by JOSH MURRAY // photo illustration by ARTIE LIMMER and T.J. TUCKER


DOWN FROM THE

TORNADO PHOTO ON OPENING SPREAD COURTESY: TEXAS NOAA PHOTO LIBRARY, NOAA CENTRAL LIBRARY; OAR/ERL/NATIONAL SEVERE STORMS LABORATORY

A TORNADO BLOWS THROUGH A SMALL TEXAS TOWN, DEBRIS FLYING INTO BUILDINGS AND CARS, WITH LIVES BEING THREATENED. ERNST KIESLING AND OTHER TEXAS TECH ENGINEERING RESEARCHERS ARE BATTLING THE FORCES OF THE WIND BY STUDYING THE EFFECTS OF MOTHER NATURE ON STRUCTURES AFTER THESE TERRIFYING STORMS.

Texas Tech University engineers began thinking about how to build an above-ground tornado shelter after a major storm devastated Lubbock in 1970. Now, 33 years later, some of those same engineers have not only developed that shelter but also have played an integral role in establishing national shelter building standards.

The shelter Texas Tech developed can be built as closets, bathrooms or they can be built in a garage. The concept drew major national media attention on NBC's Dateline after the May 27, 1997, tornado virtually wiped out a rural subdivision in the small central Texas town of Jarrell.

Ernst Kiesling, Ph.D., Texas Tech professor of civil engineering and director of the university's storm shelter program said that it was the 1999 tornado in Oklahoma City that drew attention to the need for standard building codes for above-ground storm shelters.

A shelter designed using plans similar to Texas Tech's plans survived the storm and is credited with saving the lives of two women. The Federal Emergency Management Agency began awarding grants for residents to build wind-resistant shelters, and the boom was on, but the lack of shelter standards and the dearth of experience in design and construction of shelters led to many quality issues.

Kiesling then invited a number of shelter manufacturers to Texas Tech to discuss the issues and plan a course of action. The National Storm Shelter Association grew out of that meeting. Shortly thereafter, Kiesling was appointed executive director.

"Our dilemma now is to encourage shelters to be built, but we want them to be of high quality, lest people are led to a false sense of security," Kiesling said. "We don't ever want to dictate that shelters are required, but if products are marketed as shelters, consumers need to know that they are getting quality products."

The International Code Council and the National Storm Shelter Association signed the first agreement on storm shelter building standards at the Federal Emergency Management Agency in Washington, D.C., in June 2002. Kiesling said the new joint standards consolidate existing references about shelter standards published by the National Storm Shelter Association, the Federal Emergency Management Agency and the American Red Cross into one standard to provide measurable and enforceable provisions for designing storm shelters. The new joint code will regulate the design, construction and installation of safe and economical shelters.

"The concept of the above-ground storm shelter grew out of research at Texas Tech," said Kiesling. Texas Tech's Wind Science and Engineering Research Center is internationally known for research aimed at mitigating the effects of extreme winds. One of the early successes was the development of an above-ground storm shelter that provides near absolute protection even in the strongest tornados. Texas Tech researchers have traveled to tornado and hurricane sites to evaluate damage and gain an

ABOVE: A STORM SHELTER THAT SURVIVED THE OKLAHOMA CITY TORNADO IN 1999.

> "Our research continues to find ways to economically provide protection from extreme winds and to reduce the damage they cause."

understanding of how to construct buildings and shelters to withstand winds.

As a result of their research, Texas Tech scientists and engineers have contributed to two Federal Emergency Management Agency publications, "Taking Shelter from the Storm," and "Design and Construction Guidelines for Community Shelters."

"The primary purpose of the National Storm Shelter Association is to foster quality in the shelter industry and to distinguish those products and producers that meet or exceed the high levels of quality represented by widely recognized standards," said Kiesling. "Our partnership in establishing a consensus standard represents a significant step toward achieving the goals of the National Storm Shelter Association."

Kiesling said these standards will evolve into a national consensus standard. Producers, engineers, architects and public members will be on a committee to closely scrutinize the standards and evolve into national consensus. After agreeing on the standards, they will be offered to building code jurisdictions for them to adopt into their codes. After that, it will become law for any shelter to meet the standard.

