



## CITY OF FAIRFAX FIRE DEPARTMENT

# SIGNIFICANT ACCIDENT / INJURY INVESTIGATION

Two Firefighters Injured in Ladder Fall

9650 Colonial Avenue

April 29, 2013



Report Issued July 24, 2013



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## I. Executive Summary

On April 29, 2013, B-shift conducted a multi-unit drill at the City of Fairfax Training Center located at 9650 Colonial Avenue, Fairfax, Virginia. During this drill, a deployed 20' straight ladder fell to the ground with a firefighter near the tip. The resulting fall injured the firefighter on the tip and the firefighter that had been heeling the ladder. Both firefighters suffered blunt force internal injuries and lacerations and were transported to a hospital. Both firefighters were treated and released however both were placed on injury leave.

As part of the multi unit drill, an evolution was conducted based on the concept of Vent, Enter, Isolate, and Search (VEIS). This evolution involved a three person crew where one person heeled the ladder; one person ascended the ladder and entered the burn building through a second story window, and one person on the ladder near the tip guiding the search with a thermal imager. The 20' ladder used for the VEIS evolution had been deployed as part of a separate prior laddering evolution and was left in place.

The crew involved in the accident had completed this scenario twice, rotating members to different positions. The accident occurred during this crew's third and final attempt. Firefighter 1 heeled the ladder, Firefighter 2 ascended the ladder and entered the building through the window, and Firefighter 3 ascended the ladder to guide the search from the ladder using a thermal imager. As Firefighter 3 took a position near the tip of the ladder near the window, the ladder slid vertically downward off the metal trim piece below the window and momentarily stopped when the tip made contact with the building's siding. The stoppage in movement was momentary and the ladder began to slide downward with the feet sliding away from the building. As a result of the ladder beginning to fall, Firefighter 1 was compressed in a "baseball catcher's" stance under the ladder creating a fulcrum for the ladder to pivot on, thus causing the feet of the ladder to become airborne and allowing the tip to separate from the wall for the remainder on the fall. Firefighter 3 landed on the ladder with a leg protruding between two rungs. As part of the collision with the ground, Firefighter 3's SCBA was pushed upward on his back causing the back of his head to strike the top of the SCBA cylinder.

On April 29, 2013, the Assistant Chief of Operations notified the chair of the safety committee of the incident and requested a Significant Injury / Accident Investigation be conducted. This report is the result of the investigation and is based on witness accounts, physical evidence and industry standards. The ladder placement was recreated using the ladder involved in the incident.



## **II. Investigative Team:**

**Team Lead:** Battalion Chief Mark Ciarrocca, Chair of the Occupational, Health and Safety Committee

### **Occupational, Health and Safety Committee Team Members:**

Captain James Jeckell  
Lieutenant David Whitacre  
Master Firefighter John Jeniec

## **III. Investigative Tasks:**

- Review all written statements
- Conduct follow-up interviews
- Photo document evidence
- Recreate scenario
- Review similar incidents in Fairfax County
- Review all relevant existing departmental procedures, manuals, and other pertinent documentation for insight into the need for preventative action and procedural changes

## **IV. Incident Information:**

Date: April 29, 2013

Time: 1450 hours

Address: 9650 Colonial Avenue

Weather: 60 degrees Fahrenheit  
13 MPH wind, direction not available  
Misting rain, daily accumulation 0.09 inches



## **V. Findings, Discussion, and Recommendations**

### **1. Position of Ladder**

#### **Finding 1-1:**

The ladder was placed at a 44 degree climbing angle with the tip 14.146 feet from the ground and the butt 14.708 feet from the building.

#### **Finding 1-2:**

The butt spurs of the ladder, when at a 44 degree angle, do not correctly make contact with the ground, in this case concrete, with the biting edge of the spur.

#### **Finding 1-3:**

The rounded portion of the tip was the only point of contact with the window sill which is sloped at a 45 degree angle. This resulted in minimal ladder / sill contact.

