

# Fall from Heights Fatalities Analysis

Prepared for the Chief Prevention Officer

December 2018

## Project Overview

- The project was undertaken to better understand causes (“contributing factors”) and circumstances around falls from heights.
- It involved reviewing and extracting information from files prepared by ministry inspectors about fatal injuries to better understand contributing factors.
- This included a review of 92 fall from height fatality events that occurred from 2009 to 2016 (excludes slips, trips, staircases).

# Limitations

- **Sample Size:** The small sample size (n=92) limits the explanatory power of the analysis
- **Only Fatalities:** The analysis covers only fatalities, not non-fatal injuries. The conditions and factors surrounding critical injuries may be similar to or different than those that lead to fatalities.
- **Data Quality:** Data source contained information that is relevant only to the specific event information relevant for analysis had to be extracted/interpreted from the event details. Additionally, not every data point was available in every file.
- **Data Capture, Coding and Interpretation:** Despite the rigorous consistency checks, there might have been differences in coding and interpreting the information by the team working on the pilot project.

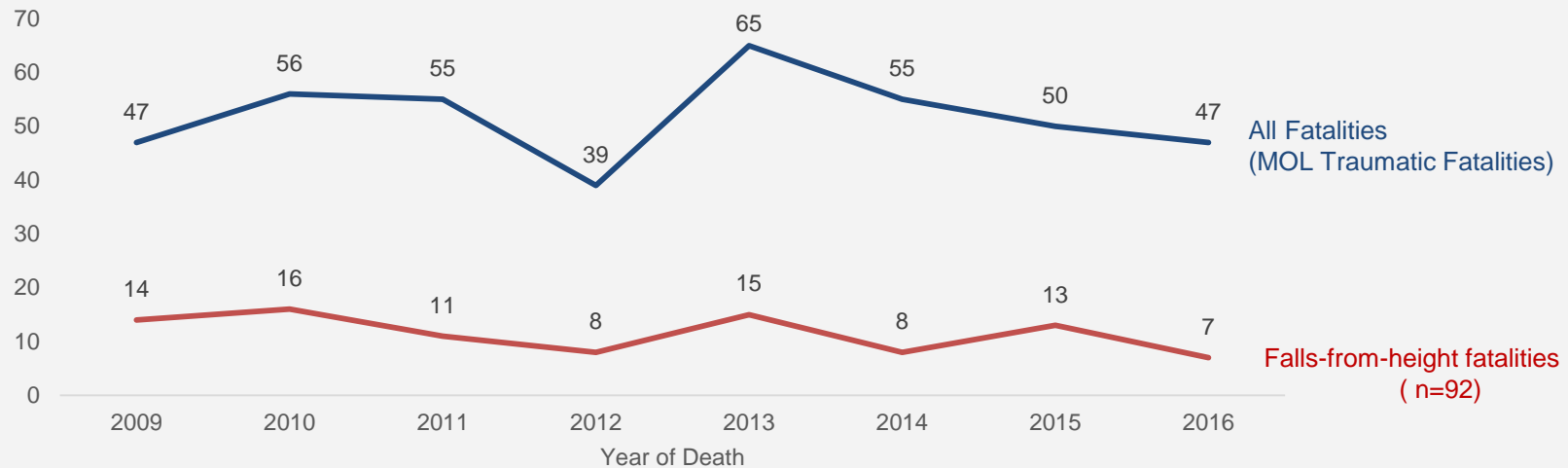
# Results: Overview

## Fatalities by Region and Program

Region	Program			Total
	CHSP	IHSP	HCU	
Central East	17	9	0	26
Central West	15	8	0	23
West	15	6	0	21
East	9	6	1	16
North	4	2	0	6
<b>Total</b>	<b>60</b>	<b>31</b>	<b>1</b>	<b>92</b>

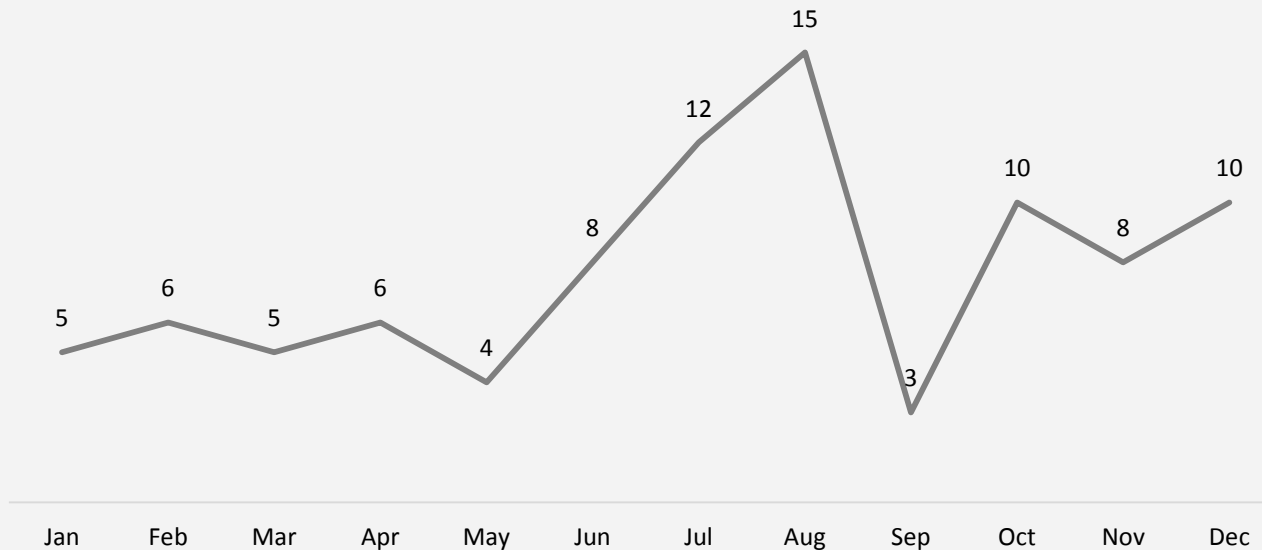
- 60 fatalities occurred in construction workplaces that are under the program authority of CHSP (65.2%).
- 26 fatalities occurred in the Central East (28.3%) and 23 in Central West (25.0%) regions.
- One fatality occurred in a workplace that is under the program authority of Healthcare Unit.

