



Department
for Transport

A photograph showing a road that has been severely damaged by a landslide. A large section of the road has collapsed into a river, leaving a deep, jagged gap. The river is turbulent and carries a lot of sediment and rocks. The surrounding landscape is hilly and appears to be in a rural or mountainous area.

Fit for a changing climate?

Adapting the UK's
transport system

Cover image: A591, Lake District,
damaged during flooding caused
by Storm Desmond, 2015

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Contents

Ministerial foreword	4
1 Executive summary	6
2 Context	11
2.1 Why does climate change matter to transport?.....	14
2.2 Why do we need to adapt now?.....	15
2.3 Benefits of climate adaptation	18
3 Vision, objectives & scope	22
4 Culture: Embedding climate risk	26
4.1 Assessing risk	28
4.2 Strategic approach to risk.....	32
5 Economics: Making the case for adaptation	35
5.1 Providing the tools required	37
5.2 Building the evidence base	40
5.3 Incentivising action	42
5.4 Measuring progress.....	45
6 Regulatory: Setting the long-term direction	47
6.1 Standardising the approach	49
6.2 Reviewing the role of regulators.....	52
7 Collaboration: Sharing knowledge	54
7.1 Working in partnership.....	56
8 Timeline of adaptation action for transport	61
9 Consultation approach	62
Annex 1 – State of the sector	65
The legislative framework	66
How is the transport sector already responding to climate change?	70
Annex 2 – Consultation questions	75
References	78

Ministerial foreword



Anthony Browne MP
Parliamentary Under
Secretary of State,
Department for Transport

We are committed to reducing emissions and limiting global warming to 1.5°C above pre-industrial levels, in line with the Paris Agreement.ⁱ To this end, in June 2019, we became the first major global economy to legislate for a net zero emissions target by 2050.

The UK is making good progress in achieving against these targets, halving greenhouse gas emissions whilst growing our economy by nearly 80% between 1990 and 2022.ⁱⁱ This trajectory means that we are decarbonising faster than any other G7 country, and delivering ambitious plans to decarbonise the transport sector.

However, despite this progress, in recent years we have witnessed an increase in frequency and intensity of extreme weather events due to climate change.ⁱⁱⁱ

In England, temperatures exceeded 40°C for the first time in July 2022. According to Met Office data, climate change is increasing the chance of this type of event occurring in the UK.^{iv} There is also a similar trend in relation to rainfall; in the last 20 years, the UK experienced five of the 10 wettest years in a series from 1836.^v In the future, UK winters are projected to be wetter, and summers drier – with rainfall intensity projected to increase.^{vi}

The impact of these events is evident on transport, both in the UK and globally. Extreme weather events have already damaged transport infrastructure,^{vii} caused the closure of rail lines^{viii} and led to red weather warnings advising against travel.^{ix}

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- i United Nations (2015). 'Paris Agreement to the United Nations Framework Convention on Climate Change'. Available at: https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf
- ii Office for National Statistics (2023). 'Gross Domestic Product'. Available at: <https://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/abmi/ukea>
- iii Met Office (2022). 'Effects of Climate Change'. Available at: <https://www.metoffice.gov.uk/weather/climate-change/effects-of-climate-change>
- iv Met Office (2021). 'UK and Global Extreme Events'. Available at: <https://www.metoffice.gov.uk/research/climate/understanding-climate/uk-and-global-extreme-events-heatwaves>
- v Kendon, M., McCarthy, M., Jevrejeva, S., Matthews, A., Williams, J., Sparks, T., West, F. (2023). 'State of the UK Climate 2022'. Available at: <https://rmets.onlinelibrary.wiley.com/doi/10.1002/joc.8167>
- vi Met Office (2020). 'Climate Change in the UK'. Available at: <https://www.metoffice.gov.uk/weather/climate-change/climate-change-in-the-uk>
- vii National Highways (2023). 'National Highways set to Reopen A40 in Gloucestershire as Landslide Repairs Near Completion'. Available at: <https://nationalhighways.co.uk/article/national-highways-set-to-reopen-a40-in-gloucestershire-as-landslide-repairs-near-completion/>
- viii Network Rail (2021). 'We Prepare for the Weather's Impact on our Network by Forecasting it Daily and Understanding the Projected Effects of Climate Change'. Available at: <https://www.networkrail.co.uk/sustainability/climate-change/>
- ix Independent (2023). 'Red Weather Warnings in the UK: Recent examples'. Available at: <https://www.independent.co.uk/news/uk/met-office-south-wales-red-network-rail-london-b2431762.html>

