

Tornadoes essay



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Tornadoes

HAINES CITY, Fla. (Dec. 27) – Tess Bentley knew the high-pitched whine that woke her early Saturday was a tornado. She took two steps and dived into her bedroom closet full of clothes.

Within seconds, Mrs. Bentley, 48, and her two-bedroom house were spinning in the air. She was still in her closet when her home landed upside down on top of a neighbor's house about 50 yards away.

More than 100 homes were damaged by the tornado that tore through the Lake Region Mobile Village, a retirement community 35 miles southwest of Orlando. The twister – part of a series of storms that swamped Florida's Gulf Coast – left four residents hospitalized, but none of the injuries were life-threatening.

Mrs. Bentley suffered only bumps and bruises.

neighbor Dick Runge said " If this isn't a miracle, I don't know what is."

Tornadoes form from severe thunderstorms. They are very destructive because they have a high energy density. They also don't last very long. This makes it hard to learn about them. Since scientists don't know much about tornadoes, it's also hard to forecast them. And because little is known about tornadoes, there are many myths about them which aren't true.

Tornadoes can form anywhere in the world. About 75% of the them happen in the United States. Most of these form in the central U. S. in a place called tornado alley.

People who are interested in tornadoes sometimes become spotters for their community. Sometimes people actually chase tornadoes! After a tornado passes by, scientists try and figure out how strong it was by using the Fujita Tornado Scale.

U. S. Killer Tornadoes of 1997

September 18, 1997 5: 15 PM

A series of at least five tornadoes swept through northeastern Minnesota this evening. The worst damage was in Little Falls, Hillman and Onamia. One person was killed in a building 6 miles east of Lastrup, Minnesota. Two men were injured in Hillman when their vehicle was lifted into the air, spun around, and dumped into the woods about 100 feet off the road.

July 2, 1997 3: 32 PM

The tornado that struck the Chatueau Oak Hill Trailer Park near Holly in Oakland County, Michigan, was one of 16 reported that afternoon. It killed a 36-year-old woman in a trailer. The whole metropolitan Detoit area was beseiged by storms during the early evening, and the strong winds, lightning and flooding caused more destruction than any storm since the Palm Sunday storms in 1965.

May 27, 1997 2: 50 PM F5

A devastating tornado touched down in Jarrell and killed 27 people in this small central Texas town. Although television stations scrolled tornado warnings 30 minutes in advance, and sirens went off, there were few places

to go for safety. Most, if not all, homes were on slabs, with no basements to shelter in. Whole families died. Some meteorologists who have seen photos of the damage have said that they have never seen house foundations that were swept as clean. The death total was delayed several days because of the condition of the bodies, which were difficult to identify. This was one of the worst tornadoes in Texas in many, many years. A \$20, 000, 000 damage total was estimated.

May 2, 1997 5: 50 PM

Tornadoes touched down in Alabama, Mississippi and Georgia on Friday, May 2, 1997. One killed a nine-year-old girl and injured three other people when it struck a mobile home park 6 miles south-southwest of Chickamauga, Georgia. Her brother was one of the injured in the 90-home park.

April 10, 1997 8: 45 PM F1

Small tornadoes touched down and numerous funnel clouds were sighted in Lubbock, Crosby, Hale, Swisher, Lynn, Dawson, Lamb, Garza and Dickens Counties in the Texas Panhandle. Some homes and communities suffered wind damage, and houses and cars were damaged by hail. A Crosby County man was killed when his double-wide mobile home near White River Lake was “ twisted” and torn apart, with him inside. As authorities attempted to extricate him from the wreckage, they were pelted with base-ball sized hail. His wife was badly cut up.

March 28, 1997 8: 15 PM F2

One person was killed in a trailer home a mile west of Summer Shade, Kentucky.

March 28, 1997 6: 04 PM F3

One man was killed and five other people were injured in Hammonville, Kentucky by one of at least three confirmed tornadoes that struck in Hart, Metcalfe, and Greene counties. Twenty two homes were damaged or destroyed in Hammonville, and 11 homes were damaged in Bonnieville.

March 1, 1997 7: 20 PM F4

A 13-year-old girl was killed as she sought cover in one of 25 homes that were destroyed in the the Lake Luanna community between Dyersburg and Newbern, Tennessee. About 20 people were injured.

March 1, 1997 5: 05 PM F3

A tornado tore “ a near perfect line, 100 yards wide and a mile long” from southwest to northeast across Marmaduke, Arkansas. Eleven homes were destroyed, and 57 others were damaged. A 47-year-old man was killed.

March 1, 1997 3: 25 PM F4

This tornado touched down 3 miles southeast of Benton in Saline County, fifteen minutes after the previous tornado lifted. The funnel moved northeast, devastating the towns of Sardis and Shannon Hills. A total of 10 people died in Saline County and 200 were injured. About 200 residences were damaged or destroyed. The tornado was nearly a mile wide and F4 intensity as it passed across Shannon Hills.

