

Working from the same page

consistent messages for CDEM

PART B: Hazard-specific information



Damage from a tornado in New Plymouth, July 2007

Tornadoes

- ▶ Learn about your community's risks from hazards created by tornadoes.
- ▶ Contact your local council to find out if you live in an area prone to tornadoes.
- ▶ Visit the MetService website www.metservice.co.nz to find out about tornado risks.

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CORE ACTION MESSAGES IN THIS CHAPTER (p9)

- ▶ **Determine your risk.**
- ▶ **Get your household ready.**
- ▶ **Make an evacuation plan.**
- ▶ **Keep an 'in case of tornado' to-do list.**

For general readiness, every household should create and practice a Household Emergency Plan and assemble and maintain Emergency Survival Items and a Getaway Kit. In addition, every household should take tornado specific precautions and plan for and practice what to do if a tornado happens.

Please note: Core Action Messages should be read in conjunction with the rest of the text in this chapter.

Awareness messages

Why talk about tornadoes?

Each year, a few tornadoes are observed in New Zealand. More often than not, the damage resulting from these is minor because they existed for only a very short time. However, once in a while there is significant damage – and threat to public safety – when one or more tornadoes passes through a built-up area.

The most notable tornado in New Zealand occurred in the Hamilton suburb of Frankton on 25 August 1948. It carved a 100–200 m swath through the suburb, causing three deaths and 12 injuries, damaging 150 houses and 50 businesses.

More recently, at least 12 tornadoes were observed in Taranaki on 4 and 5 July 2007 and caused widespread damage in the region. Oakura, a town 12 km southwest of New Plymouth was most affected. Approximately 50 houses suffered major damage, some of it beyond repair, when two tornadoes ripped through the town.

What causes tornadoes?

A tornado is a narrow, violently rotating column of air extending downwards to the ground from the base of a thunderstorm.

Only thunderstorms that have a particular sort of rotating air column produce tornadoes and it is only when this rotating air column touches down to the ground, or gets very close to the ground, does it become a hazard to land- (or sea-) based activity. A waterspout is simply a tornado that occurs over a body of water.

Compared with the tornadoes that occur over the Earth's major continents, those observed in New Zealand are generally small and weak. They are usually around a few tens of metres wide, have tracks a few kilometres long and lifetimes of just a few minutes. Like all tornadoes, their damage paths are extremely localised.

Over major continents, thunderstorms – and therefore tornadoes – tend to be more common in the afternoon and evening of the summer months. In the west of the North and South Islands, where most of New Zealand's tornadoes are observed, this is not the case: they occur just as frequently in the winter as in the summer – and at any time of day or night.

The Fujita Scale (**see** Fig. 1 on the next page) relates tornado strength according to the amount of damage observed. Tornadoes in New Zealand are seldom stronger than F2.

F-Scale	Winds	Potential damage
Category F0	64–116 km/h	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
Category F1	117–180 km/h	Moderate damage. The lower limit is the beginning of tropical cyclone wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
Category F2	181–253 km/h	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated.
Category F3	254–332 km/h	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
Category F4	333–418 km/h	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
Category F5	419–512 km/h	Incredible damage. Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 m (109 yd); trees debarked; steel reinforced concrete structures badly damaged; incredible phenomena will occur.

Fig. 1 Fujita scale (MetService)

Effects on buildings

A tornado is a wind storm with a strong rotation component which means that all obstacles in its path will experience variations in both wind speed and direction. As construction methods vary, the ability of a building to withstand a tornado depends on the direction and magnitude of the force applied.

A major contribution to tornado damage is the strong acceleration of the upward motion near the surface, often described as suction by eyewitnesses. Buildings are typically designed to hold structures down, but not to withstand large lifting forces. It only takes one point of weakness to initiate structural failure. In addition to the lift forces, horizontal wind creates dynamic inward acting pressure. This horizontal flow interacts with the building and can increase lifting forces.

