cab of the northbound semi. D2 died at the scene. (11KY001)

Company Size

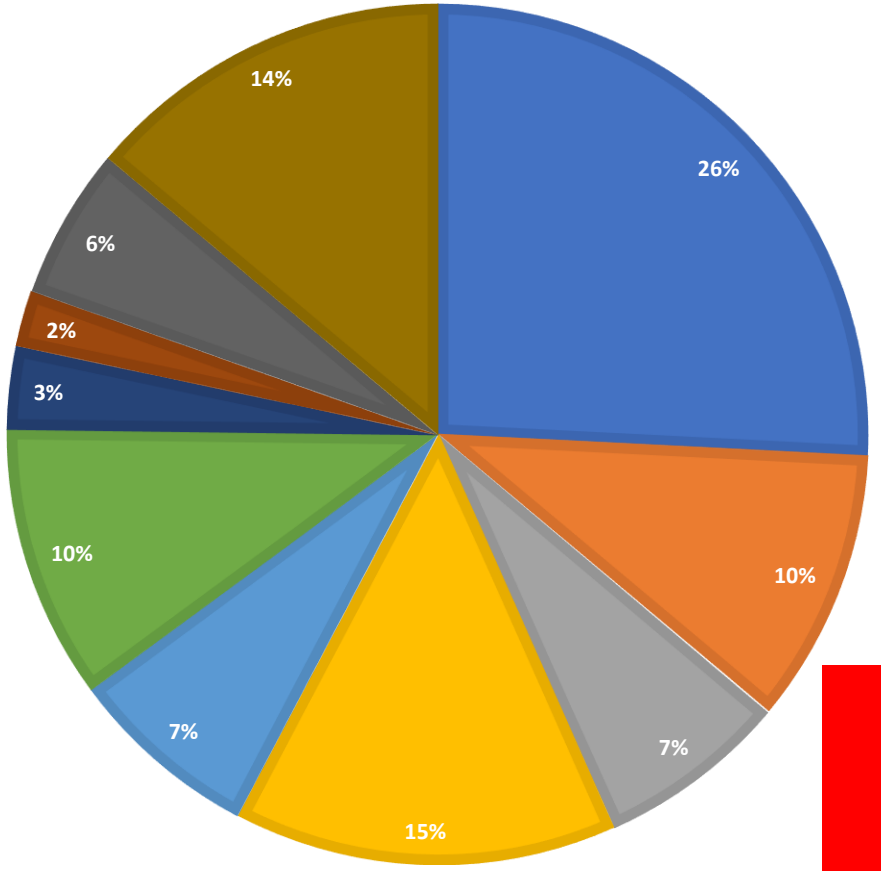
Item	Company Size (From BLS)	# of Employees	Should Have Used a Ladder	Peripheral	Ladder	Ladder Otherwise Involved	Totals	%	Cumulative %	Comments
1	1	1 to 4	1		47		48	25.4%	25.4%	NOTE: I did not compile data on company size for peripheral incidents.
2	2	5 to 9	2		18		20	10.4%	35.8%	
3	3	10 to 19	1		13		14	7.2%	43.0%	
4	4	20 to 49	2		25	1	28	14.5%	57.5%	
5	5	50 to 99	1		11	2	14	7.2%	64.7%	
6	6	100 to 249	2		17	1	20	10.4%	75.1%	
7	7	250 to 499			6		6	3.1%	78.2%	
8	8	500 to 999	1		3		4	2.1%	80.3%	
9	9	1,000 or more	2		8	1	11	5.7%	86.0%	
10	Not Reported				27		27	14.0%	100.0%	Not reported = No or insufficient information in NIOSH Reports to tabulate company size
		Totals:	**12**	**0**	**175**	**5**	**192**	**100.00%**		
		Totals w/Peripheral:	**12**	**155**	**175**	**5**	**347**			

Perhaps 50% or more of these incidents involve companies that are so small that they don't have safety professionals on staff and a minimal or non-existent safety program. Getting ladder safety information to these is perhaps our greatest challenge!

FACE investigators realize this and there were recommendations in several reports addressing it (07MI007, 08MA042, 10IA054)

Company Size

- 1 = 1 to 4 employees
- 2 = 5 to 9 employees
- 3= 10 to 19 employees
- 4= 20 to 49 employees
- 5= 50 to 99 employees
- 6= 100 to 249 employees
- 7= 250 to 499 employees
- 8= 500 to 999 employees
- 9= 1,000 or more employees
- Not Reported



No one is immune to these – not the small employer and not the large employer with a comprehensive ESH program!!!