#### **Discussion:**

Of the drill participants who were interviewed, no one perceived this climbing angle to be improper. The industry standard proper climbing angle for a ground ladder is 75 degrees as stated in the 5<sup>th</sup> edition Essentials of Firefighting and Fire Department Operations textbook published by IFSTA (IFSTA Essentials).

Several interviewed participants stated that the ladder needed to be at “a bailout” angle. Two separate and unrelated evolutions have been merged regarding ladder placement. The VEIS evolution involves working from a ladder and using a ladder to enter a window. Based on this concept, a climbing angle close to 75 degrees should be used in accordance with published industry standards. Ladders placed at lower angles are prevalent in “laddering for egress” or “bailouts”. These ladders are typically not ascended.

#### **Recommendation 1-1:**

Department wide re-training on the placement of ladders, as described in IFSTA Essentials, should be provided. Understanding the physics of how loads are transferred and dispersed should be attained.



## 2. Securing the Ladder

### Finding 2-1:

The ladder was heeled by Firefighter 1 from the under the ladder position which did not secure the ladder.

### Finding 2-2:

Firefighter 1 weighs approximately 150 pounds undressed. With full protective equipment ensemble and SCBA, Firefighter 1 is estimated to weigh 215 pounds.

### Finding 2-3:

Firefighter 3 (working on ladder) weighs 285 pounds undressed. With full protective equipment ensemble, Firefighter 3 is estimated to weigh 350 pounds.

### Discussion:

By heeling the ladder from the underside, Firefighter 1 was using arm strength and some body weight to pull the ladder downward. Due to the low angle, this effort appears to have added force in a direction compounding the force applied at the tip, thus assisting the ladder in sliding down the face of the building.

Heeling the ladder from underneath and in front are acceptable methods detailed in IFSTA Essentials. In this case, the in front of the ladder heeling position would have employed most of Firefighter 1's weight, transferred to the ground in two points (each foot) in fairly equal amounts. This method relies on the firefighter's weight more so than strength to secure the ladder.

The physics of this scenario with a 350 pound tip load at a 44 degree angle, with the tip of the ladder not truly bearing weight on the building, may have defeated the heeling efforts regardless of position. Additionally, the concrete and building were both wet from a persistent misting precipitation that would have reduce the friction between the ladder and these surfaces.

During the investigation, the potential of Firefighter 1 being distracted was analyzed. Although Firefighter 1 had verbally called out to another employee immediately prior to this accident with an unrelated communication, it was determined through witness accounts that Firefighter 1 was in the proper heeling position and was attempting to heel the ladder.



Recommendation 2-1:

The department should establish a preferred position for heeling ladders based on best practices within industry standards.

3. Ladder Selection

Finding 3-1:

Other ladders of differing lengths were available for use that would have provided a more appropriate climbing angle.

Finding 3-2:

The instructor advised the crew to use a non-optimal ladder for this evolution. A 16' roof ladder would provide for a 61 degree climbing angle which is much closer to the industry recommended 75 degrees for climbing and working from.

Discussion:

The VEIS evolution was immediately preceded by an evolution where the crew of three removed and deployed all the ground ladders stored in the rear of T403. During the ladder throwing evolution, Firefighter 3 placed the 20' ladder in the target window as an egress ladder. The tip placement was such that several inches of the ladder tips were visible above the window sill. At the completion of the ladder throwing exercise, the instructor advised the group to stow the ladders and leave the 20' ladder in place which would be used in the VEIS evolution. A conference ensued amongst the crew and instructor regarding tip placement. Agreement was reached to reposition the ladder by sliding the butt further from the building thus placing the rounded tips on the 45 degree window sill.

Firefighter 3 originally placed the ladder in the window with the tips above the sill. A decision was made to alter the ladder's position after a group discussion. This situation relates back to the discussion section of the previously listed finding describing the merging of two separate evolutions, VEIS and bailouts.



