

Parking Garage Collapse during Construction

U.S. Department of Labor

Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

INCIDENT SUMMARY

Incident type:Parking garage collapse during construction
 Weather conditions/Time of day: Mostly cloudy/morning
 Type of operation: Construction
 Size of work crew: Approximately 120
 Worksite inspection conducted: Yes
 Competent safety monitoring onsite: Yes
 Safety and Health program in effect: Yes
 Training and education for workers: Yes
 Occupation of deceased workers: Two laborers,
 one pump truck operator
 and one electrician
 Age/Sex of deceased workers:60/M; 53/M; 53/M; 48/M
 Time on job:26 days
 Time at task: Not available
 Employment Classification (FT/PT/Temporary): 8 hours per day
 Language spoken: English/Spanish
 Union/Non-Union: Non-Union



Figure 1: Aerial view of collapsed garage

BRIEF DESCRIPTION OF INCIDENT

A six-story parking garage was under construction when the north east portion collapsed, trapping and killing four workers and injuring three others (see Figure 1). The workers were using precast concrete structural members (columns, double tee beams, inverted tee beams, and shear walls) to build the parking garage. OSHA's investigation revealed that the parking garage was not properly erected, causing the structural collapse and worker fatalities. The five construction firms involved in the project were cited by OSHA. OSHA issued citations for failing to provide a workplace free from recognized hazards causing or likely to cause death or serious physical harm to workers; and for not adequately supporting the precast concrete structural members.

Likely Causes of Incident

The employer failed to ensure that the parking garage structure was safe before allowing workers to enter. The unstable structure collapsed likely due to the following contributing factors:

- One interior and one exterior column did not have grout placed between the column and the footing to evenly transfer the load (see Figure 2). The load on the interior column gradually increased.
- The interior column collapsed after the increased load on the column exceeded the anchor bolts and shim plates capacity.
- When the interior column collapsed, a cascade effect was initiated that led to other columns, inverted tee beams, and double tees to collapse.
- Precast structural members were not adequately supported by welding and bracing (29 CFR 1926.704(a)). These deficiencies added to the structural instability.



Figure 2: Column base plate and shims

Terminology

- **Footing:** concrete pad used to transfer the weight from the columns to the ground. Columns are placed on a footing and secured in place by anchor bolts.
- **Anchor bolt:** longer bolt imbedded in a footing to attach a column.
- **Shim (shim plate):** used for leveling or filling space between the column and footing.
- **Grout:** used to fill holes and gaps between the column and the footing. The grout evenly distributes the weight from the column to the footing.

INCIDENT PREVENTION

Employers must provide a workplace free from recognized hazards that are causing or are likely to cause death or serious physical harm to workers (*Occupational Safety and Health Act of 1970, Section 5(a)(1)*).

Inadequate grouting was identified as a contributing factor in other parking garage structural failures. It is important that all construction contractors follow recognized standards and engineering practices, including:

- Make sure that the parking garage structure is stable, that design specifications are in compliance with building codes and good engineering practices, and that the specifications are followed during construction. Proper practices include:
 - Use grout to connect columns to footings so that footings will evenly bear the load.
 - Weld and brace precast structural members immediately after erection as specified in the design specifications.
- Ensure that precast concrete structures are adequately supported to prevent overturning and collapse until permanent connections are completed (e.g., bracing columns appropriately, [29 CFR 1926.704\(a\)](#)).
- Verify that the construction site, materials, and equipment are properly inspected, frequently and regularly, by competent persons ([29 CFR 1926.20 \(b\)\(1\) & \(b\)\(2\)](#)) who are able to identify and correct any hazards ([29 CFR 1926.32\(f\)](#)). Correct any deficiencies immediately to prevent workers' exposure to an unsafe work environment.
- Train workers on how to recognize and avoid unsafe conditions during construction work ([29 CFR 1926.21\(b\)\(2\)](#)).
- Train workers on applicable work environment controls or eliminate any hazards ([29 CFR 1926.21\(b\)\(2\)](#)).

You Have a Voice in the Workplace

The *Occupational Safety and Health Act of 1970* affords workers the right to a safe workplace (see OSHA's **Worker Rights** page, www.osha.gov/workers). Workers also have the right to file a complaint with OSHA if they believe that there are either violations of OSHA standards or serious workplace hazards.

How OSHA Can Help

For questions or to get information or advice, to report an emergency, report a fatality or catastrophe, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call our toll-free number at 1-800-321-OSHA (6742), TTY 1-877-889-5627. It's confidential.

More Information

OSHA standards and regulations:
www.osha.gov/law-regs.html

OSHA publications:
www.osha.gov/publications

OSHA-approved state plans:
www.osha.gov/dcsp/osp

OSHA's free On-site Consultation services:
www.osha.gov/consultation

Training resources:
www.osha.gov/dte

Help for Employers:
www.osha.gov/employers



Note: The described case was selected as being representative of improper work practices which likely contributed to a fatality from an incident. The incident prevention recommendations do not necessarily reflect the outcome of any legal aspects of this case. OSHA encourages your company or organization to duplicate and share this information.

This Fatal Facts is not an OSHA standard or regulation and it creates no new legal obligations. The recommendations contained herein are advisory in nature and are intended to assist employers in providing safe and healthful workplaces. The Occupational Safety and Health Act of 1970 (OSH Act) requires employers to comply with safety and health standards promulgated by OSHA or by an OSHA-approved state plan. The requirements of OSHA-approved state plans can be reviewed by selecting the state's website at: www.osha.gov/dcsp/osp. The OSH Act's General Duty Clause, Section 5(a)(1), requires employers to provide employees with a workplace free from recognized hazards likely to cause death or serious physical harm.

For assistance, contact us. We can help. It's confidential.



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