# Fatalities by Year



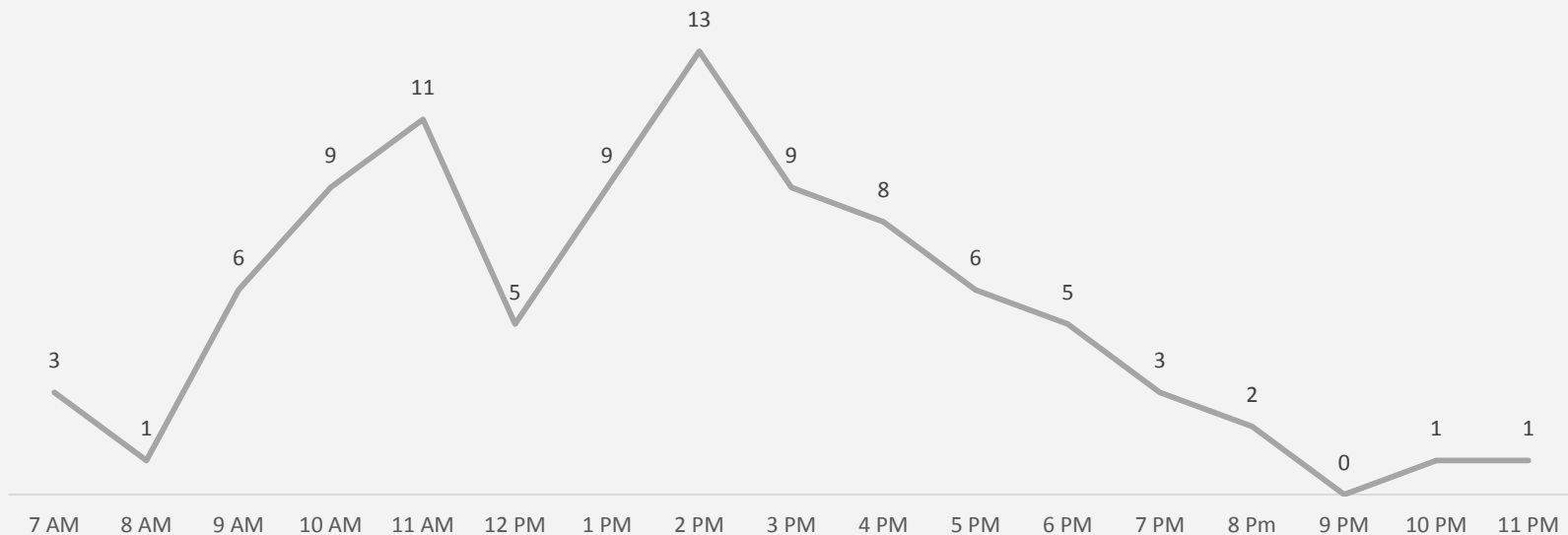
- The year-to-year fall-from-heights fatality numbers show a slight downward trend. However, the number of annual fatalities is subject to year-to-year fluctuations and a high degree of variation, limiting the ability to draw statistically meaningful trends on an annual basis.
- The overall trend of fall-from-heights fatalities was similar to the trend for all traumatic fatalities.

# Fatalities by Month



- Fatality trend had a spike during summer months, a sharp decline in September, and remained relatively high through December.
- Due to the small sample size, the sharp decline in September might not be statistically relevant. Nevertheless, it can be said that falls fatalities increased in summer months when construction activity was high.

## Fatalities by Time of Day

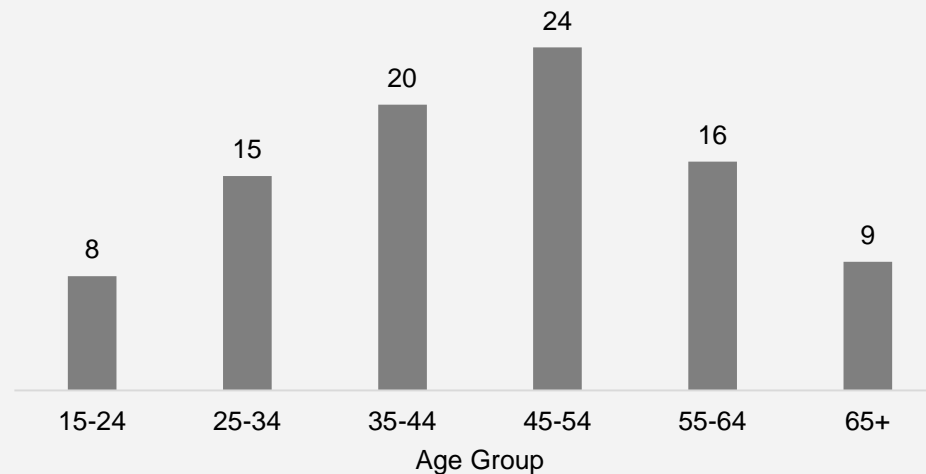


- The number of fatalities began to increase around 9 a.m., declined around 12 noon, and spiked around 2 p.m., after which it diminished gradually.
- The decline around 12 p.m. can be attributed to low work activity during lunch break.

\*Event time was rounded to the nearest hour.



## Fatalities by Age Group



- The 45-54 age group had the highest number of fatalities (26.1%), followed by the 35-44 age group (21.7%).
- There were 8 fatalities among “young workers”—those who are under the age of 25 (8.7%).
- There were 9 fatalities among those 65 and older (9.8%).