Projectile impacts and internal pressurization are also frequent causes of severe building damage. Openings, such as doors or windows, are the weak points of the building envelope and might not resist wind loads or can be damaged by debris. Once damaged, the wind can enter the building and amplify forces on the ceiling and roof and can combine with outward acting pressure. It's like a house blowing up like a balloon and could result in what people often describe as an explosion, but is actually it's the result of the dynamic pressure not the pressure deficit.

Tornadoes can move quickly, are generally small in diameter and interact with a given structure for only a few seconds, but they can also be slow-moving, with a wide path and therefore can act on a building for a longer duration. The level of damage a building sustains is not directly correlated to the duration of interaction with a tornado. Some failures occur if the forces increase rapidly while other damages are more likely if the forces increase slowly. However, in general the probability of a failure will increase the longer the wind interacts with the building.

The rapid variation in wind speed and duration, together with differences in structural strength can result in the destruction of some structures, whereas other structures in the near vicinity are almost untouched. And unlike other strong wind events, not only the windward side of a building is vulnerable; the fluctuation in the wind field can trigger damage to every corner of the building. The variation in wind

speed and direction, in combination with debris impact often causes buildings to fail at relatively low wind speeds.

Forecasting / warning

Every morning and evening, MetService publishes a Severe Thunderstorm Outlook for all of New Zealand for the current and following day at www.metservice.com/default/index.php?alias=thunderstormoutlook.

The Severe Thunderstorm Outlook states, in broad terms, the likelihood that severe weather – including tornadoes – associated with thunderstorms will occur. The “today” part of the Severe Thunderstorm Outlook is published around 8.30am, with the “tomorrow” parts following later at about 11.00am.

In New Zealand, MetService defines Severe Thunderstorms as those which produce:

- Heavy rain (from thunderstorms): Rainfall of 25 millimetres per hour, or more; and/or
- Large hail: Hailstones 20 millimetres in diameter, or larger; and/or
- Strong wind gusts (from thunderstorms): Gusts of 110 kilometres per hour (60 knots) or stronger; and/or
- Damaging tornadoes: Fujita F1 (wind speeds greater than 116 kilometres per hour (63 knots)) or stronger.

Example: Severe thunderstorm outlook

Situation Statement:

The atmosphere is expected to be very unstable today with thunderstorms expected in many areas.

A band of rain and thunderstorms will move onto western parts of the North Island late morning, bringing a high risk of thunderstorms to western areas from the Kaipara Harbour to Awakino, with localised heavy rain and hail.

This band will weaken as it moves eastwards across the North Island, however scattered heavy showers and thunderstorms are expected to develop from afternoon cloud build-ups in many areas from Coromandel Peninsula to Taihape and Hawkes Bay. Localised heavy rain and hail will accompany these storms.

In inland parts of Gisborne, Hawkes Bay, eastern Bay of Plenty and possibly Taupo, the afternoon and evening thunderstorms are expected to be slow-moving and therefore have the potential be severe with rainfall rates as high as 35mm/hr.

Rainfall rates of this intensity can cause surface and/or flash flooding, especially about low-lying areas such as valleys, streams and drains.

There is also a much lower risk of afternoon thunderstorms about inland Taranaki, the Wanganui hill country and Wairarapa as indicated on the chart.



If there is a high risk of severe thunderstorms within the next 6 to 12 hours, MetService will issue a Severe Thunderstorm Watch. If tornadoes are expected to be associated with the severe thunderstorms, they will be mentioned in the Severe Thunderstorm Watch. As with the Severe Thunderstorm Outlook this is for all of New Zealand, is usually valid for no more than six hours and describes the risk of tornadoes in fairly general terms.

The Severe Thunderstorm Watch is available at www.metservice.com/default/index.php?alias=thunderstormwatch .

A text version is also available by email: to receive it, follow the instructions at www.metservice.com/default/index.php?alias=warningemail .

