



Issued May 2025 Transport hazard summary series

Cold weather hazards



Cold weather hazards, such as ice, frost, and snow can create treacherous conditions on roads, railways and for pedestrians. They can disrupt transport operations in various ways, from network closures to damaged vehicles and equipment. When these cold weather hazards occur, they pose significant challenges to the reliability and safety of transport in the UK. While cold weather events are predicted to decrease in frequency due to climate change, rare extremes will still occur, requiring ongoing preparedness to maintain safety and resilience.

The Department for Transport, Met Office and partners have created a series of transport hazard summaries to explain natural hazards and other hazards that are not the result of malicious acts, their impacts and how they may change in future. This summary will introduce what is meant by cold weather hazards and how they can impact transport, providing pointers to further information which can help decision makers manage and adapt to the risks posed to transport.

Over the past decade, the UK's average annual lowest temperature was -14.6°C. This is 4.4°C higher than the average from 1961 to 1990*

^{*} Kendon, M., Doherty, A., Hollis, D. and others, International Journal of Climatology 44, 'State of the UK Climate 2023', 2024, available at: https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.8553

Cold weather hazards

Cold weather hazards that impact transport generally occur between late autumn and early spring when the temperature of the air, ground or other surfaces falls below 0°C. These hazards include snow, ice, and frost, along with some less common occurrences such as:

Freezing rain

A rare type of liquid precipitation that strikes a cold surface and freezes almost instantly. It occurs during winter when rain falls into air that is below 0°C.*

Snow and ice accretion

The build-up of snow and ice on surfaces due to freezing precipitation or snow driven by the wind. Ice can also build up on surfaces when fog occurs in freezing temperatures.

Hail

Pieces of ice that develop in powerful storm clouds. Hail can occur in both winter and summer, causing direct damage as it falls or accumulating to create slippery, icy surfaces.[†]

Figure 1: The change in temperature through 24 hours showing the difference between a normal day, where air temperatures remain above 0°C, a frost day and an icing day



In climate terminology, a **frost day** is a day where the minimum temperature is below 0°C. The more severe **icing days** are where temperatures remain below 0°C all day. If combined with snow and ice, a series of icing days can lead to prolonged challenges for transport.

^{*} Met Office, 'Freezing rain', available at: https://weather.metoffice.gov.uk/learn-about/weather/types-ofweather/rain/freezing-rain

[†] Met Office, 'Hail', available at: https://weather.metoffice.gov.uk/learn-about/weather/types-of-weather/hail

How might cold weather events change with climate change?

As global temperatures rise, both frost days and icing days are expected to decrease in frequency across the UK.⁺ However, it is important to note that the risk of cold extremes will not disappear completely, and the effects will vary geographically across the UK. For more information on climate projections, global warming levels and emissions scenarios, see 'The changing climate' transport hazard summary.

Figure 2 shows the projected decrease in frost days for different global warming levels. On average, the number of frost days per year is predicted to decrease by up to 75% by 2100 under a high emissions scenario.^{*}

Figure 2: The projected average occurrence of frost days for different global warming levels (Met Office UKCP18) with the potential range in brackets



- Between now and the middle of the century, continued climate change is largely inevitable.
- Global warming of 2°C is reached by most emissions scenarios by the middle of the century.
- In the second half of the century, a wide range of global warming levels remain possible.
- 4°C of global warming is reached only by the higher emissions scenarios, and not until later in the century.[†]

Even as cold weather events become less frequent, extreme cold can still occur. Those travelling and people working in transport might not be as prepared to handle cold weather hazards in future. This means that thorough cold weather planning will continue to be essential for maintaining transport resilience, regardless of the level of climate change.

^{*} Met Office, 'UK and Global extreme events – Cold', available at: www.metoffice.gov.uk/research/climate/ understanding-climate/uk-and-global-extreme-events-cold

[†] Climate Change Committee, 'Proposed methodology for the Fourth Climate Change Risk Assessment – Independent Assessment', 2024, available at: www.theccc.org.uk/publication/proposed-methodology-forthe-ccra4-advice/?chapter=3-proposed-methodological-approach-for-ccra4-ia



The number of icing days is projected to decrease from a long-term average of 5 days per year, to less than 1 day per year across most parts of the UK by the middle of the century under a high emissions scenario.*



Snowfall across the UK is also projected to continue to decrease as the climate becomes warmer. This will be most noticeable in low-lying areas like southern England.[†]



There is a high-impact, low-likelihood scenario where disruption to global ocean currents could bring significantly colder temperatures year-round across the UK after 2100.

2009 to 2010 case study

The winter of 2009 to 2010 was the coldest in the UK for 30 years, with exceptionally low temperatures and widespread snow and ice coverage. During December and January, night time temperatures regularly fell well below freezing, occasionally dropping below -10°C, with daytime temperatures often remaining below freezing. The Federation of Small Businesses estimated that one in seven staff in small firms could not travel to work due to heavy snowfalls, and business closures cost around £600 million to the economy.[‡]



Several airports, including London Heathrow and Manchester Airport, experienced temporary closures due to snow accumulation on runways.[§]



All Eurostar services were cancelled from the 19th to the 21st of December, with trains stranded inside the Channel Tunnel due to electrical failures caused by the cold weather.



To preserve dwindling road salt supplies, usage was reduced by 25-50%, limiting the areas of the network that could be treated.