As the climate changes, travel disruption from extreme weather could have an increasing impact on our day-to-day lives if we do not take action to manage the risk.^x The Government's 2023 National Risk Register identified risks such as extreme heat, storms and flooding had become more likely due to climate change, with the trend expected to continue over the coming decades.^{xi}

In response to climate change, we are changing what 'business as usual' means for the transport sector. Alongside safety, reliability, and low carbon travel, passengers can expect a well-adapted transport network. A strong, resilient system – including UK government, devolved administrations, local authorities, emergency services and the private, voluntary and community sectors – is more important than ever.

Forward-looking, flexible, and proactive adaptation has clear benefits – economic, social and safety. This strategy will support transport infrastructure operators in recognising the opportunities, including cost savings, that come with adaptation.

There is not a one-size-fits-all approach on how to adapt and it is a challenge which is being grappled with all over the world. A transport network that is fit for our changing climate will only be possible if the transport sector changes its perspective on climate risks.

These events are no longer a problem for the distant future, but our reality now. The sooner we tackle this, the sooner we can work together to ensure we have a transport system that is resilient and will serve generations for many years to come.

x Cabinet Office (2023). 'National Risk Register 2023'. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1175834/2023_NATIONAL_RISK_REGISTER_NRR.pdf

xi Cabinet Office (2023). 'National Risk Register 2023'. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1175834/2023_NATIONAL_RISK_REGISTER_NRR.pdf

1

Executive summary

The government has a vision for a well-adapted transport network that is flexible, reliable, operates safely and is responsive to a changing climate. This strategy will put the transport sector on a pathway to realising this vision.

Accessible, safe, and reliable transport infrastructure is fundamental to day-to-day life. Climate change has the potential to disrupt operations and damage the transport network, through hazards such as flooding, subsidence, high and low temperatures, and other extreme weather events.¹

Adapting transport to projected climate change and its effects will ensure this infrastructure remains resilient and will support our needs in future decades. In doing so, we can limit the future cost of disruption, and infrastructure damage and ensure climate impacts are embedded in transport infrastructure investment in a proportionate, economically efficient manner.

This strategy will enhance adaptation planning across the sector, ensure these plans are delivered and lead to improved climate resilience

in the transport system. It focuses on adapting transport infrastructure to the changing climate and looks to address the risks identified in the latest Climate Change Risk Assessment (CCRA3). Whilst there are plans to adapt transport infrastructure in some parts of the transport system, this is not consistent across the sector and is not being translated into action at sufficient pace.

Adaptation is an iterative process, not a single action – and it will never be complete. This requires understanding the climate-related risks and vulnerabilities of the whole system, including interdependencies and impacts of cascading failures. It requires concerted, long-term planning and action by transport infrastructure operators and the wider transport sector to address climate risks.

The overarching objectives of the strategy

The transport sector will understand the need to adapt their business and operations to the changing climate, building their response into 'business as usual'.

The transport sector will utilise available guidance and tools to support them in prioritising investments on adaptation and sharing information to galvanise adaptation action.

The Department for Transport (DfT) will set the strategic direction for the transport sector, enhancing adaptation action and fostering cross-sector collaboration.

Headline policies for adaptation

The policies and actions within this strategy will encourage adaptation action across the transport sector. These actions have been grouped into three themes, which overlap and support each other, with collaboration underpinning everything. Some policies are relevant to all transport modes, whilst others target mode-specific challenges.

These policies will be developed over the next five years to enable progress ahead of the fourth National Adaptation Programme in 2028. Given this urgency, most policies have a target date in the next two years; where commitments have a longer lead time, this is to allow for actions, such as data gathering and research, so we can provide informed and evidenced policies.

Culture Embedding climate risk

Build on positive progress and identify further actions to embed climate risk in planning and operations, encouraging culture change across the sector. Key policies include:

- By 2024, transport infrastructure operators identify senior ownership of climate risks and, by 2026, include adaptation in their organisational objectives.
- Between 2024 and 2026, improve risk assessment across the transport sector through the Defra-led adaptation reporting process and inviting voluntary risk assessments.
- Regularly reviewing and assessing climate risks to the transport sector as part of DfT's role in preparing for and responding to significant and complex emergencies.