Other Information

Ladder Fatality Data

- “Fatal work-related falls in the United States, 2003-2014,” by Christina M. Socias-Morales, Cammie K. Chaumont Menendez, and Suzanne M. March
  - 8,880 fatal work-related falls

- “Occupational Ladder Fall Injuries – United States, 2011,” by Christina M. Socias, Cammie K. Chaumont Menendez, James W. Collins, and Peter Simeonov. In CDC MMWR Weekly/Vol. 63/No. 16, April 25, 2014
  - Among workers, approximately 20% of fall injuries involve ladders

8,880 x .2 = 1,776/12 years = 148 ladder fall fatalities/year in the workplace
148 x 37 years = 5,476 ladder fall fatalities in the time these NIOSH FACE Reports were generated
88 fatal ladder falls in this analysis/5,476 occurring in time span studied: (Sample size = 1.6% of population)

Ladder Fatality Data

- “Relative Risks of Ladder Fatalities Increase Precipitously by Age Compared to Other Work Fatalities in the US,” by Gordon S Smith; David A Lombardi; Helen Corns; Theodore K Courtney; Jack T Dennerlein; X Dong; Melissa Perry
  - Shows that fatality rates increase with age
    - In their study, they normalized to the 16 - 24 year old (young worker) age group)
    - Age 25 - 34 had 2x the risk
    - Age 45 – 54 had almost 4x the risk
    - Age 55 – 64 had 6.5x the risk, and,
    - Those 65 and over had almost 14x the risk of fatality in ladder use in the US workplace

Perhaps we need to have a conversation about capping ladder use at a particular age!

Training Regulations

- OSHA General Industry
  - 1910.28(b)(10)(ii) When an employee engaged in outdoor advertising climbs a fixed ladder before November 19, 2018 that is not equipped with a cage, well, personal fall arrest system, or a ladder safety system the employer must ensure the employee:
    - 1910.28(b)(10)(ii)(A) Receives training and demonstrates the physical capability to perform the necessary climbs in accordance with § 1910.29(h);
  - 1910.30(b)(1)The employer must train each employee on or before May 17, 2017 in the proper care, inspection, storage, and use of equipment covered by this subpart before an employee uses the equipment.

- OSHA Construction Industry
  - 1926.21 - Safety training and education.
    - 1926.21(b)(2)The employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury.
  - 1926.1060 - Training requirements [for stairways and ladders].
    - 1926.1060(a): “The employer shall provide a training program for each employee using ladders and stairways, as necessary. The program shall enable each employee to recognize hazards related to ladders and stairways, and shall train each employee in the procedures to be followed to minimize these hazards…”

Training Requirements

CalOSHA General Industry

3276(f) [Portable Ladders] Employee Training. Before an employee uses a ladder, the employee shall be provided training in the safe use of ladders, unless the employer can demonstrate that the employee is already trained in ladder safety as required by this subsection. Supervisors of employees who routinely use ladders shall also be provided ladder safety training, unless the employer can demonstrate that the supervisor is already trained in ladder safety as required by this subsection. The training may be provided as part of the employer's Injury and Illness Prevention Program required by Section 3203. The training shall address the following topics, unless the employer can demonstrate a topic is not applicable to the safe use of ladders in the employer's workplace.

(1) Importance of using ladders safely, including: frequency and severity of injuries related to falls from ladders.

(2) Selection, including: types of ladders, proper length, maximum working loads, and electrical hazards.

(3) Maintenance, inspection, and removal of damaged ladders from service.

(4) Erecting ladders, including: footing support, top support, securing, and angle of inclination.

(5) Climbing and working on ladders, including: user's position and points of contact with the ladder.

(6) Factors contributing to falls, including: haste, sudden movement, lack of attention, footwear, and user's physical condition.

(7) Prohibited uses, including: uses other than designed, climbing on cross bracing, maximum lengths, and minimum overlap of extension ladder sections.

CalOSHA's regulation is very prescriptive!!!

