

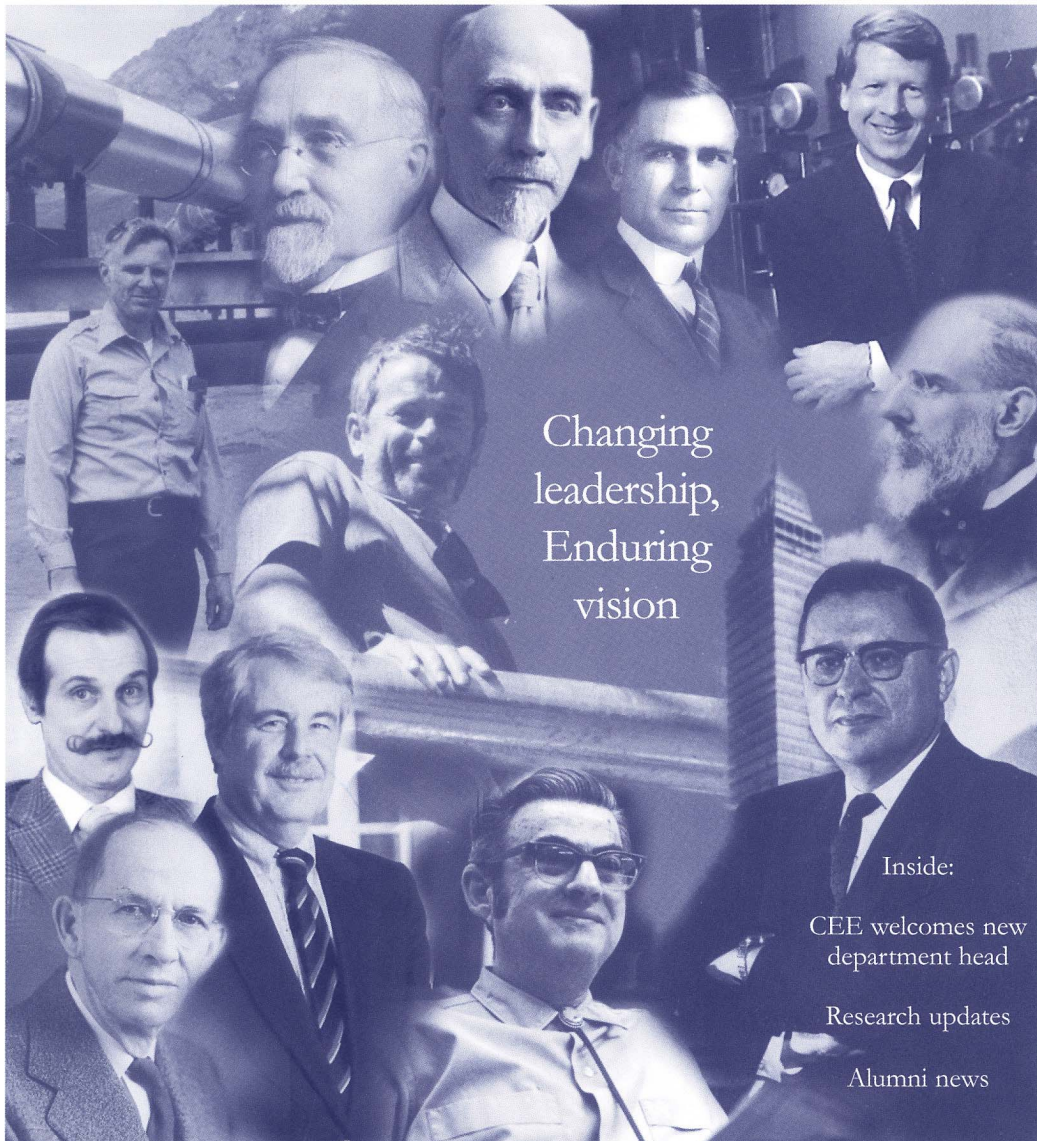
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Looking back on 9/11

The alumnus who led the study into the WTC collapse recalls how engineers helped pick up the pieces after the attacks, answering the tough questions about building safety after a catastrophe

Civil engineering alumnus W. Gene Corley (BS 58, MS 60, PhD 61) has been instrumental in establishing and developing the practice of forensic structural engineering. Corley, Senior Vice President of Construction Technology Laboratories, Inc., (CTL) of Skokie, Ill., led the ASCE/FEMA-sponsored structural investigation into the collapse of the New York World Trade Center. The investigative team published its preliminary report in May. Corley performed a similar role after the 1995 bombing of the Murrah Federal Building in Oklahoma City. CTL's corporate communications editor, Kenneth Hooker, interviewed Corley about his experiences on behalf of the CEEAA Newsletter. This article is based on their conversation.



While both studies were going on, I spoke frequently with Paul Makar, the Pentagon study team leader, and helped coordinate the two efforts.

The World Trade Center study was a major effort. A total of 23 team members participated. Five of these were designated as a core group, responsible for seeing that the work was done well and on time. The WTC study started with some of the team members getting to the site to assist the contractors removing debris. Core Team Member **Bill Baker** (MS 80), along with team members from New York City, were on site from soon after the attack up through February of 2002. They also visited the scrap yards frequently to search for and set aside important pieces of the structure.

The study also entailed site visits by the whole team in early October, review of the plans and details of damaged buildings, and limited analysis of the towers. After gathering the data, the team met several times to exchange information and to write the report. The Building Performance Study Team completed its work in April, and the final report was published and presented to the House Science Committee of the U.S. Congress on May 1, 2002.