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It entered Pulaski County and continued northeast, where it did F3 damage at College Station, just 3 miles southeast of downtown Little Rock. Six people died in this area. Across Pulaski County, 180 people were injured, 90 homes destroyed, and 175 homes damaged.

March 1, 1997 3: 15 PM F2

This tornado touched down 10 miles northeast of Searcy in White County, and moved northeast, passing 3 miles south of Denmark and 3 miles west of Newport. The funnel crossed the White River and passed through Jacksonport, where it was a half-mile wide and did F2 damage. It lifted 5 miles east of Tuckerman. South of Denmark, in Jackson County, it killed two men at Velvet Ridge. They fled their mobile home and crawled into a narrow, muddy ditch for shelter. They were crushed to death when the tornado blew a 100-year-old oak tree into the ditch. Other people also fled their mobile homes to hide in ditches, and survived. Another person died in a mobile home near Jacksonport. About 60 people were injured in Jackson County.

March 1, 1997 2: 46 PM F4

This tornado touched down about two miles northeast of Hope in Hempstead County, at 1: 50 PM. About 50 minutes later it ripped apart 60 city blocks of Arkadelphia, killing 6 people and injuring 100. Fifty-six out of 57 mobile homes were destroyed in one trailer park. About 250 homes, 90 mobile homes, and 45 businesses were damaged or destroyed. More details can be read here. The funnel lifted 4 miles northeast of Malvern. The total path length was 67 miles.

March 1, 1997 1: 03 AM F1

A 50-year-old man was killed when a tornado destroyed his mobile home at Randolph, Pontotoc County, Mississippi. He was thrown 75 feet from his home.

January 24, 1997 5: 00 PM F2

Tuscaloosa, Alabama A 71-year-old retired physician was killed when a tree limb was propelled into the windshield of his pick-up truck. Fifteen homes were destroyed and 100 more damaged in town. At least 10 people were injured.

Tornado Safety

One of the most important things you can do to prevent being injured in a tornado is to be ALERT to the onset of severe weather. Most deaths and injuries happen to people who are unaware and uninformed. Young children or the mentally challenged may not recognize a dangerous situation. The ill, elderly, or invalid may not be able to reach shelter in time. Those who ignore the weather because of indifference or overconfidence may not perceive the danger. Stay aware, and you will stay alive!

If you don't regularly watch or listen to the weather report, but strange clouds start moving in and the weather begins to look stormy, turn to the local radio or television station to get the weather forecast.

Check The Weather Channel for additional information, or if you have trouble getting up to the minute forecasts on a regular radio, then a " weather radio"

is a wise investment. Check with your local Radio Shack store to see whether your area is actually covered by NOAA Weather Radio.

If a tornado “ watch” is issued for your area, it means that a tornado is “ possible.”

If a tornado “ warning” is issued, it means that a tornado has actually been spotted, or is strongly indicated on radar, and it is time to go to a safe shelter immediately.

Be alert to what is happening outside as well. Here are some of the things that people describe when they tell about a tornado experience:

A sickly greenish or greenish black color to the sky. If there is a watch or warning posted, then the fall of hail should be considered as a real danger sign. Hail can be common in some areas, however, and usually has no tornadic activity along with it. A strange quiet that occurs within or shortly after the thunderstorm. Clouds moving by very fast, especially in a rotating pattern or converging toward one area of the sky. A sound a little like a waterfall or rushing air at first, but turning into a roar as it comes closer. The sound of a tornado has been likened to that of both railroad trains and jets. Debris dropping from the sky. An obvious “ funnel-shaped” cloud that is rotating, or debris such as branches or leaves being pulled upwards, even if no funnel cloud is visible.

If you see a tornado and it is not moving to the right or to the left relative to trees or power poles in the distance, it may be moving towards you!

Remember that although tornadoes usually move from southwest to

northeast, they also move towards the east, the southeast, the north, and even northwest.

Encourage your family members to plan for their own safety in many different locations. It is important to make decisions about the safest places well BEFORE you ever have to go to them.

IN HOMES OR OTHER SMALL BUILDINGS:

The best places are:

In a basement, away from the west and south walls. Hiding under a heavy work-table or under the stairs will protect the family from crumbling walls or chimneys. Old blankets, quilts and an unused mattress will protect against flying debris, but they should be stored in the shelter area. Precious time can be lost by trying to find these items at the last minute.

In a small, windowless, first floor, interior room like a closet or bathroom. The bathtub and commode are anchored directly into the ground, and sometimes are the only thing left in place after the tornado. Getting into the bathtub with a couch cushion over you gives you protection on all sides, as well as an extra anchor to the foundation. Plumbing pipes may or may not help hold the walls together, but all the extra framing that it takes to put a bathroom together may make a big difference. If there is no downstairs bathroom and the closets are all packed with "stuff," a hall may be the best shelter. Put as many walls as you can between yourself and the tornado. In a pinch, put a metal trash over as much of you as you can. It will keep some flying debris

from injuring you. Even that may make the difference between life and death.