Example: Severe thunderstorm watch

SEVERE THUNDERSTORM WATCH

Issued by MetService at 11:05 am Tuesday 12 February 2008

Valid until: 08:00 pm Tuesday 12 Feb 2008

Daytime cloud build-ups are expected to produce scattered showers and thunderstorms about Gisborne, Hawkes Bay (from about Hastings northwards), and near the ranges of eastern Bay of Plenty and eastern Taupo this afternoon and evening.

A few of these thunderstorms are likely to be severe, especially about the inland hills and ranges where rainfall rates may reach 35mm/hr.

Rainfall rates of this intensity can cause surface and/or flash flooding, especially about low-lying areas such as drains, streams and rivers.

Issued by: John Crouch

This watch will be updated by: 03:00 pm Tuesday 12 February 2008



The map shows the outline of New Zealand with major cities labeled: Kaitiaki, Whangarei, Auckland, Hamilton, New Plymouth, Tairāhema, Gisborne, Napier, Wairoa, Palmerston North, Masterton, Wellington, Havelock Bay, Westport, Greymouth, Hokitika, Milford Sound, Queenstown, Timaru, Dunedin, and Invercargill. A red shaded area covers the region from Hastings northwards to the Bay of Plenty. A red box in the top right corner of the map contains the text: 'MetService Severe Thunderstorm Watch Issued: 11:05 am Tuesday 12 February 2008 Valid to: 08:00 pm Tuesday 12 February 2008'. A red arrow points from this box to the watch area on the map.

In New Zealand, weather radars are located at or near Auckland, New Plymouth, Wellington, Christchurch and Invercargill. By mid 2011, additional weather radars will be installed near Mahia, in Northland, in the Bay of Plenty and on the South Island's West Coast.

MetService provides Severe Thunderstorm Warnings. Because weather radar is required to accurately detect and track thunderstorms, Severe Thunderstorm Warnings are only available within 180km of a weather radar, and are issued once severe thunderstorms have been identified and are valid for a maximum of two hours. As shown in the example below, they are much more specific about the location and timing of expected severe weather. Because tornadoes in New Zealand are too small and too short-lived to be reliably tracked by weather radar, Severe Thunderstorm Warnings do not contain forecast tornado paths.

Severe Thunderstorm warnings are published on MetService's web site (www.metservice.com), available through the broadcast media and by email. The very short lead time for a Severe Thunderstorm Warning means you will have to be prepared to act quickly.

Example: Severe thunderstorm warning

SEVERE THUNDERSTORM WARNING FOR TORNADOES, LARGE HAIL AND HEAVY RAIN

Issued by MetService at 2:11 pm Monday 32nd December 2008
Valid until 3:00 pm today

This warning affects people in:

HOROWHENUA, RANGITIKEI and WANGANUI districts.

At 2:00pm, MetService weather radar detected severe thunderstorms offshore Kapiti. Severe thunderstorms are forecast to move northeast and lie near Levin, Foxton and Sanson at 03:00pm.

Tornadoes, large hailstones and very heavy rainfall are possible with these storms.

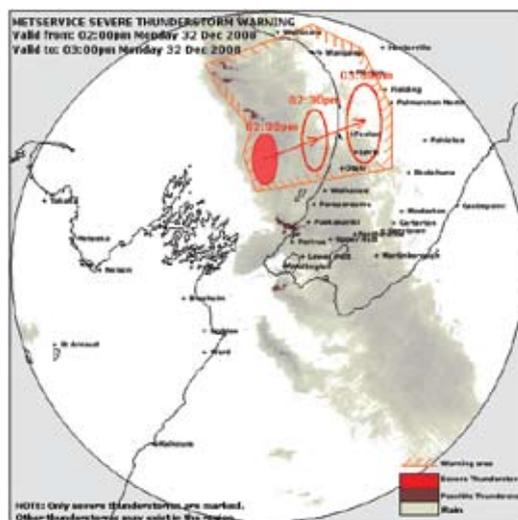
As storms approach people should:

- take shelter
- put vehicles under cover

During and after the storm people should:

- beware of fallen trees and power lines
- avoid creeks and drains as you may be swept away

This Severe Thunderstorm Warning will be updated by 3:00 pm



What are the warning signs of a tornado?