IFSTA Essentials states that the tip of a ladder placed for entry through a window is to be placed below the window sill. Furthermore, City of Fairfax Administrative Regulation 7-10 (1994) states ladders are not to be placed against window sashes.

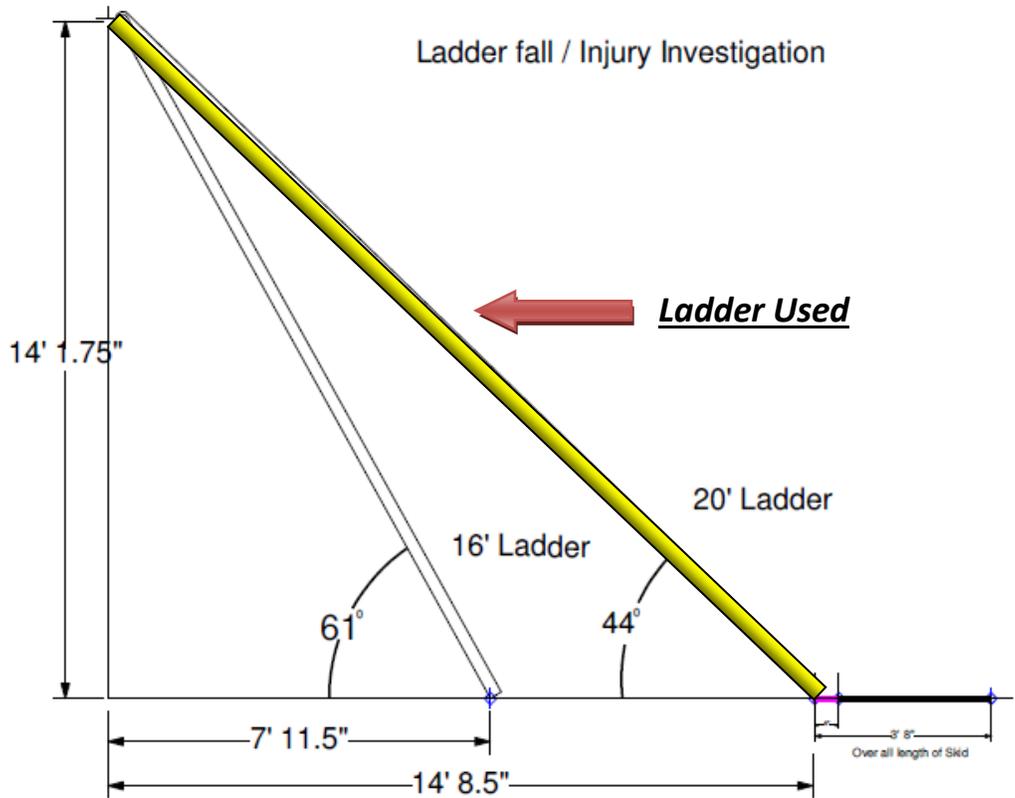


Illustration 1 - Calculated Angle of 20' ladder compared to 16' ladder

Recommendation 3-1:

Two separate laddering evolutions should be identified clearly differentiating one for VEIS and one for bailouts. Instructors should use scenarios that maximize safety to teach points. This should be documented in the lesson plan for training and delivered to the entire department.

Recommendation 3-2:

Drill lesson plans should list specific equipment to be used, provide adequate guidance to instructors to ensure standardized safe practices are taught and list references used to develop the drill when possible.



#### 4. Designated Safety Officer

##### Finding 4-1:

The designated safety officer for the drill was also an instructor for a specific engine company evolution while other activities were simultaneously occurring.

##### Finding 4-2:

The designated drill safety officer was not dedicated to the safety officer role.

##### Finding 4-3:

The individual selected as the drill safety officer does not possess an Incident Safety Officer (ISO) certification from NFA or VDFP.