In a storm shelter specifically designed for that use-within the basement or outside the home entirely. Some companies manufacture pre-fab shelters that you drop into a hole in the ground, and that blends in with home landscaping(some more, some less).

One of them is Heartland Shelters, in Mt. Orab, Ohio. We have talked with this man extensively, and he has put his heart, soul, life savings and several years of his life into the production of these carefully engineered fiberglass shelters. You can contact him at 1(800)454-7077 or write to him at this address for more information and a brochure.

We were recently contacted by a man associated with a company that makes fiberglass boats. He also has developed a storm shelter, beginning this project just after the Jarrell tornado(he lives near Cedar Park). The shelter is called the Tahoe Tunnel, and its size can be increased by combining the 10 foot modules. You may get more information by writing to George Ingram at PO Box 869, Manor, Texas, 78653. His phone number is 1(800)532-7102. He also has a brochure.

Another storm shelter company that has a home on the web is Canton Enterprises.

If you live in a house that has no basement, and you don't want or can't have a storm shelter outside because of a high water table or bedrock, The Institute for Disaster Research, Box 41023, Texas Tech University, Lubbock,

Texas (806) 742-3476 has plans available for in-home shelters for a small fee. It details how to reinforce a space to make a safe shelter.

Wherever it is, the shelter should be well known by each member of the family. If you and your family will conduct annual emergency drills (fire, tornado, etc), everyone will remember what to do and where to go when a tornado is approaching—automatically and without panic. Choose a friend or family member in another part of town or elsewhere to be a “contact person” that will be called by everyone should the family members become separated.

The Red Cross suggests that you assemble a “disaster supplies kit” that you keep in your shelter area. It should contain:

A first aid kit with essential medication in addition to the usual items. A battery powered radio, flashlight, and extra batteries. Canned and other non-perishable food and a hand operated can opener. Bottled water. Candles and matches. Sturdy shoes and work gloves. Written instructions on how to turn off your home's utilities.

IN SCHOOLS

Leave auditoriums, gyms, and other free-span rooms, exiting in an orderly fashion. Go to interior rooms and halls on the lowest floor, but avoid halls that open to the outside in any direction. If there are no interior hallways, avoid those that open to the southwest, south, or west, since that is the usually the direction the tornado will come. Stay away from glass, both in windows and doors. Crouch down, and make as small a “target” as possible.

If you have something to cover your head, do so, otherwise, use your hands. Don't assume that there will always be a teacher or other adult there to tell you what to do—if there is, you should follow their direction, but you need to know these things too.

Peak time for tornadoes to strike varies from region to region. In some southeastern states, early morning tornadoes are almost as common as late afternoon ones. In western and northern states, peak hours are from 3 to 7 PM, just at the end of the school, but including the hours of afterschool activities.

TO AND FROM SCHOOL, WORK, OR AFTERSCHOOL ACTIVITIES:

If really severe weather is expected, your school may be dismissed early in order that you can reach home before the worst of the weather reaches the area.

If you are on foot or riding a bike, it is doubly important that you go home immediately, and not linger with your friends. If caught in the open, you should seek a safe place immediately. The chances of encountering falling trees, power lines, and lightning is greater than encountering the tornado itself. The basement of a sturdy building would be best, but lying flat in a ditch or low-lying area may be the only thing available. A culvert in a ditch MAY be a good choice if there is no rain, but if there IS rain, flash flooding may be more dangerous and likely than the tornado.

If you are in a car, and you can see a tornado forming or approaching, you should leave the car and take shelter as above. You may think you can

escape from the tornado by driving away from it, but you can't know what you may be driving into! There may be dozens of other panicky drivers trying to do the same thing, and this results in traffic jams and maybe even accidents that keep you in the path of the tornado. A tornado can blow a car off a road, pick a car up and hurl it, or tumble a car over and over. Many people have been killed in cars while they were trying to outrun the tornado, and although it is sometimes possible to escape, it is generally not a good idea. (When Joel Manes was a young man, he outran the Wichita Falls, Texas tornado in a car, but many people tried the same thing and were killed.

You can read his story here.)

An underpass may seem like a safe place, but may not be. While videos show people surviving under an underpass, those tornadoes have been weak. No one knows how survivable an underpass is in a strong or violent tornado. The debris flying under the underpass could be very deadly... head for a ditch.

IN HIGH-RISE BUILDINGS:

Interior rooms and halls are the best locations in large buildings. Central stairwells are good, but elevators are not. If the building loses power, you may be in the elevator for a long time. Stay away from glass walls.

MOBILE HOMES:

Most tornado deaths occur in cars and mobile homes. If you live in a mobile home park, you should find out from the manager where you should go in the event of a tornado—but don't wait until you really need the information—

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ask him/her on a nice day! Mobile home parks may have a designated tornado shelter, or a steel reinforced concrete laundry room. If they don't, you need to find another substantial structure that you can reach very quickly. You may have only seconds to get to it.