- Hail or heavy rain followed by dead calm or a fast, intense wind shift
- Hailstone size can indicate storm intensity
- Long continuous roar or rumble, much like the sound of an approaching freight train
- At night, small, bright, blue-green to white flashes at ground level near a thunderstorm
- A large, dark, low-lying cloud
- Dark, often greenish sky
- Cloud of debris - an approaching cloud of debris can mark the location of a tornado even if a funnel is not visible.

CORE ACTION MESSAGES

- ▶ Determine your risk.
- ▶ Get your household ready.
- ▶ Make an evacuation plan.
- ▶ Keep an 'in case of tornado' to-do list.

For general readiness, every household should create and practice a Household Emergency Plan and assemble and maintain Emergency Survival Items and a Getaway Kit. In addition, every household should take tornado specific precautions and plan for and practice what to do if a tornado happens.

What can I do before the storm?

Develop an emergency communication plan in your family (for all hazards) in case family members are separated from one another during a tornado, such as during the day when adults are at work and children at school. Have a plan for getting back together.

1. Discuss where and how to shelter in your home.
2. Get familiar with your Household Emergency Plan.
3. Have Emergency Survival Items on hand (**see** Emergency Survival Items and Getaway Kit section).
4. Make list of emergency services telephone numbers (fire, police, council/civil defence emergency management office, ambulance, etc.). Farmers should also include emergency numbers for vets, local livestock transport companies, alternative powers supply equipment, Local Rural Support Trust etc. You may not have time in an emergency to look up critical numbers.
5. Check your household insurance policy for coverage.
6. Know where your utility switches or valves are located and how to turn them off.
7. For people with special needs, write down your specific needs, limitations and medication.
8. Keep insurance policies, important family documents (birth certificates, ownership certificates, passport, etc.), and other valuables in a waterproof container. You may need quick, easy access to these documents.
9. Prepare a list of important medical information, bank account number, etc.
10. Keep trees and shrubbery trimmed. Make trees more wind resistant by removing diseased or damaged limbs, then strategically remove branches so that wind can blow through. Strong winds frequently break weak limbs and hurl them at great speed, causing damage or injury when they hit. Debris collection services may not be operating just before a storm, so it is best to do this well in advance of approaching storms.
11. Remove any debris or loose items in your yard. Branches and firewood may become missiles in strong winds.

12. Consider installing permanent shutters to cover windows. Shutters can be closed quickly and provide the safest protection for windows.
13. Strengthen garage doors. Garage doors are often damaged or destroyed by flying debris, allowing strong winds to enter. As winds apply pressure to the walls, the roof can be lifted off, and the rest of the house can easily follow.
14. Conduct periodic tornado drills, so everyone remembers what to do if a tornado approaches. Practice having everyone in the household go to your designated safe place.
15. Discuss tornadoes with your family. Everyone should know what to do in case all family members are not together. Discussing disaster preparedness ahead of time helps reduce fear and lets everyone know what to do in a tornado situation.

