



## Fire Fighter Dies While Fighting Warehouse Fire When Parapet Wall Collapses—Vermont

### SUMMARY

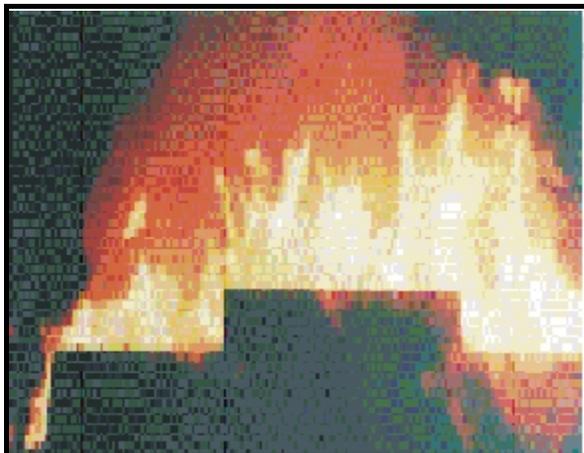
On September 5, 1998, a total of four fire departments (three volunteer and one career) were dispatched to fight a warehouse fire that housed recycled paper. The warehouse was built around the late 1800s of brick masonry frame with heavy wood truss construction. The first arriving Engine Company Chief (volunteer) observed smoke issuing from below the eaves at the rear of the structure and made the decision not to enter the structure, but to surround and drown. When the Engine 3 crew arrived (career), they were ordered to position their Engine at the north end of the structure and attack from the exterior of the structure. One of the fire fighters from Engine 3 approached the structure to open the large barn-like doors to enable the fire fighters to attack from the exterior. The fire fighter then returned to the hose line and discovered the doors had closed behind him (self-closing doors). He was returning to re-open the doors to prop them open, when without warning, the parapet wall above the doors suddenly collapsed on him. The

NIOSH investigator concluded that to prevent similar incidents, fire departments should:

- *ensure that pre-fire planning and inspections cover all structural building materials/components and exterior walls*
- *should establish a collapse zone around buildings that have parapet walls that could collapse*

### INTRODUCTION

On September 5, 1998, a career fire department responded to a mutual aid call from a volunteer/on-call department to assist in a large warehouse fire. The career department arrived on the scene and was positioned at the north end of the structure. A 54-year-old male fire fighter (victim) had opened a large set of barn-like doors on the north end to provide an opening for an exterior attack. The doors were hinged to be self-closing. The doors closed, and the fire fighter was returning to prop open the doors,



*Warehouse where fatality occurred.*

The **Fire Fighter Fatality Investigation and Prevention Program** is conducted by the National Institute for Occupational Safety and Health (NIOSH). The purpose of the program is to determine factors that cause or contribute to fire fighter deaths suffered in the line of duty. Identification of causal and contributing factors enable researchers and safety specialists to develop strategies for preventing future similar incidents. To request additional copies of this report (specify the case number shown in the shield above), other fatality investigation reports, or further information, visit the Program Website at:

<http://www.cdc.gov/niosh/firehome.html>

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when an exterior brick parapet wall suddenly collapsed on him, killing him instantly.

On September 21-24, 1998, an investigation of this incident was conducted by Ted A. Pettit, Chief of the Trauma Investigations Section, Division of Safety Research. Meetings and interviews were conducted with the Chief and members of the career fire department and the Chief of the volunteer/on-call fire department. Copies of photographs from the incident site were obtained from the career department along with an estimated time line of the incident. A site visit to the incident scene was conducted, and the site was photographed.

The fire departments directly involved in the incident were a career department with 10 paid fire fighters (Chief, Assistant Chief, 2 Captains, and 6 fire fighters) and 20 on-call fire fighters who are paid when called out. The departments serve a geographic area of 35 square miles and a population of approximately 8,000. The volunteer/on-call fire department has 15 volunteer/on call fire fighters who are paid when called out. The department serves a geographic area of 5 square miles, and a population of approximately 6,500. The fire departments involved provide all new fire fighters training commensurate with the National Fire Protection Association (NFPA) recommendations for Level I. Refresher training is provided throughout the year on each shift or at planned events. The career fire department has the written basic operating procedures which are accessible to all fire fighters. The victim had approximately 35 years total fire fighting experience.

