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Occupational Safety and Health Administration
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Hazard of Potential Sidewalk Grate System Failure

Safety and Health Information Bulletin

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Preface

Many sidewalks and roadways near large urban buildings incorporate surface grate systems to cover vaults and pits. In heavy snowstorms, snow accumulates on the grates. During a snowstorm in 2003, a skid-steer loader being used to clear sidewalk snow fell into a vault when the grate system failed under the weight of the loader, fatally injuring the operator.

Purpose

The purpose of this Safety and Health Information Bulletin (SHIB) is to:

- Alert employers and employees who use skid-steer loaders and other heavy machinery to clear snow or debris from grate systems over pits and vaults that:
  - They must determine whether local building codes permit heavy machinery to be operated on sidewalks and over grate systems;
  - These grate systems may fail under the weight of the loaders/machinery;
- Remind employers that OSHA standards for Walking-Working Surfaces that address floor opening covers and their supports require that they meet standard strength and construction requirements; and
- Recommend that all such surface grate systems be inspected regularly and remind employers that steps must be taken to ensure that these grate systems have the capacity to support the weight of heavy machinery, unless procedures are implemented to effectively prevent the operation of heavy machinery on such grates.

Background

The Occupational Safety and Health Administration's (OSHA's) Braintree, Massachusetts Area Office investigated a fatal accident where a skid-steer loader used to clear snow from sidewalks plunged into a vault when a metal grate (Figure 1) covering the vault failed.

Accident Description

The accident occurred at a large hospital in the Boston metropolitan area. Many of the sidewalks and roadways on the hospital grounds have grates built flush with the surface to cover vaults or pits. In heavy snowstorms, snow accumulates on the grates. The hospital uses two skid-steer loaders to clear snow from roadways and sidewalks. The grates involved in this accident were made of aluminum and were bolted onto steel angle iron that was bolted into the concrete of the sidewalk vault. At the time of the accident, the age of the grates and their load capacities were unknown. The engineering drawings for the grate that were found after the accident did not reflect the conditions of the grate system as it was built.

Different crew members drove the skid-steer loader over the grate on the evening of the accident. When the victim drove over the grate, the grate system failed. The bolts attaching the angle iron to the concrete later were found to be corroded. The load caused the bolts to fail, pulling the angle iron away from the concrete and permitting the grates and the skid-steer loader to drop approximately 20 feet (Figures 2 & 3). The employee died about an hour after the accident.

Figure 1.

Figure 2.

Figure 3.

OSHA's Walking-Working Surfaces Standards

29 CFR 1910.21(a)(2) defines *Floor Opening* as "an opening measuring 12 inches or more in its least dimension, in any floor, platform, pavement, or yard through which persons may fall; such as a hatchway, stair or ladder opening, pit, or large manhole."

29 CFR 1910.22(c) requires that "Covers and/or guardrails shall be provided to protect personnel from the hazards of open pits, tanks, vats, ditches, etc."

29 CFR 1910.23(a)(5) requires that "Every pit and trapdoor floor opening, infrequently used, shall be guarded by a floor opening cover of standard strength and construction."

29 CFR 1910.23(e)(7)(i) requires that "Trench or conduit covers and their supports, when located in plant roadways, shall be designed to carry a truck rear-axle load of at least 20,000 pounds."

29 CFR 1910.23(e)(7)(iii) requires that "The construction of floor opening covers may be of any material that meets the strength requirements."

Other Information

Consultation with municipal public works departments has revealed that some municipalities may not have specific building code provisions that address the capability of existing sidewalk grate systems to support concentrated loads. In addition, there also may not be specific regulations prohibiting the use of heavy equipment on sidewalks.

One municipality indicated that, for new construction of sidewalk grate systems over which heavy equipment may be operated, it requires that the grate system's building plan reflect that the grate systems are able to support concentrated truck loads with load capacity certifications provided by a professional structural engineer.

Conclusion

Employers are required to comply with applicable OSHA standards. In addition, employers must determine whether local building codes allow heavy equipment to be operated on sidewalks and, if so, whether grate systems comply with building code provisions relating to grate system design and support capability.

In general, sidewalk grates are designed and constructed for pedestrian use and are not built with redundant supports, which are essential when heavy equipment is operated on sidewalk grate systems.

The support system for the sidewalk grate at the Boston-area hospital was not built with redundant supporting mechanisms and the entire grate system was not designed for the concentrated load of heavy equipment such as skid-steer loaders, forklifts or other vehicles. The steel and concrete interface was subject to corrosion from weather and salt. The bolts that anchored the angle iron into the concrete wall were not visible during regular inspections, so the extent of the corrosion could not be detected.

Employees who drive equipment with concentrated loads on wheels (skid-steer loaders, forklifts or other heavy equipment) on sidewalks or roadways with flush surface grates are exposed to a potential hazard. In this accident, the employer performed regular maintenance checks of the sidewalk grate and support system. However, the areas subject to corrosion were not visible during inspections.

The employer installed a new grate system with sufficient capacity to support heavy equipment (Figure 4) after the accident.

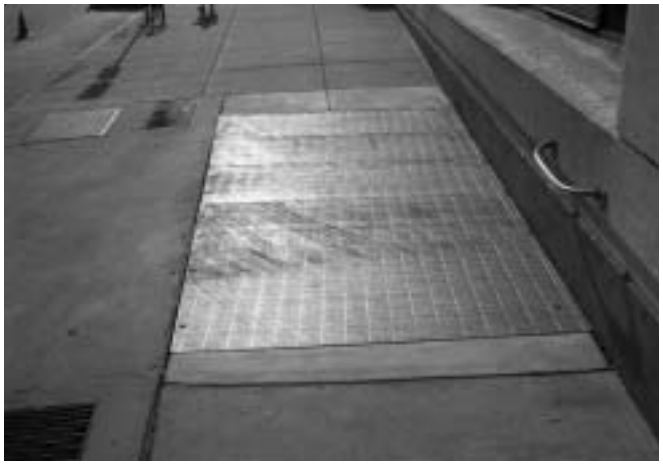

Figure 4.
New Grate System

Methods to Address the Hazards

In addition to complying with applicable OSHA standards and local building codes relevant to sidewalk grate systems, employers can significantly reduce the likelihood of a grate system failure by taking the following steps:

- Develop and communicate written policies regarding snowplowing or operating machinery on top of grates.
- Ensure that all operators of heavy machinery that can access sidewalks or roadways, know the weight of the machines that they are operating, the locations of the grates, and the load capacities of the grates.
- Inventory all sidewalk and roadway grates on site and perform regular engineering inspections to determine the condition and load allowances of all grates.
- Consult with engineers regarding redundant support structures for new and existing grate systems.
- Ensure that all engineering drawings for grate systems are current and reflect the conditions of the grate systems as they were built.
- When building new vaults, consult with a professional structural engineer in designing a concrete shelf system for the angle irons to rest on and be bolted onto, and certify the load capacity of the grate system.