Economics

Making the case for adaptation

These actions will equip the transport sector with the tools, guidance and evidence to make informed decisions, take account of climate risks in investment decisions and monitor progress. Key policies include:

- Research and development (R&D) programme including £10 million research hub launched in September 2023 in partnership with UK Research and Innovation (UKRI).
- By 2024, consider adaptation actions in necessary relevant planning policy documents.
- By 2025, enhance climate risk assessment guidance, in line with HMT's Green Book, and develop tools to identify best-practice adaptation measures.
- By 2025, review approaches to valuing the costs of climate risks to transport systems and assets.
- By 2025, explore how and where funding for R&D, trials and adaptation measures could be effective.
- By 2025, embed consideration of climate risks in DfT business case process and decision-making, supported by associated guidance, including Transport Analysis Guidance.
- By 2025, incentivise adaptation measures through funding agreements, such as the Road Investment Strategy and Network Rail Control Periods.
- By 2027, collate the data that transport stakeholders capture on weather and climate related disruption and costs.
- By 2028, progress the development of indicators to measure adaptation outcomes.

Regulatory

Setting the long-term direction

Use DfT's unique position in the transport sector to explore untapped or under-utilised policy levers to identify new opportunities and reduce uncertainty by setting a clear direction for adaptation ambition. Key policies include:

- By 2025, support the sector to take a consistent approach when using climate scenarios and climate risk assessments.
- By 2027, explore the role of adaptation standards for the transport sector and determine what information is required to inform these.
- By 2027, consider the need for climate resilience remits for regulators, working with the Office of Rail and Road, the Civil Aviation Authority and relevant stakeholders.
- Implement commitments in the Resilience Framework, aligning with regulatory cycles to maximise the window of opportunity for investment, where possible.

Collaboration

Sharing knowledge

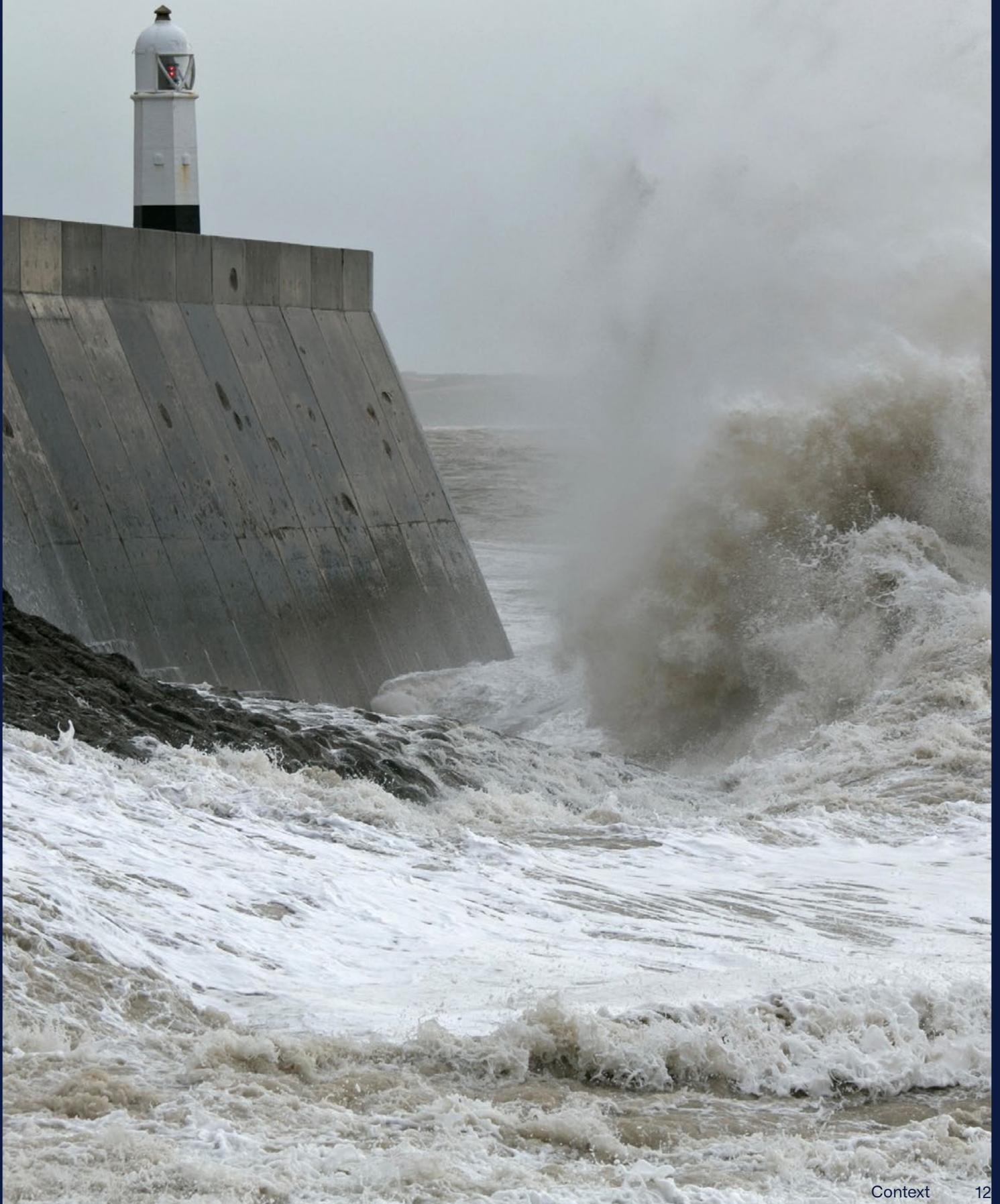
DfT will continue to bring together transport operators to collaborate, share best practice, expand their knowledge and address their interdependencies within transport and wider infrastructure. Key policies include:

