
Tornado Safety — June 2009

Q What change did the Red Cross make to its public safety advice regarding tornadoes?

A The American Red Cross has revised its public safety advice to include new information about what to do if you are caught outdoors during a tornado.

Based on a review of six research studies by various authors over the past 20 years, the American Red Cross now recommends the following actions if you are caught outdoors and a tornado threatens:

- First, seek shelter in a basement, shelter or sturdy building.
- If you cannot quickly walk to a shelter:
 - Immediately get into a vehicle, buckle your seat belt and try to drive to the closest sturdy shelter.
 - If flying debris occurs while you are driving, pull over and park. Now you have two options as a last resort:
 - Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.
 - If you can safely get noticeably lower than the level of the roadway, exit your car and lie in that area, covering your head with your hands.
 - Your choice should be driven by your specific circumstances.

The most important thing to remember is that you should always try to seek shelter first in a basement, shelter or sturdy building. That guidance has not changed and is universally recognized as the most effective way to stay safe in a tornado.

This new Red Cross guidance covers what to do only if the driver is unable to obtain underground shelter in a basement or an interior room (closet, hallway or bathroom) of a sturdy permanent building.

Q Why did the Red Cross change its recommendation for tornado safety?

A Over the past 20 years, research studies by various authors have examined the stability of vehicles in high winds. While you should always try to seek shelter first in a basement, shelter or sturdy building when a tornado threatens, these studies suggest that staying in a vehicle with seatbelts buckled during a tornado offers more protection than staying in a mobile home or being outdoors.

Q What science supports the change?

A The Preparedness Sub-Council of the Advisory Council on First Aid, Aquatics, Safety and Preparedness (ACFASP) conducted a review of the literature on tornado safety and found evidence that supports remaining in a vehicle in the event that the driver cannot get to a safe shelter during a tornado warning. Multiple studies (6) conducted over the past 2 years were found that focused on how death and injury rates for residents of mobile home can be decreased. These studies examined the risk associated with being in a vehicle during a tornado compared to the risks of being in a mobile home or outdoors in a ditch during a tornado.

The research shows that family passenger vehicles can withstand greater wind speeds than can a mobile home before they are tipped over, or even moved, due to their aerodynamic qualities. Four sources of data were used to determine the impact of different amounts of wind speed on vehicles: 1) data from instrumented storm chase vehicles; 2) houses that had been struck by a tornado were compared to the damage incurred by parked cars near the houses struck by tornados; 3) wind tunnel studies using scale replicas of minivans and sedans at wind speeds of 110 to 180 miles per hour, and; 4) epidemiological studies of tornado-caused injuries and deaths found that people in cars were better protected than those in mobile homes or outdoors.

The research concluded that relative tornado safety may be placed on a continuum as follows—

1. Underground shelter (safest place to be)
2. Basement
3. Interior of a sturdy building
4. Exterior room
5. Vehicle
6. Mobile home
7. Outside/Ditch

Q What is ACFASP?

A In late 1998, the American Red Cross formed an independent panel of nationally recognized preparedness and health and safety experts. This group, the Advisory Council on First Aid, Aquatics, Safety and Preparedness, (ACFASP) is a collective body of experts that represent diverse fields such as emergency medicine, emergency management, public health, preparedness, occupational health, sports medicine, school health, EMS response and disaster mobilization. ACFASP is charged with advising the American Red Cross in areas related to the development and dissemination of audience-appropriate information and training in first aid, aquatics, safety and preparedness.

Q Is the Red Cross recommending that people seek shelter in their cars?

A No. The safest place to be is an underground shelter, basement or an interior safe room (closet, hallway or bathroom) of a sturdy permanent building. That guidance has not changed. We are recommending that you take shelter in your car only as a last resort, and when it is not possible to get to a solid shelter.

Q Should I leave the car running?

A Although car airbags will only deploy if the engine is running and the airbags may provide you with more protection, there is no scientific evidence that it is more or less dangerous to have the ignition on if you are forced to take shelter in your vehicle when a tornado is approaching.

Q What if there isn't room in my car to duck below the windows?

A If you are unable to duck below the windows, cover your head and body with cloth (such as a jacket or blanket) to provide some extra protection against flying debris and

glass breakage.