# Fatalities by Sector

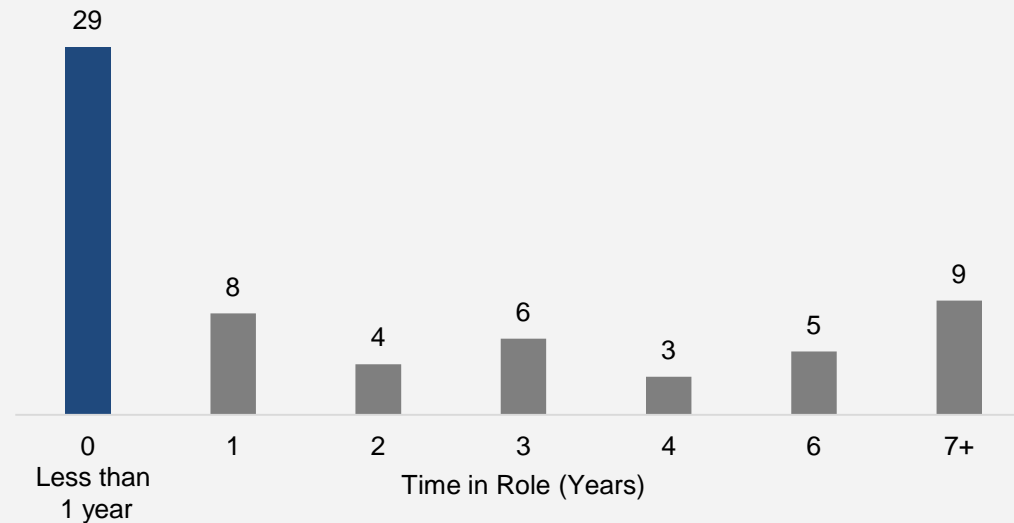
Top 10 NAICS (5-Digit) by Fatalities (n=60)



- Sector information (by The North American Industry Classification System or NAICS 5-digit) was available in the case of 60 of the fatalities.
- The NAICS category with highest number of fatalities was “Roofing contractors” (21 fatalities, 22.8%), followed by the residential building construction” (13 fatalities, 14.1%).
- “Arborists” accounted for 3 of the 7 “landscaping services fatalities”.

# Injured Worker – Time in Role

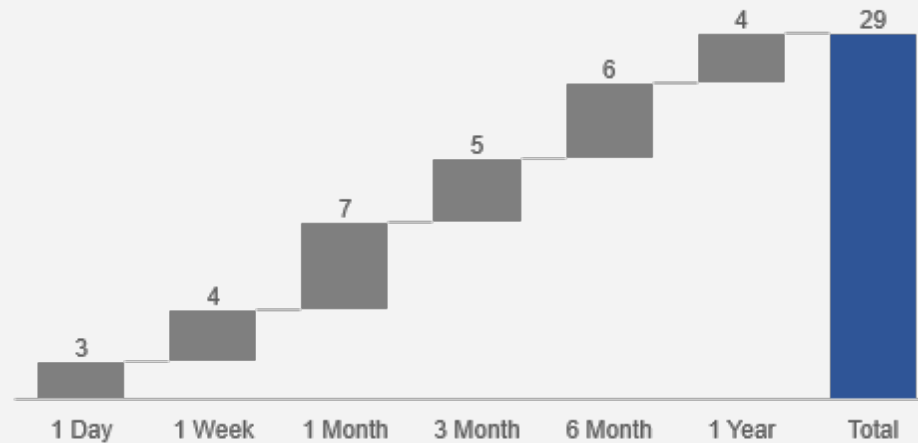
Fatalities by Time in Role (n=64)



- 29 workers had been in their role for less than one year.

# Time in Role

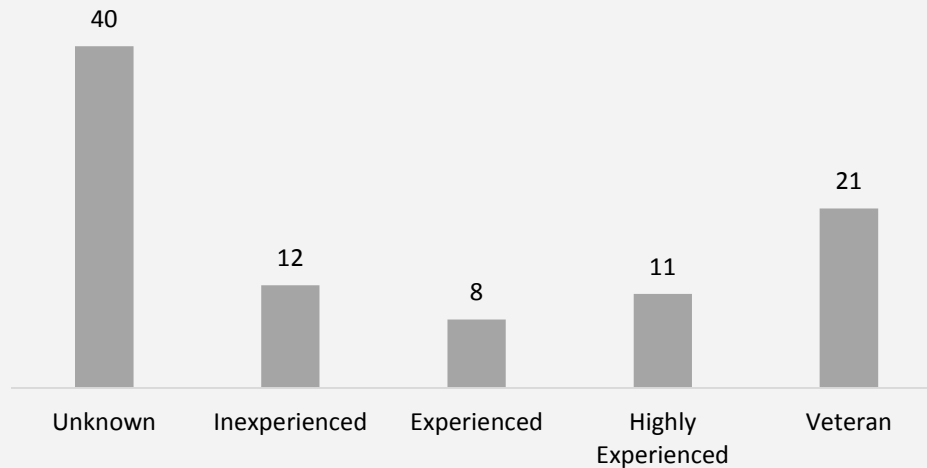
Fatalities in the First Year in Role



- The chart above provides the breakdown of the 29 workers who had died in their first year on the job.
- A *cumulative* count reveals that 14 workers died in their first month
  - 7 of those workers died in their first week
  - 3 of those workers died on their first day