- Utilise forums to drive industry collaboration, including Infrastructure Operators' Adaptation Forum (IOAF), Transport Research Innovation Board and the UK Roads Leadership Group.
- Transport infrastructure operators to identify and map their interdependencies across all sectors.
- Transport infrastructure operators to enhance their adaptive capacity by providing training to relevant staff.

2

Context

Porthcawl, Wales, 2014



We know how important it is to reduce emissions as part of global efforts to tackle climate change, and the UK is committed to playing its part. We were the first major economy to set a target of net zero emissions into law, have one of the most ambitious decarbonisation targets in the world and have had the fastest reduction in greenhouse gas emissions among major economies since 1990.²

Transport is the UK's largest emitting sector,³ and its accelerated decarbonisation is central to delivering net zero. The UK government has set out a holistic, cross-modal approach to reducing transport emissions in successive publications – including our 2021 Transport Decarbonisation Plan, our 2021 economy-wide Net Zero Strategy, and our 2023 Net Zero Growth Plan – all detailing the actions needed to decarbonise transport.

The impacts of climate change are being experienced across the globe, with observed increases in the frequency and intensity of heatwaves, flooding, drought, and wildfires.⁴ The annual average temperature in the UK in 2022 was the highest since records began in 1884.⁵

The July 2022 heatwave saw 40°C temperatures recorded in seven locations in England. This record warm year was made more likely because of human-induced climate change.⁶ This trend is set to continue. The Met Office global temperature forecasts confirmed 2023 was the hottest year on record.⁷

Climate projections suggest the UK could experience warmer, wetter winters; hotter, drier summers; and more frequent and severe weather events. By 2070, winters could be up to 30% wetter and summers could be up to 60% drier compared to 2020.⁸



Flooding in Braunton, December 2012

2.1 Why does climate change matter to transport?

Accessible, safe and reliable transport infrastructure is fundamental to day-to-day life. It helps us get to school and work, visit loved ones, travel to appointments and supports the vital movement of goods that we need. Extreme weather events can disrupt operations and damage the transport network, due to direct impacts, such as high temperatures or strong winds, or can lead to other hazards, such as flooding or subsidence.⁹ As the climate continues to change, the severity of these risks is projected to increase, putting additional stresses on transport infrastructure and its ability to support the economy.

Extreme weather generates additional and sometimes substantial costs for operators. Without effective adaptation measures, the financial implications of climate impacts may be significant. This may be due to damaged infrastructure, the disruption of economic activity and trade, resource shortages, and the diversion of capital from more productive uses.^{10, 11}

Economic cost of extreme weather for transport operators



£180m

estimated damage to motorways in 2013–14 winter floods

14% of

£1.3bn

total damage¹²

£80m

invested in 2023 for 8m high sea wall at Dawlish, after 80m of railway track washed away in 2014, cutting off key railway link to Devon and Cornwall for two months¹³