### **INVESTIGATION**

On September 5, 1998, at 2332 hours, a call came into dispatch of a possible fire at a warehouse in the local town. The warehouse

was used for storage of recycled, compressed bales of paper. Dispatch notified the local volunteer/on-call fire department of the warehouse fire and the volunteer department responded with Engine 1 (Driver and 5 fire fighters) and Engine 2 (Assistant Chief and Captain), and the Chief in his own vehicle. Upon arrival at 2337 hours at the warehouse, which is directly across the street from the fire department, the fire fighters observed smoke issuing from below the eaves of the roof at the east end of the building (see Figure). The warehouse is approximately 70 feet wide by 300 feet long and 25 feet high at the center, and was constructed in the late 1800s. The warehouse was constructed of brick walls with heavy timber (approximately 10" x 14" beams) supporting the roof. The Chief of the volunteer department ordered his fire fighters not to enter the building, but to attack the fire from the exterior using their deck guns and hand lines.

At 2344 hours, the Chief of the volunteer department called fire dispatch to request mutual aid, which would be an additional three fire departments. One of those departments responding was a career fire department from a neighboring town (approximately 8 miles away), which responded with Engine 3 (Captain, Engineer and three fire fighters--one being the victim, who was off-duty). The Chief responded from his residence to the warehouse fire in his own vehicle.

At 2356 hours the Chief (career department) arrived at the warehouse fire scene, and at 0001 hours Engine 3 arrived. Engine 3 set up operations on the north end of the warehouse by running a 5-inch line to the nearest hydrant (800 feet). The fire fighters pulled two 2 ½ inch charged lines within 20 feet of the end of the structure and prepared to attack the fire from the

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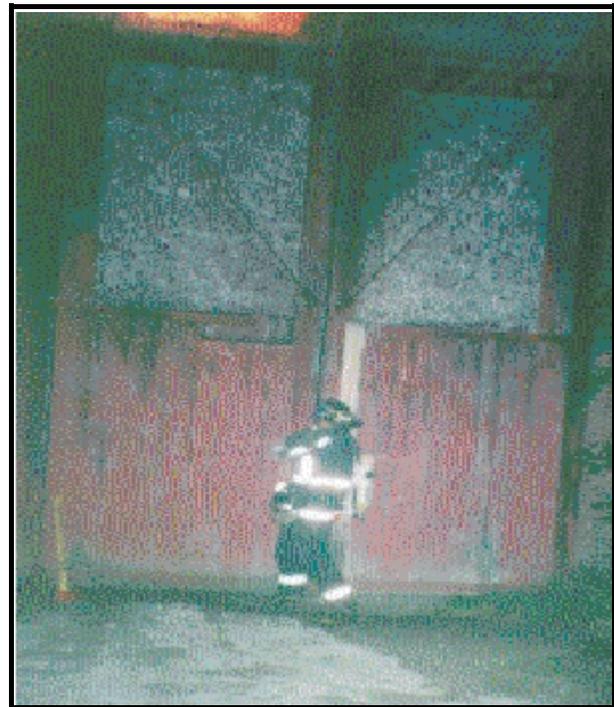
exterior. One of the fire fighters (the victim) approached the center doors (see Picture 1), each 15 feet high by 6 feet wide (see Figure 1), forced off the lock and opened the doors so that the 2-½ inch hand lines could be used to attack the interior fire at the north end (fire was visible in the interior). However, the doors were designed to be self-closing, so as he walked away, the doors closed. To compound the problem, there was a 500-gallon propane tank at the corner of the building that the fire fighters had to be concerned about. The victim turned, saw the doors had closed, and was going back to prop them open. In the interim (0030 hours), the Chief of the volunteer fire department noticed the top of the wall leaning and yelled to the Chief of Engine 3 to watch the wall. By the time the Chief of Engine 3 noticed the wall was leaning and turned to warn the fire fighters operating at this end of the warehouse, the brick parapet wall, with an approximate 8-foot top, had collapsed at a 90-degree angle on top of the fire fighter. It was reported that the roof on the east end of the warehouse had collapsed into the fire at approximately the same time the parapet wall collapsed. The Captain on Engine 3 also received minor injuries from the falling bricks. The falling bricks broke a line on the propane tank, igniting the propane gas, which was shooting a stream of fire directly over the downed fire fighter, making his removal extremely difficult. The fire fighter was removed from the brick debris and transported to a local hospital where he was pronounced dead.

It should be noted that several things happened simultaneously (similar to a chain reaction) at 0030 hours: the volunteer fire fighters at the east end of the warehouse reported a partial roof collapse; at the same time flames broke through the roof in back of the parapet wall (see Picture

2) on the north end of the warehouse (area of attack by Engine 3); and the parapet wall collapsed.

### CAUSE OF DEATH

The cause of death as listed on the death certificate was multiple crushing injuries.