# Experience

Fatalities by Experience



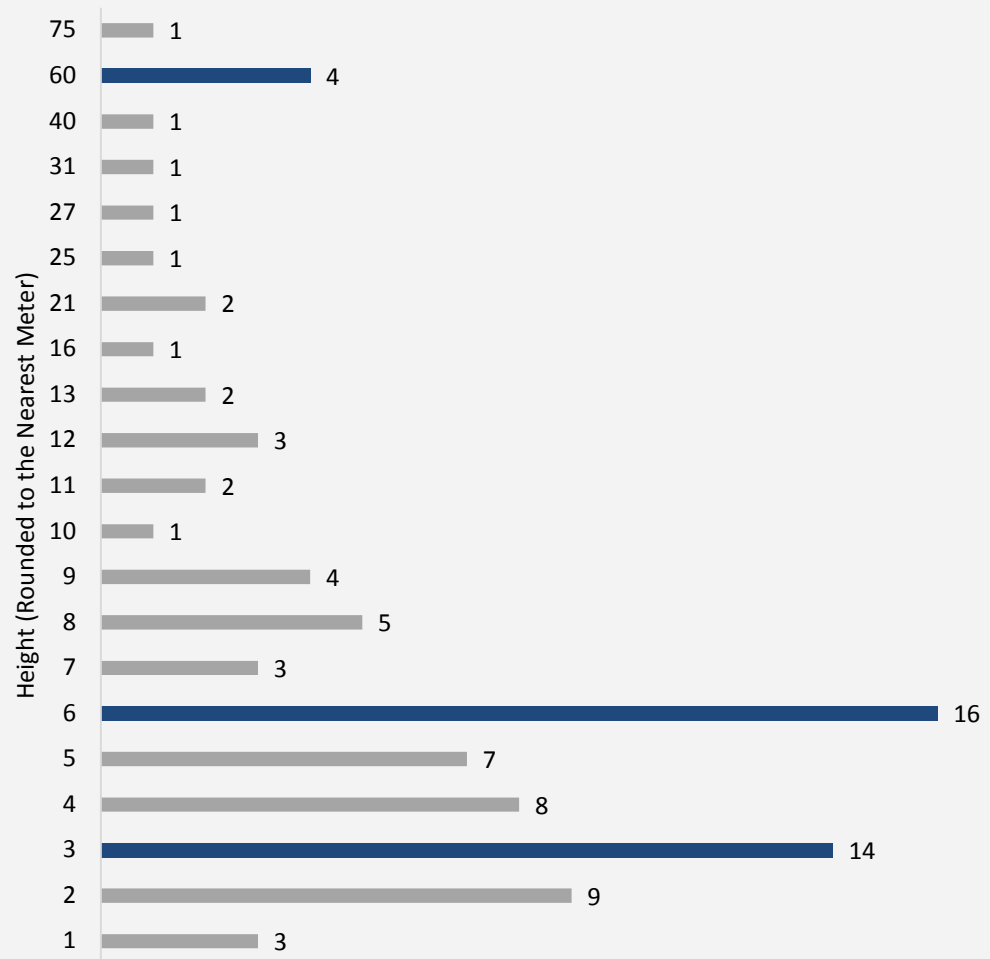
- Inexperienced (<1 year)
- Inexperienced (1-3 years)
- Highly Experienced (3-10 years)
- Veteran (10+ years)

- This chart highlights that information about worker experience is inadequate in the files. The experience level of the worker is unknown in 40 fatalities or in 48.8% of the analyzed cases.
- 21 of the workers had been in the same line of work for over 10 years.

# Height of Fall

- The most common height of fatal falls was from 6 metres (16 fatalities). Fatal falls from 3 metres was nearly as common (14 fatalities). These heights roughly correspond to two-storey and one-storey roof/floor heights.
- 12 fatal fatalities were from a height of less than 3 metres.
- The four fatal falls that were from 60 metres were due to the same incidence.

Number of Fatalities by Height of Fall (n=89)



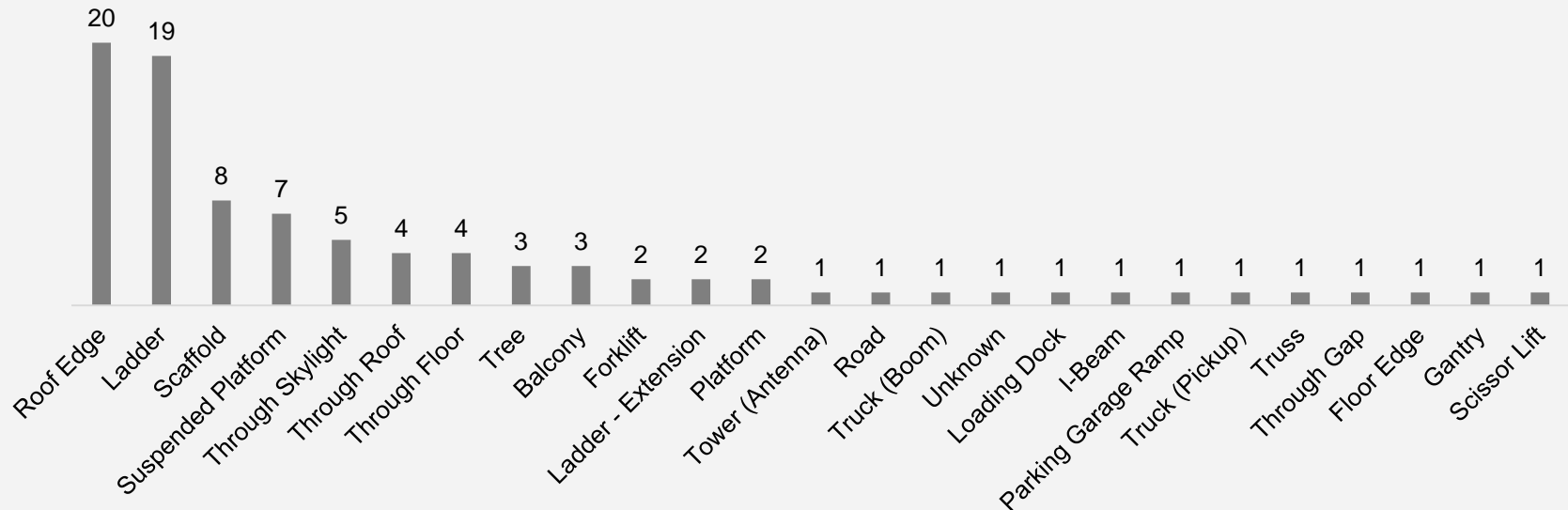
# Worker Location and Height of Fall

Worker Location	Height (m)											Total
	1	2	3	4	5	6	7	8	9	10-19	20+	
Roof			4	3	2	9	2	3	1	4		28
Ladder	1	7	1	1	4	3	1		1		2	21
Scaffold		1	3	1		2				1		8
Suspended Platform										1	6	7
Floor			4	1						1		6
Moving Equipment	1		2			1			1			5
Other				1		1		1			1	4
Tree								1	1	1		3
Road/Ramp/Dock	1				1						1	3
Balcony										1	1	2
Platform		1		1								2
<b>Total</b>	<b>3</b>	<b>9</b>	<b>14</b>	<b>8</b>	<b>7</b>	<b>16</b>	<b>3</b>	<b>5</b>	<b>4</b>	<b>9</b>	<b>11</b>	<b>89</b>

- 31.5% of the fatal falls were from roofs (28 fatalities). Nine of these roof falls were from 6 metres.
- Ladders accounted for 23.6% of fatal falls (21 fatalities). Seven of these ladder falls were from 2 metres.
- There were six fatal falls from suspended platforms that were more than 20 metres.
- Worker location was rolled up to a less detailed level and some heights were grouped. Note that fatalities for which heights were unknown were excluded.