5m

fewer journeys and

£8m

lost ticket sales for Transport for London during July 2022 heatwave¹⁴

£120m

to repair damage to 350km of roads & 720 bridges

from 2015 Storm Desmond across Cumbria and Lancashire¹⁵

£3bn+

weather costs for Network Rail over last 15 years¹⁶



2.2 Why do we need to adapt now?

Even if the global temperature increase can be limited to 1.5°C, in line with the goals of the Paris Agreement, a level of warming is locked in and is changing the UK's climate.¹⁷

Transport infrastructure has a long lifespan. New transport schemes, such as HS2, are being designed for a 120-year lifespan. The roads and railways we rely on today were planned and built for different weather conditions than we experience today and will experience in the future. Based on current rates of replacement, 85% of rail infrastructure assets in use today could still be in place by 2055.¹⁸

Adapting transport infrastructure now could reduce future costs from climate change, with investments in adaptation capable of delivering strong value for money in the order of £2 to £10 of benefits per pound of investment.¹⁹



Landslide on the A951, Lake District, Storm Desmond, 2015

Adaptation and Resilience

Climate adaptation

The process of adjustment to actual or expected climate change and its effects. Adaptation seeks to reduce risks, moderate harm, and take advantage of beneficial opportunities from today's changed climate conditions, and to prepare for impacts from future changes.

Climate resilience

The ability of a system and its parts to anticipate, absorb, accommodate and rapidly recover from the impacts of adverse and extreme weather conditions and gradual or erratic changes in weather patterns due to climate change.

The ability of the transport system to be resilient to extreme weather events caused by climate change is a key component of a well-adapted transport system.

Without adaptation, climate change presents an increased risk to the safety of people using and working on the transport system, as hazards such as flooding and landslides become more likely. Hazards can lead to tragic impacts, for example the 2020 train derailment near Stonehaven where three people lost their lives when a train struck a landslide after heavy rain.

The National Infrastructure Commission's Second National Infrastructure Assessment

The National Infrastructure Commission (NIC) carries out an assessment every 5 years on the UK's infrastructure requirements. The second National Infrastructure Assessment²⁰ was published in October 2023 and takes a 30-year view of the infrastructure needs in the UK, including for transport. One of the objectives of the assessment is to support climate resilience. Recommendations include:

- By 2025:
 - Following advice from regulators, publish a full set of outcome-based resilience standards for energy, water, digital, and transport services, committing to future reviews every five years.
 - Require regulators to ensure their determinations in future regulatory settlements are consistent with operators meeting these resilience standards in the short and longer term.

- Require regulators to put in place a system for cross sector stress testing which addresses interdependencies and the risk of cascade failures.
- In time to inform the next round of spending reviews (for road and rail networks), government should ask infrastructure operators to estimate the costs of maintaining government resilience standards in the face of projected climate change to 2050. For sectors without formal spending settlements, such as ports, these should be reported by 2029. All sectors should publicly report adaptation costs in a compulsory fifth round of Adaptation Reporting Power reports in 2029.

The Department will consider these recommendations and contribute to the government response in due course.

Benefits of climate adaptation

Avoided direct costs



Lower maintenance & repair costs



Fewer compensation claims & less revenue lost



Improve safety & reduce risk to passengers & staff

Economic & social benefits



Reduce disruption

Maintain productivity by enabling:



People to access workplaces, schools and hospitals



Reliable movement of goods across the UK



International trade



Allow people to travel freely, safely & reliably

Environmental co-benefits



Promote environmental action through nature-based adaptation solutions that can:



Enhance biodiversity



Improve air quality



Help us to achieve our net zero goal

2.3 Benefits of climate adaptation

There is a wide range of benefits in proactively adapting to climate change, beyond avoided direct costs.

Economic & social benefits

While the impacts of climate change on long-term economic growth are uncertain, analysis by the Office for Budget Responsibility suggests these costs could be substantial for the UK economy.²¹ This underlines the need for proactive climate mitigation and adaptation measures.

Transport infrastructure is an important factor of economic growth, enabling goods to be transported across the UK as well as imported and exported. Transport also increases connectivity and is essential to the movement of people.

Climate change has the potential to dampen economic growth by causing damage and disruption to the transport network. For example, it may reduce productivity by disrupting the movement of goods, preventing staff travelling to work and increasing costs to businesses. It may also contribute to regional inequalities, with areas most at risk from extreme weather experiencing higher insurance premiums and lower investment.

While the magnitude of these wider economic costs is highly uncertain, studies suggest they may be between one to two times greater than direct damage costs to transport infrastructure.²² Investment in adaptation supports economic growth by helping to mitigate these wider economic costs.