The report thoroughly documented the aircrafts' impacts, the damage they caused, and how the buildings collapsed. Based on the preliminary study, we recommended further study in many additional areas. Finally, we expressed several observations about things that could be done to improve resistance of future buildings to terrorist attacks.

What were the most interesting and important findings of the investigation, from a structural engineering standpoint?

One major finding was that the 767s' impact on each building was not sufficient to cause collapse of the building. Rather, that required a second large event — the fire that followed the impact.

We noted that each of the buildings survived for a relatively long time. From other studies, it appears that, except for those who stayed in the building to help with rescue or who otherwise chose not to escape, almost everyone below the point of impact was able to get out. The long survival time was due to the large number and excess strength of exterior columns. Even after about two-thirds of them were knocked out on one side of the building, the remaining columns had enough capacity to carry the load. It was only after the fire heated the steel enough to reduce its strength that the collapse occurred.

We also noted that the aircrafts' impacts dislodged fireproofing, thereby shortening the time it took to bring the buildings down. The aircraft impact also destroyed all of the escape stairs in the north tower and two of the three escape stairs in the south tower. As a result, nobody escaped from Tower One above where the

How did you come to be involved in the investigation?

At 9 a.m. Eastern time, on September 11, 2001, I began a previously scheduled conference call with four other engineers. One of the other people on the call was **Bob Smilowitz** (MS 73, PhD 77) who was located within sight of the World Trade Center in lower Manhattan. Also on the call was Jim Rossberg, an executive with ASCE/SEI in Reston, Virginia. Because Jim had been caught in traffic that morning, he had decided to pull into a parking lot and use his cell phone to join the conference call. Soon after the call started, Bob Smilowitz pointed out that a second plane had hit Tower 2 of the World Trade Center. A few minutes later, Jim Rossberg, who had chosen the Pentagon parking lot that morning, shouted into the phone that there had been a loud explosion at the Pentagon. At that point, we told Jim to get to a safer place and ended the call. A few hours later, Jim Rossberg called me back and asked if I would help form building performance study teams for both the Pentagon and the World Trade Center. That began the formation of the study teams.

What was the team's initial charge?

The initial charge for each team was to study the buildings' performance and look for anything that might be done differently in the future to increase the time that buildings stay standing after a catastrophic event. Once the teams formed and began to work, their scope became broader and better defined. Under the guidance of the Federal Emergency Management Agency, which came aboard several days after the teams were formed, the World Trade Center team was given the responsibility to collect and preserve data, do a preliminary analysis, recommend areas for additional study, and make any initial recommendations to improve response.

After getting both teams under way, I visited the Pentagon site and then concentrated on leading the World Trade Center study.

aircraft hit, and only four are known to have escaped from above where the plane hit Tower Two. Although fuel in each aircraft caused several floors to catch fire immediately, we calculated that the aircraft fuel was burned up in approximately nine minutes. Therefore, most of the fire was fueled by the buildings' contents and by flammable materials brought in by the aircraft.

Observations in other buildings also were significant. Two buildings near the towers collapsed as a result of fire in the buildings. This was the first example of fire-rated buildings collapsing as a result of fire. In one of the two buildings brought down by fire, collapse was triggered by the failure of connections. In the other building, we believe that the fire weakened a transfer truss, which then caused the entire 47-story building to collapse. This suggests that, for buildings that might be terrorist targets, more attention needs to be paid to fire-proofing of connections and transfer trusses.

How did your experience on the WTC investigation compare with your work on the Murrah Building bombing?

Having been the principal investigator on the Building Performance Assessment Team for the Murrah Building after the Oklahoma City bombing, I was in a position to compare the two events. I found that they had similarities, but also some significant differences. In both cases, terrorists attacked and destroyed major buildings, leading to the loss of many innocent lives. It's the scale of the destruction, however, that distinguishes the attack on the World Trade Center. It was the biggest single building collapse in history, and the complete devastation of the site was striking.

Despite the differences, many of the personal observations were similar in both cases. It was particularly impressive to witness the heroism of people at the scene when the events occurred and the heroism of the rescue and construction workers who searched for the living and then cleared the site.


As leader of the WTC investigative team, you've been interviewed frequently for newspapers, magazines, radio and TV. How do you feel about serving as a spokesperson?

Naturally, there's been a great deal of public interest in the collapse of the towers and in the work of the investigative team. Following the completion of our work, members of the press have helped to distribute the information we obtained in the study. Many

team members have been interviewed by newspapers, magazines, radio and TV, and all of those involved have been willing to help inform the public about what happened. In the process, we've been able to educate people not only about this particular case, but also, more generally, about who engineers are and what we do.

What is there about your education at U of I and your experience in project design and research that prepared you for the investigative work you do now?

I feel I had excellent training at the University of Illinois. My studies as an undergraduate and research work as a graduate student both helped prepare me for this investigative work. Over the years, I've had a lot of experience in designing, building and testing structures to destruction, both in the laboratory and in the field. I also served as an officer in the Corps of Engineers, where I learned demolition work and did bridge design. Experience in each of these areas has

formed my knowledge of forensic structural engineering, and I'm proud to have been able to help invent and develop the field. 



Corley and team members near Ground Zero

PHOTO COURTESY OF W. GENE CORLEY

UIUC alumni on the 9-11 study teams

World Trade Center

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