##### Finding 4-4:

The Safety Board in the Safety Station was not filled out to reflect this drill.

##### Comments:

During high risk evolutions, where human error may have catastrophic results, a dedicated safety officer must maintain a focus on safety and not be distracted by engaging in the delivery of training. For high risk evolutions,

##### Recommendation 4-1:

All company officers should be ISO certified which would raise the safety awareness level and enhance the decision making process.

##### Recommendation 4-2:

During high risk evolutions, where human error may have catastrophic results, a dedicated safety officer must be appointed. The designated safety officer should be trained as Incident Safety Officer (ISO).

##### Recommendation 4-3:

A policy should be developed mandating the Drill Safety Plan is reviewed and on hand at all department training. When conducting drills at the training center the drill safety information will be posted in the Safety Station.



## 5. Policy Review

### Finding 5-1:

The City of Fairfax new hire manual references the “IFSTA Firefighters Handbook”. A logical conclusion regarding this reference is that it is referring to IFSTA. Through this reference, the IFSTA Essentials textbook is the governing document for Department training with respect to laddering.

### Finding 5-2:

The City of Fairfax Administrative Regulation 7-10 (AR 7-10), Loss Control and Safety Program covers safe procedures for laddering. There are some sections that the fire department is exempt from however the prohibition of placing ladders on window sashes in an effort to limit “tilting and slipping” applies.

### Finding 5-3:

AR 7-10 addresses the climbing angle as being established by the feet being 1/4 the height away from the building. In this case that would have been 3’ 6”. A 24’ extension ladder would have satisfied this requirement.

### Finding 5-4:

General Order 11.024, Training and Drill Safety Plan, mandates a drill safety plan be completed with specific information requiring recommended safe procedures and steps to safely complete the training evolution in addition to identifying a designated safety officer.

### Finding 5-5:

Deviation from written policies and established practices occurred regarding the climbing angle, tip placement, and safety procedures.

### Discussion:

Locating the proper reference manual, in this case the IFSTA Essentials textbook, for this investigation was moderately challenging. The only copies were found to be at the training center. Two other similar reference textbooks were found at fire station 3, one by Delmar and one by Jones and Bartlett.

The copy of AR 7-10 referenced was published in 1994. Several but not all laddering guidelines include language that exempts the fire department by referring to Department SOP’s or NFPA guidelines. No SOP’s could be located that specifically cover laddering.



Recommendation 5-1:

Properly reference a training textbook in the new hire manual and make copies available in all work locations. Training lesson plans should reference the textbook for specific skill training.

Recommendation 5-2:

AR 7-10 should be reviewed for technical accuracy as it pertains to fire department operations to eliminate any potential conflicts between policy and industry standard practices.

Recommendation 5-3:

All personnel should review AR 7-10 in its entirety to develop an understanding of safety regulations applicable to personnel. Review of AR 7-10 should be incorporated into the minimum staffing program.

Recommendation 5-4:

Drill safety plans should incorporate specific sections of AR 7-10 that may apply to specific training evolutions.

Recommendation 5-5:

Drill safety plans should provide sufficient information to comply with General Order 11.024, Training and Drill Safety Plan.



**VI. Photographs**



Photograph 1 – Right beam/tip contact with window trim



Photograph 2 - Left beam/tip contact with window trim



Significant Injury / Accident Investigation – 9650 Colonial Ave., April 29, 2013



Photograph 3 – Position of ladder after first drop



Photograph 4 – Position of ladder where ladder butt became airborne



Significant Injury / Accident Investigation – 9650 Colonial Ave., April 29, 2013



Photograph 5 – 3'8" of skid marks on concrete



Photograph 6 – Position of ladder butt when unrestrained skid started



Significant Injury / Accident Investigation – 9650 Colonial Ave., April 29, 2013



Photograph 7 – Ladder angle comparison between 16' and 20' ladders