^{*} Met Office, 'UK and Global extreme events – Cold', available at: www.metoffice.gov.uk/research/climate/ understanding-climate/uk-and-global-extreme-events-cold

[†] Met Office, 'UKCP Snow factsheet', available at: www.metoffice.gov.uk/binaries/content/assets/ metofficegovuk/pdf/research/ukcp/ukcp18-factsheet-snow.pdf

[‡] Department for Transport, 'Transport Resilience Review: A review of the resilience of the transport network to extreme weather events', 2014, available at: https://assets.publishing.service.gov.uk/ media/5a7e42f840f0b62305b81d99/transport-resilience-review-web.pdf

[§] Met Office, 'Snow and low temperatures, December 2010', available at: www.metoffice.gov.uk/binaries/ content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2010/snow-andlow-temperatures-december-2010---met-office.pdf

Direct transport impacts due to cold weather



Human health

- Prolonged exposure to low temperatures can lead to health issues for transport workers, such as maintenance crews and those working outdoors.
- Travellers experiencing disruption may be stranded outdoors or in cold vehicles, which could lead to medical emergencies, particularly for vulnerable people.
- Slippery surfaces, including railway station platforms and paving at ports and airports, increase the risk of slips and falls for transport workers and the public.
- Snow and ice can impede emergency services, delaying responses to critical incidents.

Vehicle performance and operations

- Ice and snow reduce tyre grip on roads, increasing braking distances and the likelihood of vehicles becoming stranded or involved in accidents.
- Frost and ice build up on aircraft, trains, ship decks and equipment, and road vehicles can severely impede visibility, performance and safety, potentially making them inoperable unless treated.
- De-icing of aircraft to prevent ice build-up can cause operational delays.
- Cold weather can slightly reduce electric vehicle battery performance. Low temperatures also impair the functionality of battery-powered equipment used in transport operations.





Infrastructure

- A Heavy snow or ice can make roads and railways impassable, leading to closures and traffic disruptions.
- Grit and de-icing treatments on roads and vehicles can wash off in rain making ice difficult to prevent if temperatures drop quickly after rain.
- Repeated freeze-thaw cycles can worsen pothole formation on road surfaces, posing a danger to vehicles and cyclists.
- Build up (accretion) of ice and snow on railway overhead power cables and the electrified third rail can prevent trains from drawing power. It can add sufficient weight causing power lines to sag and tree branches to break, blocking railway lines and roads.

Interdependencies: Cold weather can disrupt heating systems by freezing water pipes, increasing energy demand and straining power networks which may already be affected by lower renewable energy output. Snow and ice can also close transport routes, delaying repairs and preventing staff and customers from reaching their destinations, which further compounds these disruptions.

Hazards associated with cold weather



Fog

Cold air near the ground can cool moist air to its dew point, causing water vapour to condense into fog, reducing visibility.



Landslides and earthwork failures

The freeze-thaw process can also cause a break down of rock or soils in slopes and earthworks leading to a risk of landslides impacting transport.



Storms

Where storms and cold conditions combine, this can lead to large snowfall accumulations or freezing rain. Strong winds can lead to blizzard conditions and ice and snow accretion.



Subsidence and soil degradation

The freeze-thaw process can cause expansion and contractions of the soil underpinning railways, roads, runways and other paved areas, weakening the soil structure and potentially leading to subsidence.



Surface water flooding

The rapid melting of snow following cold weather events can overwhelm drainage systems leading to flooding, especially when combined with rainfall.

Further information on these hazards can be found in our series of Transport hazard summaries: www.gov.uk/government/collections/transport-hazard-summaries



Risk mitigation and adaptation

Many risk mitigations for cold weather hazards are already in place in the UK. However, as cold weather events become less frequent, maintaining risk mitigation and adaptation strategies remains essential. Examples include:

- maintaining and updating winter preparedness/service plans and exercising maintenance practices to prevent loss of skills, or knowledge as cold weather hazards become less common
- running public awareness campaigns to advise travellers on safe cold weather practices
- stockpiling salt and de-icing agents in strategic locations
- scheduling preventative maintenance for vehicles and infrastructure that are vulnerable to cold weather hazards
- ensuring that ad hoc access to equipment is possible where it is not owned, such as snow ploughs or snow blowers



Questions for decision makers

- How can you stay prepared for cold weather hazards if there is a decrease in frequency of major cold weather events?
- What transport assets and infrastructure are most vulnerable to extreme cold and how can they be made more resilient?
- How can essential transport routes and systems be made more resilient and recover effectively?
- What are the public health risks, and how can comfortable conditions be maintained for staff and passengers?

Further reading

The impact on transport of the winter weather in December 2010 – House of Commons Transport Committee

UK and Global extreme events - Cold - Met Office

UKCP18 Factsheet: Temperature – Met Office

UKCP Snow factsheet – Met Office

What is the Atlantic Meridional Overturning Circulation? - Met Office

Winter weather - snow and ice - Network Rail

Your winter weather questions answered (roads and pavements) – Local Government Association

Many transport organisations have winter weather and de-icing plans which are publicly available on the internet.



Climate information and risk assessment

See 'The changing climate' and 'Transport hazards, risks and resilience' transport hazard summaries for more information on identifying and planning for risks to transport and where to find climate data, including more detail on projected changes on a regional level.



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