

# Draft NIST report on Cowboys facility collapse released for comment

October 6 2009

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This is an overall view of the collapsed Dallas Cowboys practice facility after the fabric covering was removed. Credit: NIST

A fabric-covered, steel frame practice facility owned by the National Football League's Dallas Cowboys collapsed under wind loads significantly less than those required under applicable design standards, according to a report released on October 6 for public comment by the Commerce Department's National Institute of Standards and Technology.

Located in Irving, Texas, the facility collapsed on May 2, 2009, during a severe thunderstorm. Twelve people were injured, one seriously.

Based on the national standards for determining loads and for designing structural steel buildings, NIST researchers studying the Cowboys

facility found that the May 2 [wind](#) load demands on the building's framework—a series of identical, rib-like steel frames supporting a tensioned fabric covering—were greater than the capacity of the frame to resist those loads.

Assumptions and approaches used in the design of the Cowboys facility led to the differences between the values originally calculated for the wind load demand and structural frame capacity compared to those derived by the NIST researchers. For instance, the NIST researchers included internal wind pressure due to the presence of vents and multiple doors in their wind load calculations because they classified the building as "partially enclosed" rather than "fully enclosed" as stated in the design documents. The NIST researchers also determined that the building's fabric could not be relied upon to provide lateral bracing (additional perpendicular support) to the frames in contrast to what was stated in the design documents and that the expected wind resistance of the structure did not account for bending effects in some members of the frame.

"Our investigation found that the facility collapsed under a wind load that a building of this type would be expected to withstand," said study leader John Gross. "As a result of our findings, NIST is recommending that fabric-covered steel frame structures be evaluated to ensure the adequate performance of the structural framing system under design wind loads."

The NIST report recommends that such evaluations determine whether or not: (1) the fabric covering provides lateral bracing for structural frames considering its potential for tearing; (2) the building should be considered partially enclosed or fully enclosed based on the openings that may be present around the building's perimeter; and (3) the failure of one or a few frame members may propagate, leading to a partial or total collapse of the structure.



The buckling of the steel frame of the Dallas Cowboys practice facility is seen in the upper left of the photograph (marked by arrow). Credit: NIST

Shortly after the Cowboys facility's collapse, NIST sent a reconnaissance team of three structural engineers to assess the failed structure and wind damage in the surrounding area, and collect relevant data such as plans, specifications and design calculations. Using the data acquired during the reconnaissance, the NIST study team developed a computer model of a typical structural frame used in the practice facility and then studied the frame's ability to resist forces under two wind conditions: the wind loads based on the design standard wind speed of 90 miles per hour and the actual wind loads based on conditions at the time of the collapse.

NIST worked with the National Oceanic and Atmospheric Administration's (NOAA) National Severe Storms Laboratory to

estimate the wind conditions at the time of collapse. The researchers determined that, at the time of collapse, the wind was blowing predominantly from west to east, perpendicular to the long side of the building. Maximum wind speed gusts at the time of collapse were estimated to be in the range of 55 to 65 miles per hour—well below the design wind speed of 90 miles per hour in the national standard for wind loads. The center of a microburst (a small, intense downdraft which results in a localized area of strong winds) associated with the May 2 thunderstorm was located about one mile southwest of the structure at the time of collapse.

According to the NIST and NOAA researchers, the wind field in the vicinity of the Cowboys facility at the time of collapse was consistent with design standards and not unusual.

Based on their study of the wind conditions at the time of collapse and the structural response, the NIST researchers determined the following likely collapse sequence:

- Buckling of the inner chord (inner side of the roof truss) of a frame in a section of the roof on the east side resulted in the formation of a kink in the frame.
- Failures of the east and west "knees" (connections between the side walls and the roof) allowed the frame to sway eastward with the wind.
- Compressive failure of the east side at the roof's highest point (ridge) led to fractures of the nearby inner and outer chords in the vicinity of the ridge.
- A progression of frame failures throughout the structure resulted in total structural collapse.

More information: The draft report is available online at [www.bfrl.nist.gov/investigatio ... s/investigations.htm](http://www.bfrl.nist.gov/investigations/investigations.htm)

Source: National Institute of Standards and Technology ([news](#) : [web](#))

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