# Worker Location Details

Fatalities by Worker Location (n=92)



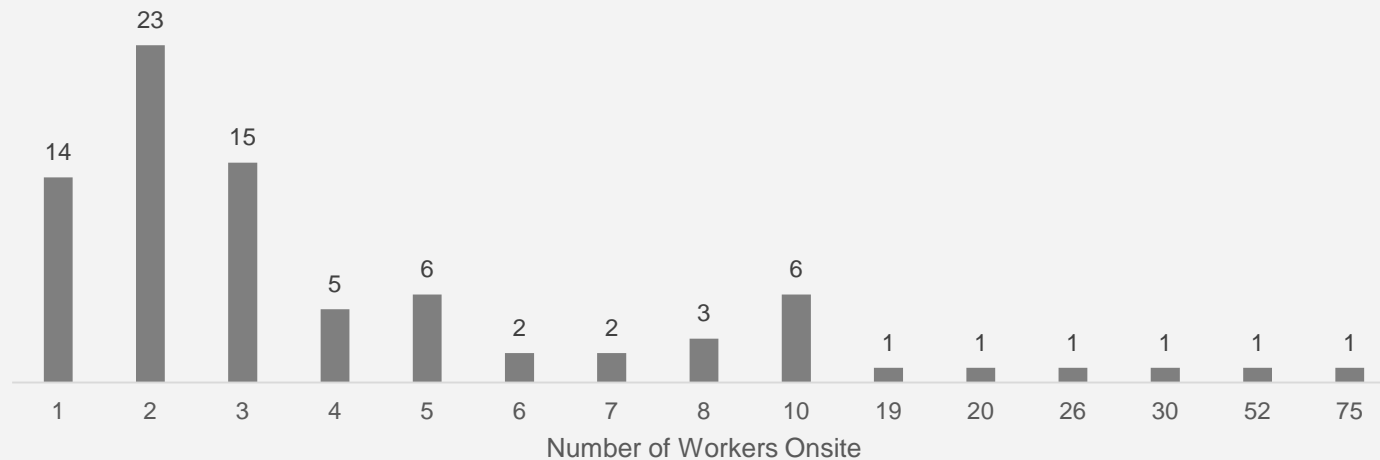
1. The most common fall location was roof edge (20 fatalities) followed by ladder (19 fatalities).
2. Worker location is further divided by the nature of fall. For example, the breakdown of the 29 of fatal falls from roofs was as follows: roof edge 20, through skylight 5, and through roof 4.

Note: 29 of fatal falls from roofs includes 1 fatality with unknown height.



# Number of Workers on Worksite

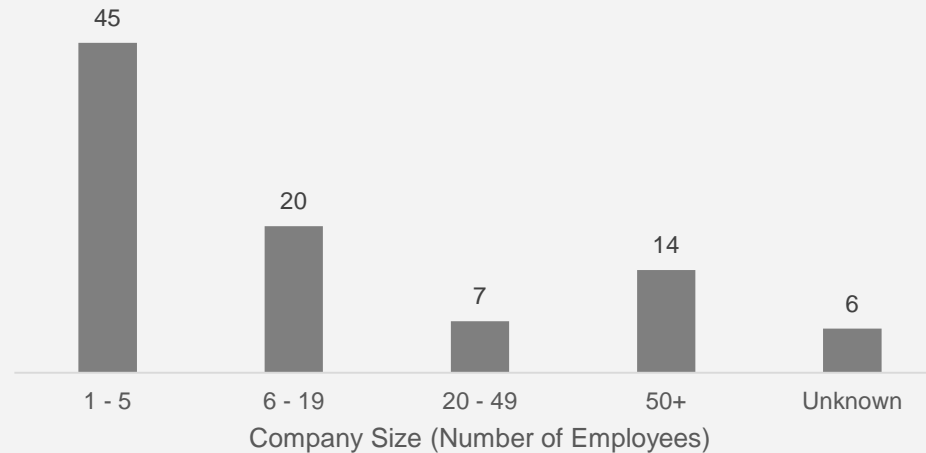
Fatalities by Number of Workers on worksite (n=82)



- 63.4% of the fatal falls (52 fatalities) occurred on the worksites where there were 1-3 workers present at the time of the incident
- This might be due to small projects' relative lack of formality and training compared to larger operations.

# Company Size

Fatalities by Company Size (n=92)



- The previous slide showed that most workers were working alone or in small groups at the time of the fatal fall.
- This slide makes a similar point, this time on company size: Small businesses accounted for most of the fatalities. The businesses with 1-5 workers accounted for 48.9% of fatal fall (45 fatalities).