Two articles that explore the stay in a "mobile home or leave in a car" debate were published recently on the web—one by Dr. Thomas Schmidlin of Kent State University is called Closet, Car, or Ditch? The Mobile Home Dilemma During a Tornado. The other, The Alternate Dilemma: How to Explain and Encourage Counterintuitive Behavior is by Rocky Lopes of the National Headquarters of the Red Cross. They are interesting and informative reading.

SHOPPING CENTERS, HOSPITALS, AND FACTORIES:

Go to interior rooms and halls on the lowest floor. Stay away from glass enclosed places or areas with wide-span roofs such as auditoriums, theaters, and warehouses. Crouch down and cover your head. Deaths have occurred in large, single story department stores. They have occurred inside the building when the roof or wide span brick walls, which collapsed. A corner would be safer than the middle of the wall. A bathroom, closet, office, or maintenance room with short walls would be the safest area, especially if it was on the north or east side of the building.

Is it likely that a tornado will strike your home or school? No. But being ready for the possibility will keep you safer!

The Fujita Scale

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The Fujita Scale(also known as the Fujita-Pearson Scale) may not be a perfect system for linking damage to wind speed, but it had distinct advantages over what had gone on before its inception. And it was simple enough to use in daily practice without involving much additional expenditure of time or money. From a practical point of view, it is doubtful that any other system would have found its way into widespread accepted use, even to this day. The entire premise of estimating wind speeds from damage to non-engineered structures is very subjective and is difficult to defend from various meteorological perspectives. Nothing less than the combined influence and and prestige of Professor Fujita and Dr. Allen Pearson, director of NSSFC(National Severe Storm Forecast Center) in 1971 could have brought this much needed system into widespread use. The FPP scale rates the intensity of the tornado, and measured both the path length and the path width. The Fujita part of the scale is as follows:

| F-Scale | Number | Intensity | Phrase | Wind Speed | Type of Damage Done |
|---------|-------------|-----------|-------------|---|---------------------|
| F0 | Gale | tornado | 40-72 mph | Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards. | |
| F1 | Moderate | tornado | 73-112 mph | The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed. | |
| F2 | Significant | tornado | 113-157 mph | Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated. | |
| F3 | Severe | tornado | 158-206 mph | Roof and some walls torn off well constructed houses; trains overturned; most trees in fores uprooted | |
| F4 | Devastating | tornado | 207-260 | | |

mph Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.

F5 Incredible tornado 261-318 mph Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-inforced concrete structures badly damaged. F6 Inconceivable tornado 319-379

mph These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies

A key point to remember is this: the size of a tornado is not necessarily an indication of its intensity. Large tornadoes can be weak, and small tornadoes can be violent. Large tornadoes can also be strong and small tornadoes can be weak. The Fujita Scale is based on damage, not the appearance of the funnel. Although storm spotters, storm chasers and other weather observers often try to judge the intensity of a tornado when they are in the field, the official estimate is made after the tornado has passed.

The Seymour, Texas, tornado of April 10, 1979 is a prime example of a tornado that is destined to be misjudged on the Fujita Scale. This spectacular funnel was probably capable of F4 damage, had it passed through a town. It produced only telephone pole and tree damage, and thus could be rated no higher than F2 damage. The Seymour tornado was in the same family as the

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devastating Wichita Falls, Texas tornado, which remains as of this writing, the most damaging in US history.

Tornado Stories

A Tragic Harvest Celebration

On Sunday, August 10, 1924, four miles east of Thurman, Colorado, the Garrett, Yoder, and Kuhns families gathered at Henry Kuhns' ranch after a Mennonite service. Twenty-seven people had just finished a harvest celebration dinner. Just after 1: 00 pm, one of the men spotted a tornado to the north, in the direction of an adjoining ranch.

Very much in the Mennonite tradition of assisting people after disasters, Henry Kuhns and eight other men left to see whether help was needed. When they saw that no buildings had been hit, they returned to the ranch to witness the most tragic moment of their lives. What may have been the next member of that tornado family was bearing down from the west, directly at the ranch house. Eighteen women and children inside were apparently unaware of the approach of an intense, 100-yard-wide funnel.

The men drove southward as fast as possible but, as they came to within 200 yards of the front gate, the house " trembled as if a giant unseen fist was shaking it." After a few seconds " the structure was ripped apart and its occupants hurled into the air." Ten of the 18 people died; nine of the 10 were children.

The Newport Family

In a northwestern Kansas wheat field, not far from the Nebraska border, John Newport returned to his field chores after a brief rain shower had passed.

The edge of an enormous thunderstorm, laced with brilliant lightning, had passed overhead and it seemed as if the worst of the storm was over.

Life was not easy on the Great Plains of Phillips County, Kansas on May 25, 1932. For some members of the Newport family, life was about to become even harder. A muffled roar in the distance grew sharper and louder. As John began to move toward the house, he realized that the low, indistinct form in the distance was not rain or a patch of fog, but a rotating transparent cloud, beneath a dark mass of cloud extending under the southwest corner of the thunderstorm. An occasional snake-like form would briefly appear within the cloud, and then suddenly vanish. It was coming directly toward the farm.

