Hospital Employee Clearing Snow Killed When His Skid-Steer Loader Broke Through a Ventilation Grate Located in a Sidewalk - Massachusetts

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SUMMARY

On February 17, 2003, a 39-year-old male auto mechanic for a local hospital (the victim) was fatally injured when the skid-steer loader he was operating to clear snow fell through a ventilation shaft grate located in the sidewalk. The victim and the skid-steer loader fell approximately 20 feet to the bottom of a ventilation shaft. The force of the skid-steer loader hitting the bottom of the shaft caused the victim's head to strike the back of the operator's seat. The victim was in the ventilation shaft for approximately two hours before co-workers discovered him. Calls were placed for emergency medical services (EMS) and the fire department. Both responded to the scene within minutes. The victim was freed from the ventilation shaft and brought inside the hospital where he was pronounced dead. The Massachusetts FACE Program concluded that to prevent similar occurrences in the future, employers, property owners and municipalities that use skid-steer loaders or other heavy equipment on sidewalks should:

- **know and communicate, with equipment operators, the intended load capacity of all grates on their property and maintain current engineering drawings for these grates that reflect "as built" conditions;**

- **have engineers conduct routine structural inspections and develop preventive maintenance schedules for all grates located in sidewalks and roadways;**

- **explore the possibility of eliminating or reducing the size of older grates when the original function of the system that the grate was part of has been eliminated, changed, or updated;**

- **develop, implement and enforce communication protocols to enhance safety of employees who are assigned to tasks that involve working alone in extreme weather conditions.**

INTRODUCTION

On February 18, 2003, the Massachusetts FACE Program was alerted by local media that a 39-year-old hospital employee was killed the day before while using a skid-steer loader to clear snow from a sidewalk. An investigation was immediately initiated. On March 5, 2003 the Massachusetts FACE Program Director and an investigator traveled to the hospital that employed the victim and interviewed the buildings and grounds manager. The employer incident report, death certificate, corporate information, and OSHA fatality/catastrophe report were reviewed during the course of the investigation.

The employer, a private non-profit healthcare organization, had been in business for well over 100 years. At the time of the incident, the hospital employed over 15,000 individuals. The victim was one of 13 full time employees of the hospital's metal shop. The employer had a designated employee in charge of safety and a written safety and health program.

The victim had been employed by the hospital for approximately 12 years. He began in the environmental services department and in 1997 transferred to the metal shop, which is part of the buildings and grounds department. His training consisted of both on-the-job and formal training; he was licensed through the Commonwealth of Massachusetts Department of Public Safety to operate skid-steer loaders. The victim did not have union representation.

INVESTIGATION

On February 17, 2003, the victim volunteered to come into work outside of his regularly scheduled hours to help clear snow during a blizzard. The total precipitation from the storm resulted in 27.5 inches of snow with the heaviest snow falling at a rate of four inches per hour. For this particular storm, six hospital employees using two skid-steer loaders and two backhoes performed the snow clearing task. These six employees were split into groups and routinely switched off with each other, allowing time to warm up indoors, throughout the task.

The machine involved in the incident, a skid-steer loader, was manufactured and purchased by the hospital in 1998. The skid-steer loader had a four-cylinder diesel powered engine and weighed approximately 5,200 pounds. The skid-steer loader was approximately ten feet long, four and a half feet wide and over six feet high (with bucket lowered).

The hospital owns all 22 grates on its grounds and two of them, including the one involved in the incident, are pedestrian or vehicle accessible. The grate involved in the incident was located in a poured concrete sidewalk and one side was against the side of a hospital building. This grate's supporting structure and cement shaft were constructed as part of a ventilation system for a transformer, and were installed approximately 38 years before the incident. At the time of the incident, the shaft was no longer being used for transformer ventilation and had been incorporated into the heating, ventilation, and air conditioning (HVAC) system for the hospital.