Q When is it safe to get out of my car?

A Once local officials deem that the threat of a tornado has passed it is safe to exit your vehicle.

Q Why is remaining in my car safer than lying in a ditch?

A If a tornado threatens, the best option is to go to an underground shelter, basement or a safe room. If you are caught outdoors or in your vehicle, cannot get to a shelter, and flying debris occurs, then you should pull over and park. Now you have two options:

- Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.
- If you can safely get noticeably lower than the level of the roadway, exit your car and lie in that area, covering your head with your hands.

Your choice should be driven by your specific circumstances.

It is important to know both of these options put you at risk from a number of things outside your control, such as the strength and path of the tornado and debris from your surroundings. That's why getting to safe shelter is so important.

The most common cause of injury and death in tornados is multiple blunt-force trauma from flying debris and the new Red Cross guidance about remaining in vehicles seeks to provide further protections in the event that you are unable to reach shelter in a basement, tornado shelter or sturdy building.

Q Is a car safer than a mobile home?

A Yes. Studies show that mobile homes can tip over when faced with 98 mile per hour winds and sustain major damage to the walls and roof in 105 mile per hour winds. Compare that to the evidence from the study that showed 50% of vehicles exposed to winds of 136-200 miles per hour were not moved and 82% of the unmoved vehicles were not tipped over. If you have access to a study shelter or a vehicle, do not stay in a mobile home if a tornado warning has been issued. If you are unable to reach an underground shelter or a sturdy building, your car is a safer alternative to staying in your mobile home.

Q What should I do if I am in my mobile home and unable to get to a vehicle during a tornado warning? Do I stay in the mobile home, get in a ditch, or do something else?

A If you do not have access to a sturdy shelter or a vehicle, the Red Cross recommends that you stay in your mobile home. Though mobile homes are not safe during tornados or severe high winds, being outdoors poses a greater risk to your safety during a severe storm. The potential for injury when outside and exposed to hail, lightning and flying debris is greater than remaining in the mobile home.

Q What if I hear conflicting recommendations from my local weather sources?

A There is no conflict in the recommendations that if a tornado is threatening, the safest place to be is an underground shelter, basement or an interior room (closet, hallway or bathroom) of a sturdy permanent building. The American Red Cross recommendation to abandon mobile homes and seek shelter elsewhere is grounded in the science. If you are in a car and cannot get to a shelter and flying debris occurs while you are driving, pull over and park.

At this point, you have two options:

- Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.
- If you can safely get noticeably lower than the level of the roadway, exit your car and lie in that area, covering your head with your hands.

Each driver's choice will depend on the specific circumstances at the time.

What do you say to people who show photos of tornado-mangled cars and say this proves that people should not remain in their cars?

Staying in a vehicle or getting into a ditch are considered last resort options because they provide less protection in a tornado than sturdy shelters. If people are unable to get to a safe shelter, they are at risk from a variety of factors outside their control, such as the strength and path of the tornado and debris from the surroundings.

In the materials reviewed by the Red Cross, researchers compiled evidence about damage sustained to 291 cars that were parked next to homes struck by tornados. That study showed that the majority of vehicles were not tipped over during a tornado.

The study found that:

- At sites with F1/F2 damage (86-135 miles per hour on the EF scale), 72% of vehicles were not moved and 96% were not tipped by wind. Tipping was defined by the researchers as one wheel lifting off the ground; it does not mean that the vehicle tipped over on its side or roof.
- At sites with F3/F4 damage (136-200 miles per hour on the EF scale), 50% of the vehicles were not moved and 82% were not tipped by the wind.

This research shows that vehicles exposed to actual tornados were not commonly moved or tipped by the wind.

News photographers seek out the most dramatic damage in disasters, and this pertains to tornado-struck cars too. To be clear, the Red Cross is not saying people who remain in their cars are not vulnerable, just that the research shows they are less vulnerable than people in mobile homes or people who are outside.

But a person who is in a car when debris is flying must choose whether to remain in the car or get to a low area depending on the specific circumstances at the time.

Q When exactly would getting into a car be a good safety precaution?