Network Rail. Freight train derailment due to buckled track, Langworth, 2015



Environmental co-benefits

Adaptation can also provide substantial co-benefits to the environment. These co-benefits may be sufficient to justify investment even in the absence of climate-related damage and disruption. For example, nature-based adaptation measures may have added benefits from enhancing biodiversity, improving air quality and support in reaching Net Zero.



Nature-based solutions for adaptation measures

The area of Kirkstall Bridge in Leeds experiences regular flooding from the River Aire. In any given year there is a 35% chance of disruptive flooding affecting safe and efficient operation of the railway. Flooding severs the network serving West and North Yorkshire to the west of Leeds, causing significant transport challenges for the Leeds area.

Network Rail formed a partnership with the Environment Agency and Leeds City Council and contributed £1.5 million to the second phase of the Leeds Flood Alleviation Scheme to mitigate the problem.

The project has a strong focus on using Natural Flood Management (NFM) and to date over 450,000 trees have been planted and over 500 hectares of soil and land management (including soil aeration, hedgerows and buffer strips) has been delivered in the River Aire's catchment. By the end of 2025 the NFM element of the scheme is projected to deliver an estimated peak river flow reduction of 5.6% in Leeds and the wider scheme is on course to give a 1 in 200-year (+40% climate change uplift) level of flood protection to the city, including the railway, by March 2024.



£1.5m

contributed by Network Rail to second phase of Leeds Flood Alleviation Scheme, in partnership with the Environment Agency and Leeds City Council



450,000+

trees have been planted and

500+

hectares of soil and land management

has been delivered in the River Aire's catchment

Our transport system is the backbone of our economy & lives

Roads



187,154

miles total road length in England²³



210bn

vehicle miles on local roads (2019)²⁴



1.4bn

tonnes of commodities carried by road,²⁵ including 98% of food & agricultural products in Great Britain (2019)²⁶

Supports sectors employing

7.4m

people

£314m

Gross Value Added (GVA) to the economy

4,500

miles of motorways & major A roads in England²⁷ known as the **Strategic Road Network (SRN)**

SRN carries:

1/3 of all traffic

2/3 of all freight²⁸

Aviation



2m+

flights in 2019



370+

destinations



100+

countries²⁹



80%+

of UK air freight is handled by three airports



Heathrow:

63%

of all UK air freight (by tonnage)³⁰

East Midlands International & Stansted:

~20%

of the UK's air freight³¹

Freight



136,000

enterprises in Transportation & Storage Sector (2021)³²



£83.5bn

GVA contributed to UK economy (2021)³³



1.6m

people employed in Transportation & Storage sector (up to June 2023)³⁴



Our transport system is the backbone of our economy & lives

Rail



Network Rail owns, operates, and develops Britain's railway infrastructure including:



20,000
miles of track³⁵



30,000
bridges, tunnels & viaducts³⁷



200,000
separate slopes³⁶



1,000s
of signals & level crossings³⁸



£2.45bn

per year rail freight contribution to the UK economy³⁹



216,000

rail jobs across Great Britain⁴⁰



£50-100m

weather delay costs yearly



Rising to

£200-300m

with the inclusion of missed targets, repairs, and socio-economic costs⁴¹



Maritime



Around

95%

of British imports/ exports moved by sea:



25%

of the UK's energy supply



48%

of the country's food supplies⁴²

£18.7bn

GVA to the UK economy (2019)



Directly employs

227,100

people⁴³



46%

of all international sea passengers and



25%

food imports transited through the Short Strait⁴⁴ in Southeast England (inc. Channel Tunnel)⁴⁵



3

Vision, objectives & scope

Railway lines flooded at Datchet, 2014



The vision

We have a vision for a well-adapted transport network that is flexible, reliable, operates safely and is responsive to a changing climate. This requires that we understand the climate-related risks and vulnerabilities of the transport system, including interdependencies and impacts of cascading failures.

What this looks like:



The transport network is developed, managed, and maintained so it can withstand weather related risks, in a proportionate, economically efficient manner.



Strategic reviews and planning of the network at national and regional levels inform risk-based investment, maintenance, and operational viability decision making.



Wherever possible, when extreme weather and associated impacts are experienced, people and goods continue to move safely and reliably.



The impacts of projected future weather trends are understood, supporting ongoing resilience of the system and proportionate investment.