Picture 1

### RECOMMENDATIONS/DISCUSSION

**Recommendation #1:** *Fire departments should ensure that pre-fire planning and inspections cover all structural building materials/components and exterior walls. [1, 2]*

Discussion: The warehouse was constructed around the turn of the century of heavy wooden beams and was subject to age and deterioration. The heavy wooden beams had deteriorated over the years, and the mortar between the bricks had lost adhesive qualities. The exterior brick

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parapet walls were anchored by steel tie rods into the wooden beams, which would possibly indicate structural instability. The heavy, timbered roof support beams were open type construction (no fire curtains at each truss), thereby, allowing rapid flame propagation throughout the open members to involve the entire underside of the roof. As trusses began to fail, the weight of the roof shifted or collapsed, allowing movement of the parapet walls, and thus an imminent collapse.

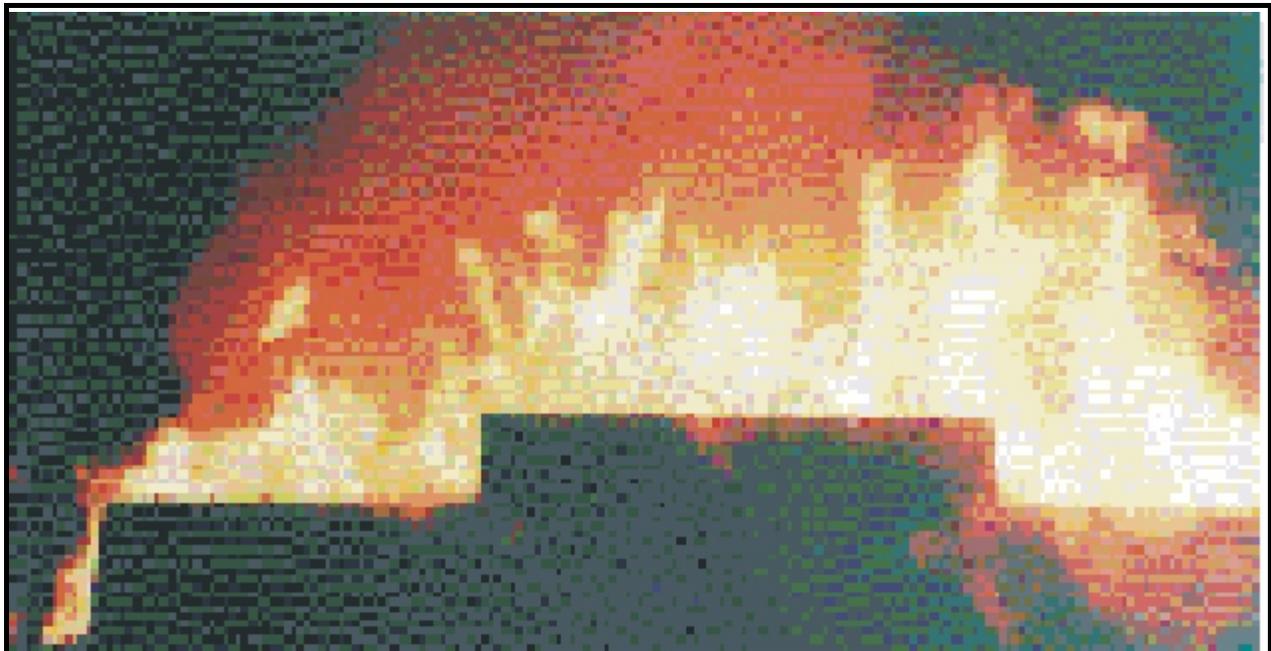
***Recommendation #2: Fire departments should establish a collapse zone around buildings that have parapet walls that could collapse. [1, 2]***

Discussion: A parapet wall is defined as the continuation of an exterior wall above the roof level. A parapet wall has less stability because it has fewer connections to the rest of the structure and is subject to collapse if it suffers

any movement, shock, or vibration during fire fighting operations. A collapse zone is the distance away from the fire building equal to the height of the wall. However, in some instances, the falling wall will break apart allowing flying debris to cover a greater distance than the height of the wall, therefore, a safety margin should be considered when establishing a collapse zone. Fire fighters should not be allowed to operate inside a collapse zone. Hose streams, deck guns/pipes, portable deluge nozzles, and aerial ladders with fire fighters operating at the tip, or inside buckets, should be directed on the fire from outside the collapse danger zone.

**REFERENCES**

1. Collapse of Burning Buildings, Vincent Dunn, Penn Well Publishing, 1988.
2. Safety and Survival on the Fireground, Vincent Dunn, Penn Well Publishing, 1992.



Picture 2

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