A It's important to remember that being in a car is the alternative to consider if you have no access to sturdy shelter, basement or interior room of a sturdy building. If you are outside or in a mobile home and do not have access to shelter, head for your car, buckle your seat belt, and drive carefully to a shelter once the tornado warning has been issued.

Q What do you say to the criticism that this sends a confusing message or the wrong message to the public about tornado safety?

A The American Red Cross has adopted this guidance based on the most current scientific findings about how to stay safe during a tornado, and has been working with the National Weather Service to provide as consistent advice as possible.

The National Weather Service and the American Red Cross share a common goal of protecting lives through public education, and both agree that the best options are to go to an underground shelter, basement or safe room. This is recognized as the most effective way to stay safe in a tornado.

The National Weather Service and Red Cross also agree on the critical importance of preparedness and quick action when conditions are right for tornadoes to develop like during a severe thunderstorm warning or tornado watch. When a tornado warning is issued, immediate action is required.

Preparedness begins by identifying a safe location well in advance of any severe weather and having a way to get weather alerts wherever you are, such as from a NOAA weather radio. When a watch or warning is broadcast, people should already have a plan on what to do and where to go. They should take action immediately and never wait until they actually see a tornado.

The National Weather Service and the Red Cross continue to agree that if no underground shelter or safe room is available, the safest alternative is a small windowless interior room or hallway on the lowest level of a sturdy building, such as an interior bathroom. We also recommend that residents of mobile homes go to the nearest sturdy building or shelter if a tornado threatens.

The Red Cross and Weather Service believe that if you are caught outdoors, you should seek shelter in a basement, shelter or sturdy building. If you cannot quickly walk to a shelter:

- Immediately get into a vehicle, buckle your seat belt and try to drive to the closest sturdy shelter.
- If flying debris occurs while you are driving, pull over and park. Now you have the following options as a last resort:
 - Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.
 - If you can safely get noticeably lower than the level of the roadway, exit

your car and lie in that area, covering your head with your hands.

- Your choice should be driven by your specific circumstances.

Q What do you say to the criticism that this may encourage people to try drive in a dangerous manner while trying to “outrun” a tornado?

A The goal is to get to safe shelter. We are not encouraging people to try to outrun a tornado.

Q Why would the Red Cross provide advice to the public that is inconsistent with guidance from the National Weather Service?

A The National Weather Service and the American Red Cross share a common goal of protecting lives through public education. Regarding tornado safety, we both agree that the best options are to go to an underground shelter, basement or safe room. And if no underground shelter or safe room is available, the safest alternative is a small windowless interior room or hallway on the lowest level of a sturdy building, such as an interior bathroom. We also recommend that residents of mobile homes go to the nearest sturdy building or shelter if a tornado threatens.

For people outside and unable to get to safe shelter when a tornado threatens, both the National Weather Service and the Red Cross believe that the decision on whether to stay in a car or to get into a low-lying area must be based on the specific circumstances faced by a driver. Both of these options should be considered only as a last resort.

Q What scientific studies support having a person stay in their car during a tornado instead of getting in a ditch?

A Here is a list of the peer-reviewed scientific studies consulted that support staying in a vehicle during a tornado, as opposed to being outdoors in a ditch or in a mobile home.

- Injuries and risk factors for injuries from the 29 May 1982 tornado, Marion, Illinois. PJ Duclos, RT Ing. International Journal of Epidemiology, 1989, 18:213-219
- Epidemiologic study of deaths and injuries due to tornadoes. AO Carter, et al. American Journal of Epidemiology, 1989, 130:1209-1218.
- Risk factors for death or injury in tornadoes: an epidemiological approach. SA Brenner, EK Noji. 1993, in The Tornado: Its Structure, Dynamics, Prediction and Hazards, American Geophysical Union Monograph 79.
- Risk of tornado-related death and injury in Oklahoma, May 3, 1999. WR Daley et al. American Journal of Epidemiology, 2005, 161:1144-1150.
- Tornado-related deaths and injuries in Oklahoma due to the 3 May 1999 tornadoes. S Brown, et al. Weather and Forecasting, 2002, 17:343-353.
- Unsafe and any (wind) speed? Testing the stability of motor vehicles in severe winds. TW Schmidlin et al. Bulletin of the American Meteorological Society, 2002, 83:1821-1830.