# Results: Contributing Factors

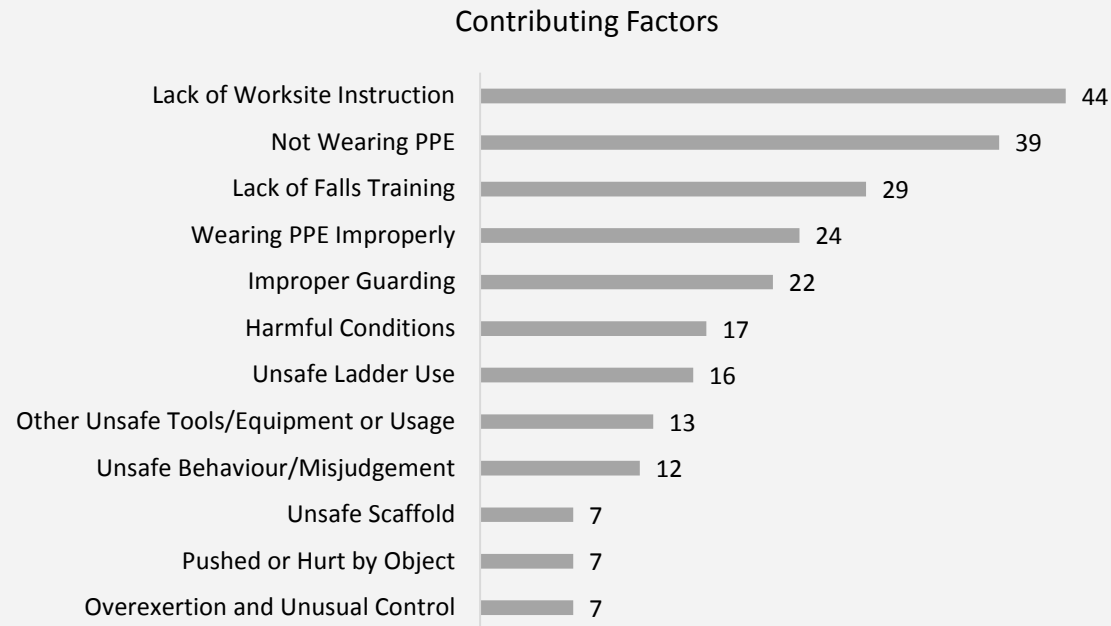
## Contributing Factor Methodology

- A contributing factor is defined as an issue pertinent to a fall, which may not have caused the fatality alone or directly, but whose presence increased the likelihood of a fall.
- A list of 13 contributing factors based on common hazards and themes was produced.
- The 92 fatalities were then reviewed and assigned relevant factors.
- Each fatality had anywhere between 1 and 6 factors.

# List of Factors

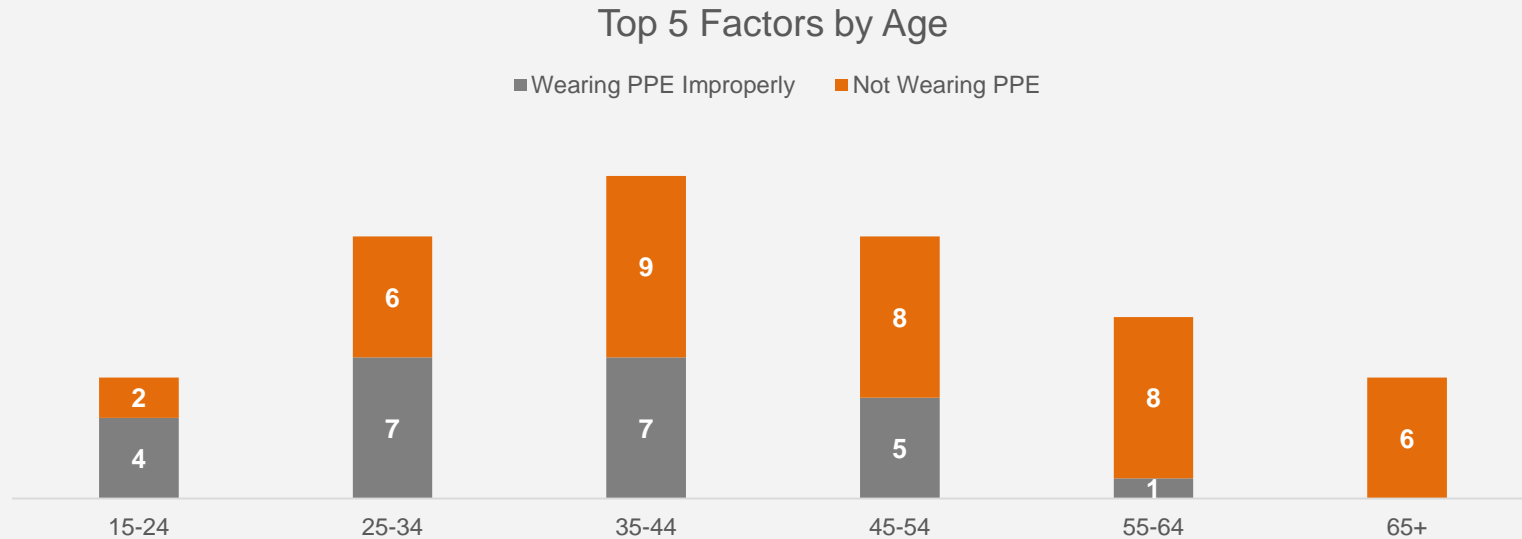
Factor	Description
Not Wearing PPE	No PPE (e.g. fall arrest harness) was worn by worker as required
Wearing PPE Improperly	Worker wore PPE incorrectly
Lack of Falls Training	Worker did not have any fall specific training
Lack of Worksite Instruction	Worker did not receive training or instruction specific to their worksite and its hazards
Unsafe Behavior/Misjudgment	Worker knowingly behaved in an unsafe manner or misjudged a clear hazard
Overexertion and Unusual Control	Incident caused by worker fatigue or impairment
Pushed or Struck by Object	Worker hurt or made to fall by object
Improper Guarded	Missing or improperly installed guarding such as guardrails (balcony, opening), skylights or hole covering
Unsafe Ladder Use	Ladder used inappropriately
Unsafe Scaffold	Scaffold used inappropriately
Other Unsafe Tools/Equipment or Usage	Tools and equipment (non-ladder or scaffold) used inappropriately
Harmful Conditions	Worksite conditions such as weather, noise or cluttered floorspace

# Contributing Factors: Summary Results



- “Lack of worksite instruction” was the most common contributing factor. It was observed in 44 of the 92 fall fatalities (47.8%).
- “Not wearing PPE” was a contributing factor in 42.4% of the fatalities, “lack of falls training” in 31.5%, “wearing PPE improperly” in 26.1%, and “improper guarding” in 23.9%.

# Focus: PPE and Age



- The 55-64 and 65+ age brackets indicate that PPE is more often not worn as opposed to worn incorrectly.
- This is in contrast with the younger age groups.