The shaft was poured concrete and approximately 20 feet deep from the sidewalk level. The grate was aluminum and approximately 11 feet eight inches long and 2 ¼ inches thick. One end of the grate was five feet wide and the other end was six feet two inches wide. Steel angle iron, bolted into the top edge of the cement ventilation shaft at the sidewalk level, was used as the grate supporting structure. The side of the steel angle iron that bolted against the ventilation shaft perimeter was approximately three inches wide and the side of the steel angle iron that supported the aluminum grate was approximately 2 ½ inches wide. When in position, the grate was supported only by the bolted angle iron within the shaft opening and was flush with the sidewalk.

The victim had begun performing the snow clearing task with the skid-steer loader using a rotating brush attachment. When the snow fell at a faster rate, the skid-steer loader attachment was changed to the bucket for better snow clearing capability. At approximately 9:45 p.m. the victim drove the skid-steer loader over the sidewalk ventilation grate. The bolts that attached the angle iron to the top edge of the concrete shaft were corroded and failed, causing the grate to collapse. The skid-steer loader fell into the ventilation shaft and landed on the counter weight located in the rear of the machine. The force of the skid-steer loader hitting the bottom of the shaft after falling 20 feet caused the victim's head to strike the back of the skid-steer loader operator's seat. The victim was inside the skid-steer loader at the bottom of the ventilation shaft for approximately two hours before being discovered by co-workers.

To reach the victim, hospital staff opened an access panel located at the bottom of the ventilation shaft and determined that the victim was trapped inside the skid-steer loader and was unresponsive. The local fire department and emergency medical services (EMS) were called and responded to the scene within minutes. The fire department used a torch to cut the front windshield of the skid-steer loader and removed the victim, who was then brought to the hospital's emergency department by EMS. The victim was pronounced dead at the hospital.

The hospital reported that eight months prior to the incident, one of the bolts supporting a section of the angle iron had been replaced. The hospital also reported that, prior to the incident, they had performed visual inspections of the grate system, but these visual inspections did not detect the corrosion of the bolts. After the incident, the hospital found the engineering drawings for the grate and shaft, but the drawings did not reflect "as built" conditions. In addition, the hospital also placed barriers around the two pedestrian and vehicle accessible grates.

CAUSE OF DEATH

The medical examiner listed the cause of death as blunt force head and chest trauma.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers, property owners and municipalities that use skid-steer loaders or other heavy equipment should know and communicate, with equipment operators, the intended load capacity of all grates on their property and maintain current engineering drawings for these grates that reflect "as built" conditions.

Discussion: The exact construction date and load capacity of the grate and its supporting structure involved in the incident was unknown. A set of engineering drawings that were found after the incident were dated September 1965, but did not reflect the "as built" conditions.

Maintaining current engineering drawings along with knowing the load capacity of grates and their supporting structures and ensuring that the grate system can withstand anticipated loads, such as skid-steer loaders, would help ensure the safety of employees and the general public. Employers should communicate grate loading capacity information with equipment operators and ensure that equipment operators know the weight of their equipment. In addition, employers should check local regulations to ensure that skid-steer loaders and other heavy equipment are allowed on sidewalks and to stay current with any relevant local building codes pertaining to grate systems.

Recommendation #2: Employers, property owners and municipalities that use skid-steer loaders or other heavy equipment should have engineers conduct routine structural inspections and develop preventive maintenance schedules for all grates located in sidewalks and roadways.

Discussion: In some cases, older grate systems could have corroded structural supports that are not visible or could have been built to lower load capacity requirements. Therefore, registered professional engineers should conduct routine inspections to ensure that the loading capacities of grates are consistent with the engineering drawings and anticipated loads and develop a preventive maintenance schedule for the grates and the supporting structure. In addition, the engineers should be consulted about the possibility of developing redundant supporting mechanisms for the grating system. In this case, a concrete shelf or lip at the top edge of the concrete shaft could be added to provide support for the grating. Grates would be positioned on this shelf or lip and then anchored into the cement shaft.

Recommendation #3: Employers, property owners and municipalities that use skid-steer loaders or other heavy equipment should explore the possibility of eliminating or reducing the size of older grates when the original function of the system that the grate was part of has been eliminated, changed, or updated.

Discussion: In this case, the sidewalk grate and connecting shaft was originally used as part of a an exhaust shaft for a transformer. At some point, the existing shaft and grate were integrated into the heating, ventilation and air conditioning system.