During a tornado or if a tornado is imminent:

16. If you see a funnel nearby, take shelter immediately. If you spot a tornado that is far away, help alert others.
17. In a home, the basement offers the greatest safety. If underground shelter is not available, move to an interior room or hallway without windows, on the lowest floor. This could be a centre hallway, bathroom or closet. Putting as many walls as you can between you and the outside will provide additional protection. Less than two percent of all tornadoes have winds over 330 kilometers per hour and are powerful enough to completely destroy a sturdy building. Make sure there are no windows or glass doors in your safe place and keep this place uncluttered.
18. For added protection, get under something sturdy such as a heavy table or workbench. If possible cover your body with a blanket, mattress or sleeping bag, and protect your head even with your hands.
19. Stay away from windows and exterior doors.
20. Evacuate any rooms that are on the top floor.
21. Long-span buildings, such as auditoriums, gymnasiums or shopping malls can be especially dangerous because the roof structure is solely supported by the outside walls. Roof collapse in such buildings is likely. If you are in such a building, stay away from windows and get to the lowest level, the basement if possible.
22. If there is no time to get to a lower level, try to get under a door frame or get up against something that will support or deflect falling debris.
23. Do not use lifts during or after tornadoes.

If outdoors:

24. If caught outside, avoid areas with many trees.
25. Lie down flat in a nearby gully, ditch or low spot on the ground. Tornadoes cause a lot of debris to be blown at very high speeds. Dangerous flying debris can be blown under overpasses and bridges, and the structures themselves could be destroyed. You will be safer lying flat in a low-lying area where the wind and debris will blow over you. Tornadoes come from severe thunderstorms, which can produce a lot of rain. If you see quickly rising water

or floodwater coming toward you, move to another spot.

26. Protect your head with an object or with your arms

If in a car:

27. Get out of your car.
28. Do not try to outrun a tornado in your car; instead, leave it immediately and do not get under your vehicle.

After a tornado:

29. Check for injuries. Give first aid and get help for injured or trapped persons. Taking care of yourself first will allow you to help others safely until emergency responders arrive.
30. Help people who require special assistance—infants, elderly people, those without transportation, families who may need additional help in an emergency situation, people with disabilities, and the people who care for them.
31. Turn on the radio or television or call your local emergency services to get the latest emergency information.
32. Wear sturdy shoes or boots, long sleeves, and gloves when handling or walking on or near debris.
33. Be aware of hazards from exposed nails and broken glass.
34. Use the telephone only for emergency calls.
35. Do not touch downed power lines or objects in contact with downed power lines.
36. Report broken utility lines to the appropriate authorities. Reporting potential hazards will get the utilities turned off as quickly as possible, preventing further damage and injury.
37. Look for fire hazards and inspect utilities in a damaged house
38. Be careful when entering any structure that has been damaged.
39. Check for gas leaks - if you smell gas or hear a blowing or hissing noise, open a window and quickly leave the building. Turn off the gas at the outside main valve if you can and call the gas company from a neighbor's home. If you turn off the gas for any reason, it must be turned back on by a professional.
40. Look for electrical system damage - if you see sparks or broken or frayed wires, or if you smell hot insulation, turn off the electricity at the main fuse box or circuit breaker. If you have to step in water to get to the fuse box or circuit breaker, call an electrician for advice.
41. If farming, check that livestock are secure and not injured. Their behaviour may be unpredictable so take care when approaching.

Insurance

Ring your insurer as soon as possible. In almost all cases the insurance company will send an insurance assessor to look at your property. They will confirm what repairs and replacements are needed and are covered by your policy.

Ask the insurance company:

42. How long it will be before the insurance assessor visits.
43. If you are to clean your property or if they will get a company to do it for you.
44. Always make your own record of your damaged property using photographs or video.
45. List the damage to your property and belongings.
46. Ask your insurance company or landlord if they will provide you with temporary accommodation. This could be a nearby motel, bed and breakfast, a static caravan or a rented house.

Things to help with your insurance claim:

47. Confirm the insurance company will pay for any service or equipment you need.
48. Make a note of all telephone calls. Record the date, name and what was agreed.
49. Keep copies of all letters, emails and faxes you send and receive.
50. Keep receipts.
51. Don't throw anything away until told (except ruined food).
52. Depending on your policy, the insurance company may only offer to clean and repair something, not replace it.
53. If you rent your property, contact your landlord and your contents insurance company as soon as possible.
54. If you do not have insurance, your local council should be able to provide information on hardship grants or charities that may be able to help you.