## Focus: PPE and Age.

- For the older age groups, **not wearing PPE** was a more common factor than wearing PPE improperly.
  - Not wearing PPE was a factor in 6 of 9 fatalities that occurred in the 65+ age group.
  - Wearing PPE improperly was a factor in only 1 of the 16 fatalities that occurred in 55-64 age group.
- For the younger age groups, **wearing PPE improperly** was more common.
  - Wearing PPE improperly was a factor in 4 of the 8 fatalities that occurred in the 15-24 age group (“young workers”)

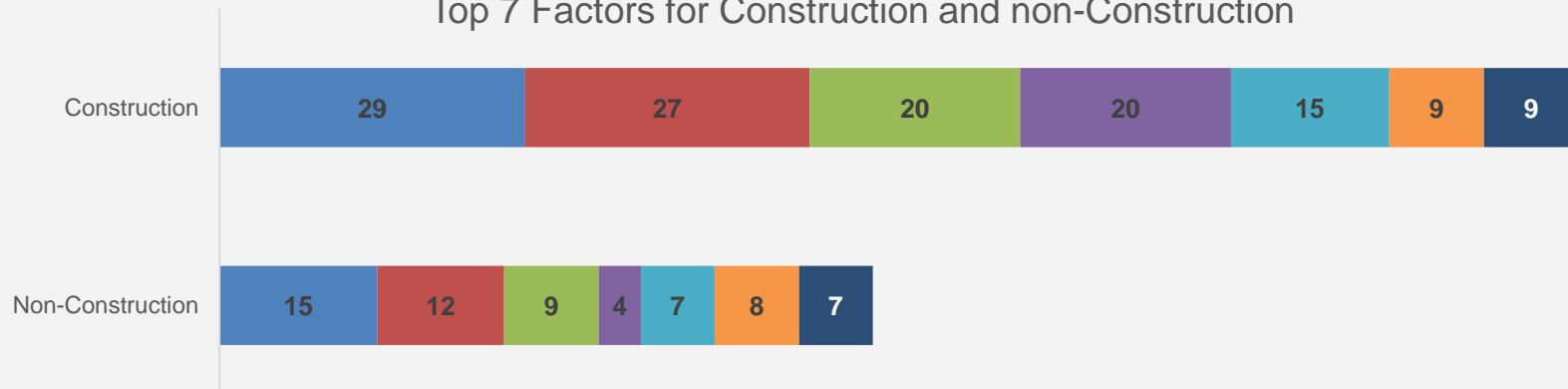
Age Group	Number of Fall Fatalities in the Age Group	Fatalities where "Not Wearing PPE" was a factor	Fatalities where "Wearing PPE Improperly" was a factor
15-24	8	2 (25.0%)	4 (50.0%)
25-34	15	6 (40.0%)	7 (46.7%)
35-44	20	9 (45.0%)	7 (35.0%)
45-54	24	8 (33.3%)	5 (20.8%)
55-64	16	8 (50.0%)	1 (6.3%)
65+	9	6 (66.7%)	0 (0.0%)
Total	92	39 (42.4%)	24 (26.1%)



# Factor Analysis – By Sector

■ Lack of Worksite Instruction ■ Not Wearing PPE ■ Lack of Falls Training ■ Wearing PPE Improperly ■ Improper Guarding ■ Harmful Conditions ■ Unsafe Ladder Use

Top 7 Factors for Construction and non-Construction

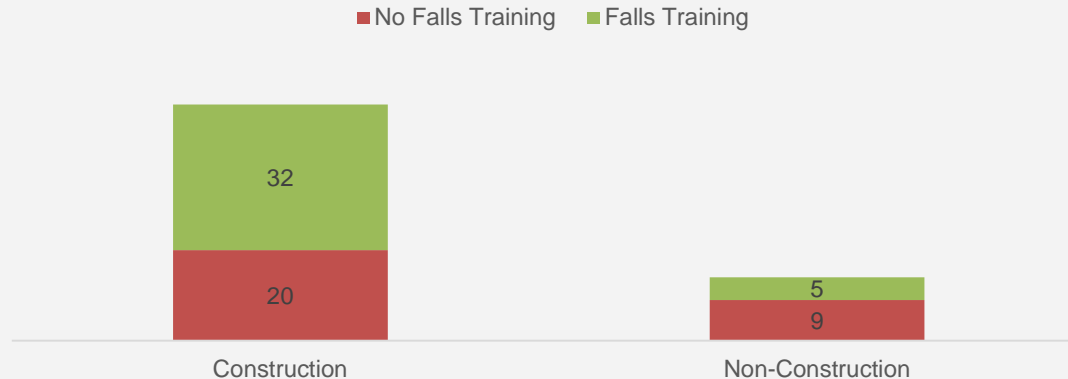


- Lack of worksite instruction is the most common factor in both construction and non-construction sectors (based on the 2-digit NAICS)
  - “Lack of worksite instruction” was a factor in 47.5% of 61 fall fatalities in the construction sector and 46.4% of 31 fatalities in the sectors other than construction.
  - “Harmful conditions” was a factor in 14.8% of 61 fall fatalities in the construction sector and 25.8% of 31 fatalities in the sectors other than construction.

## Training: Notes

- For the purpose of this analysis, “Falls Training” represents a mention in the file that the worker took some type of falls prevention training.
- There was no information/supporting documents found to assess the quality of the training.
- It’s not possible to draw conclusions from this study about the effectiveness of the Working at Heights (WAH) training.
  - This analysis covered the falls fatalities that occurred from 2009 to 2016. The mandatory WAH training program standard came into force in April 2015. In specific circumstances, some employers also had until October 2017 to ensure workers completed the working at heights training offered by the approved training providers.