At his next glance, three or four contorted and transparent columns would briefly circle the center of what looked like a patch of swirling mist. The cloud looked nothing like the thin funnels and ropes that he had seen in the distance every few years. He now ran at full speed for the house, trying with each gasp to shout " Cyclone!" Within the next few seconds, seven people would make life or death decisions about contentd possessions, about family members, and about self preservation. The rotating cloud had changed from transparent mist to solid brown mass at the edge of the newly plowed fields and continued to advance relentlessly on the small cluster of farm buildings.

With the edge of the vortex still to the southwest, the corner of the roof suddenly gave way and the 30-year-old cottonwood trees that surrounded the house began to snap. A powerful jet of air, flowing into the tornado,

began ripping at the house and the entire building vibrated as the unearthly roar grew steadily louder. One child grabbed a prized locket from a dresser, another gazed at the barnyard full of panic-stricken animals, another yelled for the dog. The oldest stared in denial at her mother; the youngest just stood and cried.

The mother had but one thought, that everyone head immediately for the small root cellar. The storm cave, dug some distance from the house, was now out of reach behind a growing wall of flying debris. The root cellar was the only remaining refuge. The children went first, the mother grabbing each by the arm, and quickening their movement by a half-step. The father braced himself against the kitchen door. The last child was on the steps when the parents finally moved toward the cellar, but the first of the intense whirling columns had reached the house.

In later interviews, none of the children mentioned whether there was, between the parents, a final glance at one another. If there were final words at the top of the stairs, they were not heard above the deafening roar.

Winds in excess of 200 mph created a pressure of 20 tons on the side of the small farm house and the building finally reached its limit of resistance. In an instant, a lifetime of work walls, beams, plaster, furniture, tools, clothes, toys, books, and family treasures were all airborne. Some would fall only a few hundred feet away; smaller bits and pieces would be carried 120 miles. Sheet metal and boards flew across the barnyard at 150 feet per second, impaling anything that was standing. The 12-inch-thick hand-hewn sills, on which the house had sat for forty years, would hit the ground a quarter-mile

away and plunge eight feet into the prairie soil. An entire cottonwood tree was found two miles away.

After a few minutes the children emerged from the cellar, not into the kitchen, but out into a rain and hail storm. They located the lifeless body of their mother about 100 yards from the empty foundation. The father, barely alive, was found 200 yards further away, across the state line in Nebraska. His last words were instructions to get to the nearest neighbor for help, a half mile away. He fell into unconsciousness in the arms of his eldest daughter. The children, Mildred, Martha, Eleanor, Dean, and Paul, ages 3-15, ran through a barrage of five-inch-diameter hail. They arrived at the next farm battered, bloodied, with broken arms and ribs. John died a few hours later neighbor's living room. The children began new lives with their grandparents.

Tornado Myths and Misconceptions

Myth or Misconception #4 Opening windows to equalize air pressure will save a roof, or even a home, from destruction by a tornado.

The idea that moving one thin pane of glass is going to protect a roof or house from one of the most violent natural forces on the planet has a certain absurdity about it. It is probably born of wishful thinking and faulty logic, stemming from the need to do something anything. In reality, opening windows is a dangerous and useless waste of time, and could actually be harmful to the house.

To get to the very center of a mature tornado (where the pressure may be low enough to cause some explosive effects), the windows would have to endure 100-200 mph winds in the walls of the vortex. Those winds would be laden with boards, stones, cars, trees, telephone poles, and the neighbor's roof shingles as well as wind pressure of more than 100 pounds per square foot. This barrage would blow more than enough ventilation holes in the building to allow any pressure difference to be equalized.

Even with the windows closed, most houses and commercial buildings have enough openings to vent the pressure difference in the time that it takes for a tornado to pass. The engineering team at Texas Tech's Institute for Disaster Research (Minor et al., 1977) point out that the pressure drop inside a tornado with 260 mph winds is only about 10%, or just 1.4 pounds per square inch. Most buildings can vent this difference through its normal openings in about three seconds. That is sufficient time even if the tornado is moving forward at a very rapid 60 mph. In the real world, the discussion is pointless. That violent a tornado would totally blow apart a house before the central low pressure ever arrived. Venting of air to relieve pressure would not be an issue.

If the home owner opens the wrong window, air can rush in and exert pressure on the structure from the inside—like blowing air into a balloon. It is unlikely that the resident knows where the construction weak points are. In addition, the wind fields in a passing tornado are very complex and constantly changing. It is not possible to predict the strongest direction of attack. The best advice from every engineer with whom the author has ever discussed this is to leave the windows alone and get into the basement or

other shelter as fast as possible. One should not think first of the house roof, but of the impact of one's death on one's family, or of one's self unnecessarily crippled or scarred for life.

I don't recall the exact origin of the "window opening" advice, but do recall that the original advice was to open windows in both the front and the back of the house. Theoretically, this would allow air to move through the house, and reduce any buildup of interior pressure. Somehow, the advice was altered to include only the windows on the north side of the house, (away from the tornado). There is no evidence that any opening of windows ever helped to hold a roof in place. The best advice is still to forget the windows and get to a shelter.