When the original function of a system connected to sidewalk and/or roadway grates has been eliminated, changed, or updated, exploring the possibility of resizing these grates for the current system or in some case eliminating these grates should be addressed. When grates and supporting structures have been altered, updated engineering drawing, as mentioned in recommendation # 1, should be obtained.

Recommendation #4: Employers, property owners and municipalities that use skid-steer loaders or other heavy equipment should develop, implement and enforce communication protocols to enhance safety of employees who

are assigned to tasks that involve working alone in extreme weather conditions.

Discussion: In this case, the clearing snow task that the victim was assigned to had him working alone in extreme weather conditions. After the incident occurred, the victim was inside the skid-steer loader at the bottom of the ventilation shaft for approximately two hours before being discovered by co-workers.

A communication protocol that included routine personnel checks every 30 minutes would have ensured that the victim's absence would have been noticed earlier. These checks could be performed via radio or in person. The length of time between checks should be determined by the hazards of the job.

REFERENCES

Code of Federal Regulations, 29 CFR 1910.22 General requirements, Government Printing Office

Code of Federal Regulations, 29 CFR 1910.23 Guarding floor and wall openings and holes. Government Printing Office

United States Department of Labor, Occupational Safety and Health Administration, Safety and Health Information Bulletins, Hazard of Potential Sidewalk Grate System Failure, SHIB 12-30-2004. http://www.osha.gov/dts/shib/shib123004.html