# Training

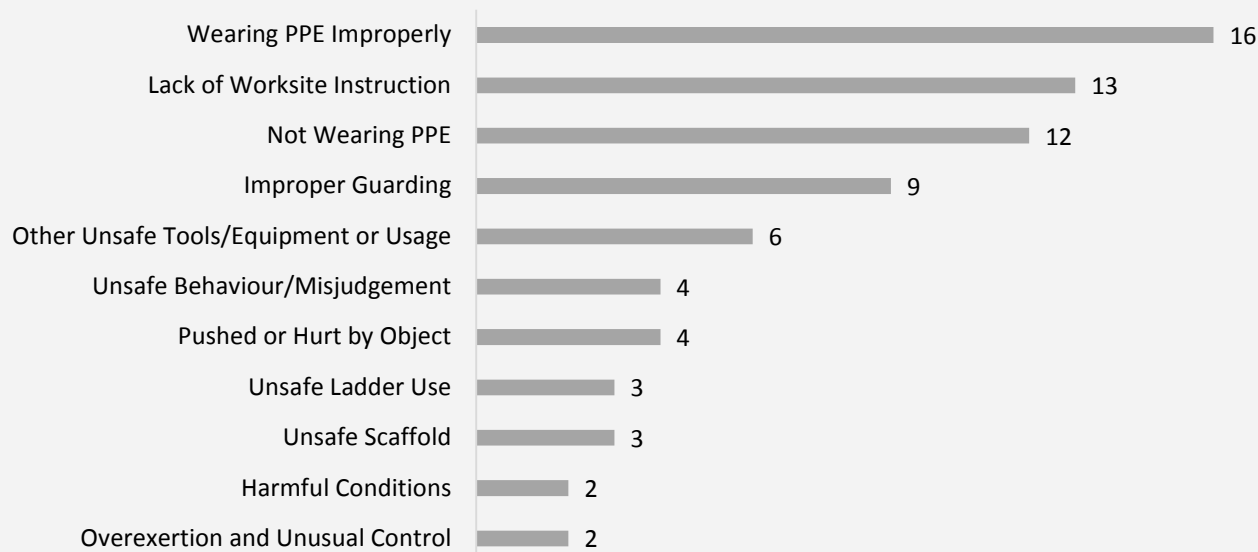


- 37 workers had falls training (40%), 29 workers did not (32%). Training information was not included in 26 of the analyzed cases (28%).
- Among the 61 construction\* fatalities analyzed:
  - 32 workers had falls training (52.4%), 20 didn't receive training (33%), training information was not available in 9 of the analyzed construction fatalities (14.7%).
- Among the 31 non-construction\* fatalities analyzed:
  - 5 workers had falls training (16%), 9 didn't receive training (29%), training information was not available in 17 of the analyzed construction fatalities (55%).

\*Note: 2-digit NAICS was used to define Construction or Non-Construction sectors.

# What Went Wrong Despite Training

Factors Present When Falls Training is Evident



- Of the 37 workers who had some form of falls training:
  - 28 had issues with PPE: 16 worn PPE improperly and 12 did not wear it at all.
  - 13 workers did not receive adequate worksite instruction.

## Highlighted Contributing Factors by Business Size

1-5 Employees	6-19 Employees
<p>Pushed or Struck by Object (6/7)</p> <p><i>Of 7 fatalities involving this factor, 6 were of workers who worked for businesses with 1-5 employees.</i></p>	<p>Other Unsafe Tools/Equipment or Usage (7/13)</p> <p><i>Of 13 fatalities involving this factor, 7 were of workers who worked for businesses with 6-19 employees.</i></p>
Unsafe Scaffold (6/7)	
Unsafe Ladder Use (9/13)	
Unsafe Behavior/Misjudgment (8/10)	
Lack of Falls Training (17/29)	
Not Wearing PPE (22/36)	

No factors were specifically notable for businesses of size 20-49 or 50+.

## Highlighted Contributing Factors by Top 2 Sectors (NAICS 5 Digit)

Roofing Contractors	Residential Building Construction
Lack of Worksite Instruction (10/21) <i>(10 out of 21 fatalities in “roofing contractors” sector involved this factor)</i>	Lack of Worksite Instruction (9/13) <i>(9 out of 13 fatalities in “residential building construction” sector involved this factor)</i>
Not wearing PPE (10/21)	
Wearing PPE Improperly (9/21)	Wearing PPE Improperly (7/13)
Improper Guarding (7/21)	
	Lack of Falls Training (6/13)

# Summary

## Summarized Takeaways

1. The year-to-year fall-from-heights fatality numbers show a slight downward trend. However, the number of annual fatalities is subject to year-to-year fluctuations and a high degree of random variation, limiting the ability to draw statistically meaningful trends on an annual basis.
2. Fatality numbers had a spike during summer months, a sharp decline in September, and remained relatively high through December.
3. The number of fatalities begins to increase around 9 a.m., declines around 12 noon, and spikes around 2 p.m., after which it diminishes gradually.
4. Fatalities by age are distributed in a bell curve with nearly equal occurrence in the 15-24 (“young workers”) and 65+ age groups.
5. Roofing contractors and residential building construction were the most common sectors (NAICS 5-digit).
6. 29 workers were in their current role less than 1 year.
7. 14 workers had been on the job less than 1 month.



8. While workers time in role and experience were positively correlated, there was a significant number of fatalities where the worker had experience, but was fairly new to their current job.
9. Workers fell from as little as less than a meter, but the most common heights of fatal falls were from 3 and 6 metres. These heights roughly correspond to one and two-storey heights.
10. The two most common locations that workers fell from were roof edges and ladders.
11. Most fatalities occurred on the worksites where there were 1-3 workers present at the time of incident
12. Most workers worked for businesses with 1-5 employees.
13. The three most common contributing factors to falls were lack of worksite instruction, not wearing PPE and lack of falls training.

14. For the older age groups, not wearing PPE was a more frequent factor than wearing PPE improperly. Whereas wearing PPE improperly was more frequent for the younger age groups.
15. A lack of worksite instruction is the most common factor in fatal falls in construction and non-construction sectors.
16. About half of construction fatalities involved workers who had falls training.
17. Of these 32 construction\* related fatalities of workers who had falls training, the most common factors were wearing PPE improperly, lack of worksite instruction, and not wearing PPE.
18. Small businesses featured a larger proportion of the following factors: pushed or struck by object, unsafe scaffold, unsafe ladder, unsafe behavior/misjudgment, lack of falls training and not wearing PPE.
19. Roofing contractors and residential building construction were the NAICS (5 digit) with the most number of fatalities and had large than average instances of lack of worksite instruction and wearing PPE improperly.

\*Note: 2-digit NAICS was used to define Construction sectors.