Myth or Misconception #3 Tornadoes never strike big cities.

This misconception has a small kernel of possible truth at its heart. Before we get to that possible bit of truth, we first have to make a number of things clear. When one thinks of a "big city", the image of sky scrapers and large office or apartment buildings come to mind. In actuality, if you were to compare the downtown where these buildings occur with the rest of the city, it would comprise a rather small percentage of the city's area.

a tornado passed through Miami, Florida before it moved out to sea, disproving the idea that they can't form in cities.

The St. Louis, Missouri and East St. Louis, Illinois areas have had more than their share of tornado strikes to their downtowns. The first time was on March 8, 1871, when a tornado that did F-3 damage moved from the west

bank of the Mississippi River, across the river, to the Brooklyn-Venice area of Illinois. Ferries and steamers were torn apart and their fragments carried as much as 30 miles. Most of the damage was to the six railroad depots that were destroyed. Eight of the nine deaths occurred in the railroad yards.

A tornado struck again on May 27, 1896, killing 255 people in the two states. Touching down on the NW edge of Tower Grove Park, the storm widened into a mile-wide, complex combination of tornado and downburst winds. It struck the Eads Bridge, just as the windstorm had in 1871. Seven people were killed in a building about where the I-55 sign is on the map to the right. A photo of that building, and another photo of the East St. Louis damage can be seen here. About 1000 people were injured as the storm collapsed or swept away portions of houses, factories, saloons, hospitals, mills, railroad yards, and churches. The storm was at its maximum intensity as it crossed the Mississippi into East St. Louis, and it killed 118 people there, 35 of which were in the Vandalia railroad freight yards.

The third time St. Louis was struck was on September 29, 1927. The tornado began at the south edge of Webster Grove and as it passed through the middle of the city, its path widened from 100 to 600 yards. Over 200 city blocks were torn apart, and 72 people were killed. In Illinois, 6 people were killed when a crucible of molten metal was overturned. Debris from the tornado was carried up to 50 miles.

In the past 40 years, the city of St. Louis and the surrounding suburbs of St. Louis County have been hit 22 times, although none of them were in the tiny skyscraper heart of the city. There are three possible reasons for that. First,

the central city may produce a “heat island” in which turbulent rising air disrupts the formation of small tornadoes (keep in mind that most tornadoes are small). The second possibility is that the “roughness” created by the skyscrapers causes turbulence that disrupts the formation of small tornadoes. The third, is, of course, the idea that tornadoes are rare, and the central city is very small. So it is a matter of coincidence.

Professor Fujita of the University of Chicago suggested that the “heat island” effect takes hold for small tornadoes when a city reaches a population of about 1,000,000. There seems to be a lack of small tornadoes in the central cities of Chicago, Tokyo, and London. These are the only three cities that have been carefully studied over a long time.

None of this applies to intense tornadoes. They are just too rare to assume that they avoid central cities. There are thousands of small towns all across Tornado Alley that have never been hit by an intense tornado. If you have ever seen video of the Wichita/Andover, Kansas tornado, it should seem ridiculous to you to think that this monster, at the bottom of an 8-mile-high rotating column, would be bothered by the presence of a few 300-foot-tall buildings. Perhaps some time in the next century, a central city will be in the path of a violent tornado, and we will learn what will happen. The probability of a violent tornado in the downtown area of any large city is about once in a thousand years.

It is possible that a tornado could actually intensify even more after it forms outside of town and moves into the central city. One speculation has it that the friction of the buildings will slow down the inflow of air into the funnel.

This would deprive the funnel of air. The pressure would drop, causing the funnel to shrink in diameter, and spin even faster. So central city tornadoes that began outside the city could be more damaging than average. As you can see, there is a lot more to this than the simplistic idea that heat and roughness keeps tornadoes away. The rarity of intense tornadoes and the fact that St. Louis has been hit by three of them is an interesting curiosity, but that is another puzzle for another day.

Myth or Misconception #2 Some towns are “ protected!”

Various Native American tribes perceived tornadoes in different ways. Some saw them as a cleansing agent, sweeping away the ragged and negative things of life. Others saw them as a form of revenge for dishonoring the Great Spirit. Today, only the myths about the protection of towns by rivers and hills linger in modern American culture.

The Osage Indians, native to Kansas, Oklahoma, and Missouri passed on tornado legends to the early settlers. One such legend has it that tornadoes will not strike between two rivers, near the point where the rivers join. In the past 150 years, this idea may have given a false sense of security to some people who thereby failed to take shelter. They may not have lived to help debunk the myth. One by one, the myths that particular towns are protected have fallen by the wayside.