Figure 1 – Skid-steer loader involved in the incident

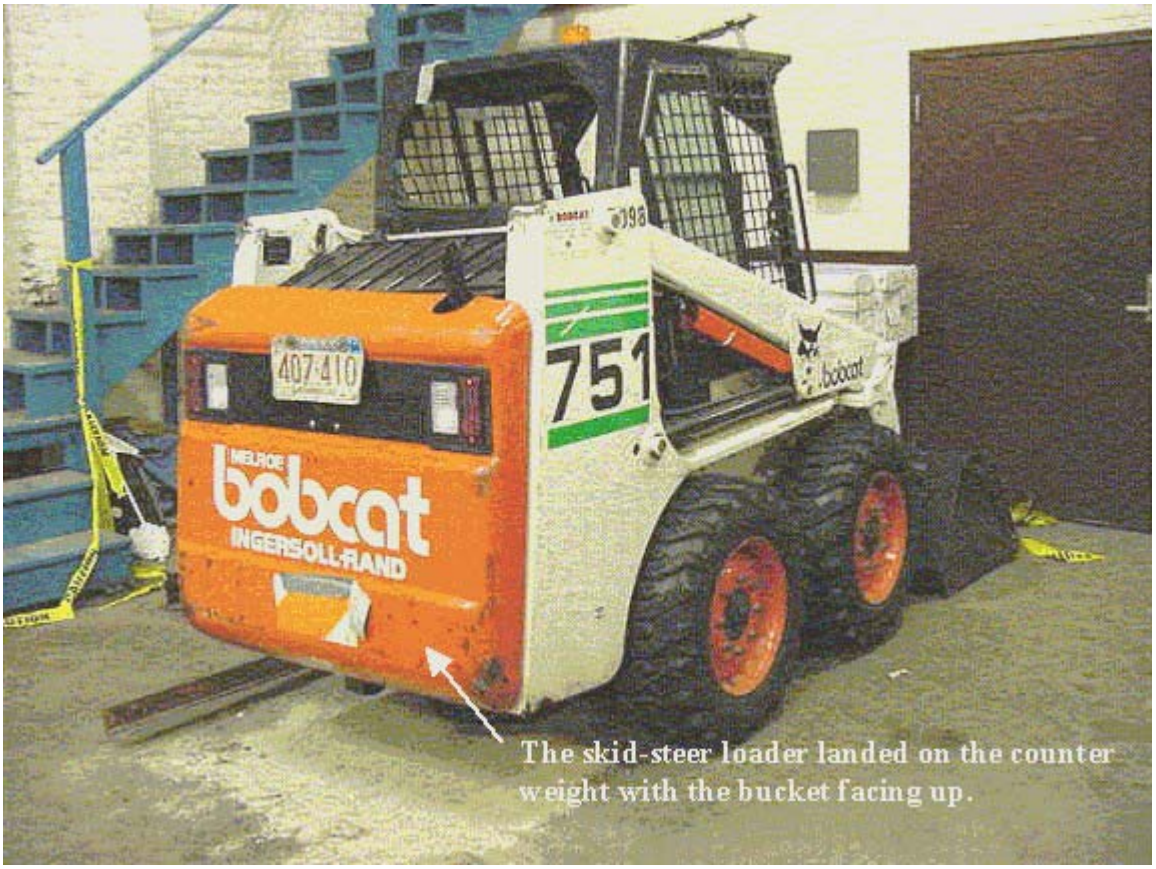

Figure 2 – Sections of the grating

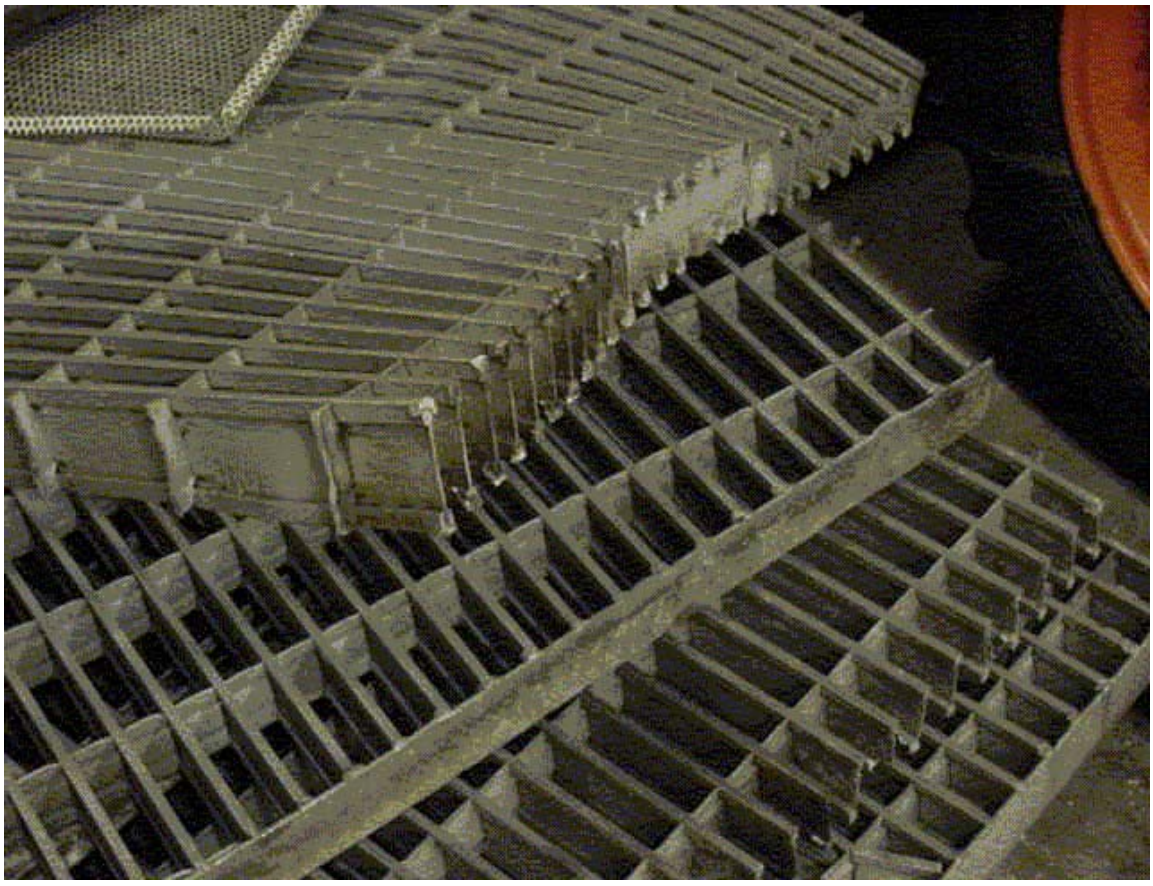

Figure 3 – Section of the angle iron that supported the grate