Tornadoes general information

Media and community education ideas

55. Publish a special section in your local newspaper with emergency information about tornadoes. Included contact information for local emergency services and the nearest hospitals.
56. Conduct a series on how to protect yourself during a tornado in case you are at home, in a car, at the office, or outside.
57. Teach children about hazards in your area

Fiction and fact

Fiction: Areas near rivers, lakes and mountains are safe from tornadoes.

Facts: Tornadoes can occur wherever thunderstorms occur.

Fiction: The low pressure associated with a tornado causes buildings to “explode” as the tornado passes overhead.

Facts: When openings (windows, doors) are damaged, wind can enter the building and amplify forces on the ceiling and roof and combine with outward acting pressure. It’s like a house blowing up like a balloon and could result in what people often describe as an explosion, but in reality it’s the result of the dynamic pressure not the pressure deficit.

Fiction: Windows should be opened before a tornado approaches to equalise pressure and minimise damage.

Facts: Opening windows will allow damaging winds to enter the structure and enhance the outward pressure. Leave the windows CLOSED and stay away from doors and windows.

Fiction: If you are driving and a tornado is sighted, you should turn and drive at right angles to the tornado.

Facts: Many people are injured or killed when they remain in their vehicles during a tornado. If you are in a vehicle during a tornado, the safest thing to do is go to a nearby sturdy building and go inside to an area on the lowest level without windows. If a sturdy building is not available, then get out of and move away from the vehicle, lie down in a low spot on the ground not subject to flooding, and protect your head and neck. Driving at right angles to a tornado will not protect you for many reasons, including the fact that tornadoes do not necessarily travel in straight lines; you cannot always tell where a tornado is coming from; the road may not be straight; and there may be more than one tornado.

Fiction: People caught in the open should take shelter under overpasses or bridges.

Facts: Do not take shelter under overpasses or bridges. If at all possible, take shelter in a sturdy, reinforced building. Dangerous flying debris can be blown under overpasses and bridges, and the structures themselves could be destroyed. If a building is not available, you will be safer lying flat in a low-lying area where the wind and debris will blow over you. Use your arms and hands to cover your head and neck.

Useful links

Facts about tornadoes

- www.teara.govt.nz/EarthSeaAndSky/ClimateAndAtmosphere/Weather/6/en
- www.nssl.noaa.gov/edu/safety/tornadoguide.html
- en.wikipedia.org/wiki/Tornado
- www.noaawatch.gov/themes/severe.php
- www.fema.gov/hazard/tornado/index.shtm
- www.weatherwizkids.com/tornado.htm
- www.niwa.co.nz/our-science/natural-hazards

Insurance companies

- www.ami.co.nz/products/contents/
- www.state.co.nz/
- www.tower.co.nz/Web_Home.asp
- www.vero.co.nz/
- www.icnz.org.nz/

Weather warnings

www.metservice.co.nz/public/weatherWarnings/warningMap.html

Preparedness:

- www.getthru.govt.nz
- www.nssl.noaa.gov/edu/safety/tornadoguide.html
- www.fema.gov/hazard/tornado/index.shtm
- www.redcross.org/services/disaster/0,1082,0_591_,00.html
- www.rural-support.org.nz/
- www.maf.govt.nz/mafnet/rural-nz/adverse-events/

Tornadoes general information

Useful numbers

Contact	Details
Local authority emergency helpline	
Insurance company 24-hour	
Insurance number and policy number	
Local radio station (Frequency)	
School	
Family and neighbours	
Bank phone number and details	
Work phone numbers	
Medical Center/GP	
Local police station	
Vet/kennel/cattery	
Local hotel or B&B	
Gas supplier and meter number	
Electricity supplier and meter number	
Water supplier and meter number	
Electrician	
Plumber	
Builder	