Plans and procedures are in place to restore services and routes to normal as quickly and safely as possible, with the implementation of temporary measures, where necessary.



Transport infrastructure is monitored and maintained, improving the cost effectiveness of infrastructure investment through future proofing and extending asset life.



A shared understanding of climate risk is embedded within the system and ways of operating.



Data is accessed, shared, and utilised effectively to understand risks and accurately forecast events.



There are clear and effective communications to passengers and transport users before, during and after an event to minimise the impact of disruption on people and businesses.



A whole of society approach enables collaboration across government, with stakeholders, operators, and industry partners to understand how interdependent risks are identified and managed, and opportunities are exploited.

Objectives of the strategy

This strategy will put the transport sector on a pathway to realising this vision. The strategy is a launch pad to a more resilient transport system. The overarching objectives of the strategy are:

The transport sector will understand the need to adapt their business and operations to the changing climate, building their response into 'business as usual'.

The transport sector will utilise available guidance and tools to support them in prioritising investments on adaptation and sharing information to galvanise adaptation action.

The Department for Transport will set the strategic direction for the transport sector, enhancing adaptation action and fostering cross-sector collaboration.

Scope of the strategy

What we mean by transport infrastructure, the organisations responsible for managing the risk of climate change (transport infrastructure operators, or TIOs) and the positive action that operators are already taking to respond to climate change is set out in **Annex 1**. Some TIOs are regulated by the Office of Rail and Road (ORR) or the Civil Aviation Authority (CAA), who also have a key role to play in adaptation, even if they do not have a climate resilience and adaptation remit.

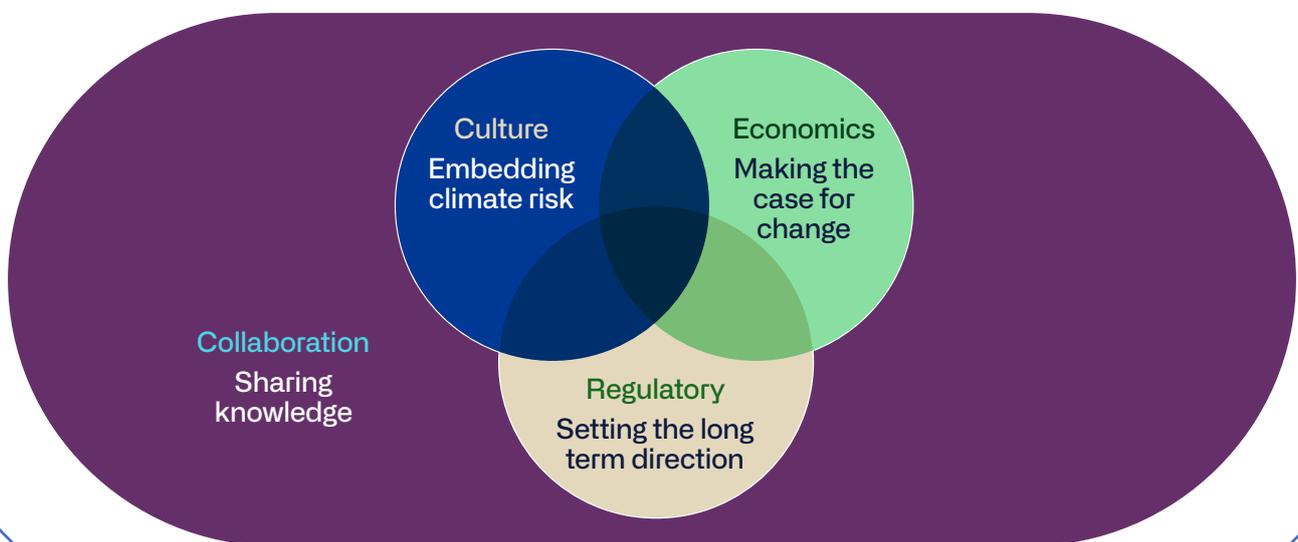
As well as considering transport as a system, the networks that are built around the transport system including freight, supply chains and border control need to be considered.

TIOs and regulators have different regional boundaries and DfT's responsibility for adaptation varies by mode. For example, DfT has no responsibility for roads outside of England,

as roads are a devolved matter. However, aviation policy is largely a reserved matter, while planning and surface access policies are devolved.