Emporia, Kansas, for instance, had sat “ protected” between the Cottonwood and Neosho Rivers, in native Osage territory, for over a century. Emporia was free of damaging tornadoes until June 8, 1974 when a tornado killed six people and destroyed \$20, 000, 000 worth of property on the northwest side

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of town. Another tornado did \$6, 000, 000 in damage along the west side of Emporia on June 7, 1990. Part of the path of the 1974 tornado was also the site of a deadly twister on September 29, 1881, but the area was farmland then.

The idea that one's town is "protected" is a combination of wishful thinking, short memory, the rarity of tornadoes, and a distorted sense of "here" and "there." Proof of protection has been offered by a very simple statement of fact. The town has never been hit by a tornado, but 10 tornadoes have touched down "outside" of town in the past 30 years. The occurrence information may be fact, but the conclusion that the town must be "protected" does not logically follow.

That logic disregards some very basic ideas. It ignores the likely possibility that rivers, ridges, and valleys have little or no effect on mature tornadoes. Tornadoes have passed seemingly unaffected over mountain ridges 3, 000 feet high. Dozens have crossed the Mississippi River, from Minnesota to Louisiana. Both sides of the river, at the confluence of the Mississippi and Missouri Rivers, near St. Louis, have seen devastating tornadoes.

Topography may have some influence, but protection is not one of them. Weak tornadoes may damage hilltops. But well-formed, mature tornadoes may actually stretch themselves into valleys and intensify. During this vortex stretching, the funnel diameter may shrink in diameter and the tornado will spin even more rapidly. This is hardly what one would call protection for buildings in a valley.

The belief that tornadoes don't hit " here," but always seem to hit " north of town" or " south of the river" ignores some very simple mathematics. " Here" may be a small town with an area of one square mile. Just " outside of town" or " there" or " to the north" may be anywhere within visual sighting from the water tower, perhaps 10 miles in all directions. Therefore, if the town has an area of one square mile, then " outside of town" has an area of over 300 square miles. A tornado touchdown is 300 times more likely " outside" of town than in-town. The " protection" of the town does not come from hills, or a mound, or the joining of two rivers. Tornado protection comes from the same source as our protection from falling comets or other heavenly visitors that afforded by the laws of probability the very low probability of rare events such as tornadoes.

Myth or Misconception #1 The southwest corner of a basement is the safest location during passage of a tornado.

The truth is that the part of the home towards the approaching tornado (often, but not always, the southwest) is the least safe part of the basement, not the safest. This is also true of the above-ground portion of the house. In most tornadoes, many more homes will be shifted than will be blown completely free of a foundation. Homes that are attacked from the southwest tend to shift to the northeast. The unsupported part of the house may then collapse into the basement or pull over part of the foundation, or both. Historically, the few deaths in basements have been caused by collapsed basement walls, houses, and chimneys, rather than by debris that was thrown into the basement from the outside.

For nearly a century, the published conventional wisdom was that the southwest corner of a building, both above and below ground, afforded the best protection. This misconception probably originated from someone's reasoning, rather than from actual observations. They probably assumed that deadly debris would be propelled over the southwest corner and land in the northeast corner.

The idea that it was safe to seek shelter on the side of a house facing the oncoming tornado dates back to at least the first book on tornadoes, the 1887 comprehensive text *Tornadoes*, by John Park Finley. He placed in italic for emphasis the following remark: "Under no circumstances, whether in a building or in a cellar, ever take a position in a northeast room, in a northeast corner, or an east room, or against an east wall." He also recommended removing the furniture from the west-facing room and closing all windows in the house. This is all incorrect, deadly, and time-wasting advice. It is quite possible that someone has died following it. While relatively few people probably read the book when it was available, the advice was quoted in many newspapers. It is possible that in the limited number of damage surveys that Finley conducted personally, he came upon a grisly scene involving the northeast portion of a poorly constructed house that had fallen over, and it strongly influenced his thinking.

These assumptions went essentially unchallenged until 1966, when Professor Joseph Eagleman of the University of Kansas undertook a survey of destroyed produced by after the Topeka tornado of June 8th. Professor Eagleman's objective study showed that the south side and southwest corners, the direction of approach for the Topeka tornado, were the least

safe areas, and the north side of homes were the safest both on the first floor and in the basement. He repeated the study after the Lubbock, Texas tornado of May 11, 1970, and the results were even more striking. The southwest portion of the houses were unsafe in 75% of the damaged homes double the percentage of unsafe areas in the northeast part of homes. As a general rule, people in basements will escape injury despite the extreme devastation above them. Being under a stairwell, heavy table, or work bench will afford even more protection.

Ignorance of this conventional wisdom, combined with common sense, has saved lives in the past. At the Pacolet Mills near Gainesville, Georgia on June 1, 1903, 550 people ran to the northeast corner of the building as the tornado approached from the southwest. That northeast corner was the only part of the building not destroyed. At least fifty people died in other Gainesville fabric mills on that day, and more than 40 more died in homes near the mills.

Tornado Oddities

The following are excerpts from the upcoming book "Tornadoes of the United States" by Thomas P. Grazulis, published by the University of Oklahoma Press.