Section 1675(b) – CalOSHA's Construction Standard – invokes the above)

NIOSH Resources

- NIOSH Ladder Application, available at: https://www.cdc.gov/niosh/topics/falls/mobileapp.html
- NIOSH 2007-155, “Preventing Worker Deaths and Injuries from Contacting Overhead Power Lines with Metal Ladders”
- NIOSH 89-110, “Preventing Electrocutions of Workers Using Portable Metal Ladders Near Overhead Power Lines”
- NIOSH “FACE Reports Brought to Life,” NIOSH FACE Videos:
  - “A Simple Task,” (2009-01)
  - “Look Up and Live,” (10-MA-019)
  - “Palm Tree Trimming Tragedy,” (12CA006)

https://www.cdc.gov/niosh/face/videos.html

These are video re-creations for NIOSH FACE reports. There are others not related to ladders. Very informative.

American Ladder Institute

- https://www.americanladderinstitute.org/default.aspx
  - They develop safety standards for ladders for ANSI
  - They also offer other resources of interest to the safety professional
  - They have a training www site: https://www.laddersafetytraining.org/ and offer courses for:
    1. ***Stepladders***
    2. ***Single & Extension ladders***
    3. ***Articulated ladders, and,***
    4. ***Mobile ladders (i.e., ladder stands and ladder stand platforms)***
  - Each course states, "The objective of this training is to provide safe ladder practices. During this video presentation you will be shown the Proper Techniques to:
    - Select
    - Inspect
    - Set-up
    - Use [and]
    - Care for…[these ladders]"

These are offered free on-line and result in a certificate of completion! You can also purchase DVDs and train in-house.

These do a good job of meeting CalOSHA's prescriptive regulatory requirements.
This is just one source of training material/provider. There are others.

UK's Health & Safety Executive

- https://www.hse.gov.uk/
- They require a risk assessment be performed, prior to employing a ladder to accomplish a particular task [not onerous]
- Two valuable resources:
  - "Working at height, A brief guide"
  - "Safe use of ladders and stepladders, A brief guide"

The two resources are free!

You'll find a lot of other good information available if you spend some time browsing their site.

Final Thoughts

What the Different Categories Tell Us

- Should have used a ladder:
  - Sometimes, ladders are the best alternative!
  - The employer needs to ensure that ladders are available!
- Peripheral:
  - Ladders are used all the time to get somewhere – sometimes up higher, sometimes down lower
  - An up-front assessment of the hazards and pre-planning to address them will prevent fatalities
- Ladder accidents:
  - While useful, ladders can also be dangerous
  - Users need to be trained
  - Training needs to be effective
  - Training alone is not enough. A monitoring and enforcement program is also necessary
- Ladder otherwise involved:
  - There are other ways that ladders become involved in fatal accidents.
  - Everyone is responsible if we are to reduce these accidents

Overall:

Think about how you might integrate ladder safety training with your confined space, excavation, and electrical safety training.

So…

- If you are not versed in this area, hopefully you've gained a better appreciation for its breadth and depth
- There are many factors that go into selecting, inspecting and using, etc., a ladder safely
- Ladder safety isn't accomplished just by having your employees:
  - Review a 4- or 5-bullet poster
  - Take a 15-minute or 1-hour web playable course
- Ladder safety requires focus and dedicated effort!

I want to thank the NSC and my employer for making this presentation possible!!!

What You Can Do?

- Familiarize yourself with ladder safety regulations and standards
- Survey and inspect ladders at your site(s):
  - What kinds of ladders do you have?
  - Remove damaged portable ladders from service
  - Implement a program to upgrade substandard fixed ladders
  - Are inspections and maintenance being performed (and effective)?
- Review your company's ladder training policy and materials:
  - Is training mandatory for all ladder users?
  - Has everyone who uses ladders been identified?
  - Do you know which types of ladders everyone is using?
  - Are ladder course materials comprehensive (i.e., is anything missing from the materials you're using vs what your employees are doing)?
- Spend time on the floor monitoring operations:
  - Explain, educate workers **and** supervisors
  - Inspect ladders
  - Enforce safe ladder practices

And don't forget about your family, relatives, and friends (and that person you happen to pass by)!!!

Ladder Safety Training

- Investigators specifically recommended (35) or implied (37) ladder safety training in 35 + 37 (41%) of 175 incidents
- My belief is that ladder safety training:
  - May have made a difference in 45 (26%) additional incidents even though the investigators didn't say anything about it in their reports
  - Probably would not have made a difference in most of (53 = 30%) the rest
- NOTE: In 5 cases, investigators determined that the victim had been trained! (9322, 96CA01501, 97NE019, 98CA00601, 07CA005)

Training can make a difference!!!

However, training alone isn't enough. Enforcement is also needed (e.g., supervision, ESH monitoring of operations)!!!