"We're elated with this step because it will be significant in the long run to improve the quality of shelters," he said.

Kiesling and Texas Tech wind engineers have now turned their attention to large-scale above-ground storm shelters suitable for schools and other public buildings. Past research had focused on small, single family shelters.

"A number of large, community shelters are now being built," said Kiesling. "In some instances, the entire population of a school, nursing home or business will be protected."

"For a tornado, people are inside the shelter for a relatively short time," Kiesling said. "But in a hurricane, people may need to spend hours in the shelter, so the shelter must have provisions for the occupants' physical needs."

"Our research continues to find ways to economically provide protection from extreme winds and to reduce the damage they cause," said Kiesling.

WEATHER DOMINATES

STORY BY SALLY LOGUE POST/JOSH MURRAY PHOTO BY ARTIE LIMMER

WEATHER DOMINATES TWO THINGS IN WEST TEXAS- conversation and the economy. Like no other factor, farmers in West Texas depend on Mother Nature for their livelihood. Farmers are always thirsty for the most up-to-the-minute weather information.

With Texas Tech University's West Texas MesoNet, wind, rainfall, soil temperature and other data are available every five minutes. In Texas, there are those who will tell you, that is just enough time for the weather to change.

Researchers in the Texas Tech Department of Atmospheric Science and Wind Science Engineering have designed a network of 35 surface weather stations and two atmospheric profilers in 28 South Plains' counties that covers an area of 150 by 200 miles surrounding Lubbock. The stations are located as far north as Friona and as far south as Lamesa. The most western station is located in Plains while the most eastern station is located in Roaring Springs. Each station is networked with the main server at Texas Tech's research station at Reese Center.

The towers stand 32 feet high and measure a variety of atmospheric conditions. "The MesoNet gives us data every 5 to 15 minutes, and the distance between sites is approximately 25 miles," said Tim Doggett, Ph.D., assistant professor of geosciences and head of the MesoNet project. "That's a vast improvement over the currently available data collected on a scale of 200 miles every hour."

The science of the MesoNet is nothing new. High quality weather observing technology are used to take measurements at standard heights, said Doggett. Humidity, wind, temperature, barometric pressure, rainfall, solar radiation, along with soil temperature and moisture, are collected at each station.

The information is sent to a central station at the Wind Science and Engineering location at Reese Center. The data are available to anyone free of charge on the Internet at www.mesonet.ttu.edu. The data also are archived so that users can see how conditions have changed over time.

The Texas Department of Economic Development has funded the project. The initial funding was used to purchase instruments and telecommunication equipment for the data sites and to hire personnel to manage the program.

The benefits of the MesoNet system are many. "A major component of the project is to provide the information to users in real time," said Doggett.

Farmers will gain from the increased soil temperature and moisture information. "With more data, farmers can better plan the planting and harvesting of their crops, leading to better crop yields," said Doggett. "The data also will help farmers know when is the optimal time to use pesticides and help them in determining their irrigation schedules."

For the National Weather Service, the MesoNet provides a better forecasting tool for severe weather. "The meteorologists can analyze current conditions at a resolution sufficient to forecast severe thunderstorm events," said Doggett. "This could ultimately save hundreds of lives and prevent thousands of injuries per year."

Power companies can use the data to plan power transmission and consumption needs of the region, he said.

Educational uses for the MesoNet involve a partnership with Texas Tech Wind Science and Engineering Program, so that the MesoNet can provide research for a doctoral program.

"Schools and colleges across the state can also access the material to use in classroom projects and college-level meteorology programs," said Doggett.

Given the shear size of Texas, the cost of implementing such a system statewide has been prohibitive. Texas Tech scientists hope the West Texas MesoNet project demonstrates the feasibility of the network. Texas Tech and Texas A&M University are working together on a statewide venture.

Oklahoma, Colorado, Iowa and Georgia have MesoNet systems. "Data from Oklahoma suggests that Texas could save $100 million per year in the agriculture industry alone," said Doggett.

THE MESONET
gives researchers data on rainfall, wind, soil temperature and other data every five minutes.