Of all the strange oddities, a few are not readily explainable and among these is the ubiquitous plucked chicken. Within the damage descriptions of rural tornadoes, there will likely be mention of a chicken "stripped clean of every feather." It has been suggested that the feathers explode off the bird in the tornado's low pressure. That explanation does not hold up because the

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bird would be blown away long before experiencing the lowest pressure at the center of the tornado. Secondly, the lowest pressure in a tornado is probably not low enough to explode a feather if indeed a feather would ever explode. It is curious how the exploding feather theory became accepted by so many people over the years, even though the remains of an exploded feather was never found. But when it come to tornadoes, facts, evidence and accurate descriptions have never bothered amateur tornado theoreticians and much of the news media.

In 1842, Elias Loomis performed an experiment that left much to be desired in the control of experimental variables. It received wide attention at the time. His goal was to gain insight into the wind speed needed to defeather a chicken. An account written a few years later states: " In order to determine the velocity needed to strip feathers, the six-pounder (cannon) was loaded with five ounces of powder, and for a ball a chicken was killed. The gun was pointed upwards and fired. The feathers rose twenty or thirty feet and were scattered by the wind. On examination, they were found to be pulled out clean, the skin seldom adhering to them. The body was torn into small fragments, only a part of which could be found. The velocity was 341 miles per hour." Loomis speculated that if a live bird was fired at 100 miles per hour, the results would be more successful, but, to my knowledge he never attempted it. He did place dead chickens under a vacuum jar to see if the feathers would explode. They did not. A widely accepted alternative theory in the 19th century was that opposing electric charges during the tornado's passage stripped feathers from chickens and tore the clothes from people. It was supposed that the highly charged tornado induced an opposite charge in

objects as it approached and things would be sent flying. While static electricity is undoubtedly present in a debris filled funnel, this makes no scientific sense whatever. There is simply no mechanism that would produce powerful opposing charges on the bird and on the feather at the same time.

The most likely explanation (Vonnegut, 1965) for the defeathering of a chicken is the protective response called "flight molt." Chickens are not stripped clean, but in actuality they lose a large percentage of their feathers under stress in this flight molt process. In a predator-chicken chase situation, flight molt would give the predator a mouth full of feathers instead of fresh fowl. In a tornado, the panicked chicken's feathers simply become loose and are blown off. Stories of chickens found dead, sitting at attention and stripped clean of feathers may be on par with reports of the blowing of a cow's horn or a two-gallon jug being blown into a quart bottle without cracking.

The Great Bend, Kansas tornado of November 1915 is the tornado which seems to have a greatest number of oddities associated with it. Why? Who knows! It was an unusual time of year for a violent tornado this far west. In fact, it is the latest date in the year that a violent tornado has ever struck the state of Kansas. The funnel began its late-evening journey five miles southwest of Larned, 16 miles southwest of Great Bend. It was visible only occasionally during the flashes of lightning. The oddities began southwest of Pawnee rock where a farm was leveled to the ground and two people were killed. From a short distance away, one could not tell that a farmstead had ever existed there. Five horses were the only uninjured survivors. They were

carried from the barn a distance of a quarter-mile. All were unhurt, all were found together, hitched to the same rail.

At the edge of Great Bend, the Charles Hammond house was unroofed. The family was completely unaware of the damage until they came outside to survey the neighbor's damage. At Grant Jones' store, the south wall was blown down and scattered, but shelves and canned goods that stood against the wall were unmoved. The Riverside Steam Laundry, built of stone and cement block, was left with only a fragment of upright wall, yet two nearby wooden shacks seemed almost untouched. At the Moses Clay ranch, on the east edge of town, 1000 sheep were killed, the most ever killed by a single tornado. A cancelled check from Great Bend was found in a corn field, one mile outside of Palmyra, Nebraska...305 miles to the northeast, the longest known distance that debris has ever been carried. A "rain of debris," receipts, checks, photographs, ledger sheets, money, clothing, shingles, and fragments of books fell on almost every farm north and west of Glasco, 80 miles to the northeast.

A necktie rack with 10 ties still attached was carried 40 miles. A four-page letter "from a swain to his fair damsel in which he promised all" was carried 70 miles. A flour sack from the Walnut Creek Mill was found 110 miles to the northeast, perhaps the longest distance ever recorded for an object weighing more than one pound. Up to 45,000 migrating ducks were reported killed at Cheyenne Bottoms. Dead ducks fell from the sky 40 miles northeast of that migratory bird refuge.

In Great Bend, an iron water hydrant was found full of splinters. Mail was lifted from the railroad depot and scattered for miles to the northeast. Some of it was returned to Great Bend, but some of it was sent on from where it was found... one of the earliest forms of air mail! Farmers living two miles from town were unaware of the tragedy and were “ dumb-founded” when they visited town the next day and “ beheld the tragic spectacle.” Over 20,000 visitors viewed the wreckage the following Sunday.

Fictional oddities were added almost daily to the growing list of stories. An iron jug was blown inside out... a rooster was blown into a jug, with only its head sticking out of the neck of the container.