While there is some planning for adaptation underway, this is not consistent across the sector and is not being translated into action at sufficient pace. As transport is a system there is limited benefit to only some parts of the system being well-adapted. We need all aspects of the transport system to be resilient to climate change if we are to stay connected.

The following chapters of this strategy set out policies to drive adaptation action across the transport sector. These actions have been grouped into three themes, which overlap and support each other, with collaboration as a thread throughout.



4

Culture

Embedding
climate risk

High temperatures outside
the Port of Dover, 2022



To effectively adapt to climate change, we need a culture shift in how climate risks are considered in the transport sector. These actions look to build on positive progress made by many TIOs by identifying further actions to embed climate risk in planning and operations across the sector.

4.1 Assessing risk

Goal

The transport sector regularly reports on the climate risks to their business. Comprehensive assessment of these risks includes plans to adapt both physical infrastructure and organisational processes to address the impacts of climate change.

Why this action is needed

There are several benefits of undertaking climate adaptation reporting including:

- Guiding organisations to assess their exposure to climate risk and take action to reduce their vulnerability.
- Making climate risk management a leadership priority and integrating it into risk management governance.
- Providing insights into the delivery of adaptation actions, the progress on declared outcomes and the monitoring and evaluation frameworks which assess the effectiveness of actions.
- Raising the profile of climate resilience within the organisation and beyond, by increasing awareness, building capacity, and making examples of good practice publicly available.
- Informing future government adaptation strategies, R&D programmes and data gathering.

Climate adaptation reporting is the primary mechanism for government to **understand whether climate impacts are being reduced** across the transport sector and how (see Annex 1). Reports are submitted to government periodically as part of a Defra-led process known as the Adaptation Reporting Power (ARP), which derives from a power within the Climate Change Act 2008 (CCA 2008) which government can use to mandate reporting. Reporting is currently voluntary.

Analysis by the Climate Change Committee (CCC) suggests **improvements to the quality of adaptation reports** in parts of the transport sector are needed to meet the requirements set out under the CCA 2008.⁴⁶ Most highway authorities and some parts of the aviation and port sectors do not report on their adaptation measures, which has resulted in an incomplete picture of adaptation across the transport sector.

Some operators may not have any plans in place to adapt to climate change, some may not have a systematic approach to addressing climate risks, others may have plans in place that have not been the subject of any scrutiny.

In addition to preparing for climate risks which directly impact transport infrastructure, organisations need to also consider the climate risks faced by sectors they depend on. CCC analysis suggests **insufficient progress has been made on identifying and managing interdependencies**.⁴⁷ Identification of interdependency risks improved in recent adaptation reports for rail, strategic roads, airports and some ports; however, assessment lacks consistency and detail, and is not effectively incorporated into risk assessments. Understanding interdependencies is essential to mitigating the risk of cascading failures.

Due to London Gatwick Airport's proximity to the River Mole, the risk of river flooding is significant to airport infrastructure. Gatwick commissioned technical experts from an engineering solutions company to produce a detailed analysis of their critical assets at risk from flood events. This report provided flood maps that allowed Gatwick to accurately target capital expenditure where it was most at risk and a prioritised list of existing buildings that required flood protection. As a result, a phased programme of resilience measures including duct sealing, tanking, flood doors and sump pumps was rolled out over several years. Gatwick continue to reassess any remaining areas that may require flood mitigation or protection works.



Transport for London (TfL) has used the Adaptation Reporting Power (ARP) process as a basis to mature its understanding of climate risk and adaptation across the organisation. TfL says, “The report and risk assessment development have been critical to increasing awareness and understanding across all business areas. The outputs have led to valuable actions, including the development of our first Adaptation Plan, the explicit integration of climate risk and adaptation into TfL standards unrelated to drainage, supporting the development and inclusion of climate change risk at enterprise risk level, and continuous work to identify and act upon climate risks. The ARP process has ensured buy-in and senior commitment to resulting actions. TfL will continue to support and improve ARP reports to ensure an evidence-based approach to climate risk assessment and adaptation”.



Task Force on Climate-Related Financial Disclosures

There are a range of reporting mechanisms which support organisations to identify, manage and raise the profile of their risks. Stakeholders, particularly those in the private sector, have cited disclosures aligned with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) as an effective mechanism to take a reflective view on the financial impacts of climate change. These include:

- An organisation’s governance around climate-related risks and opportunities.
- Actual and potential impacts of climate-related risks and opportunities on the organisation’s businesses, strategy, and financial planning.
- How the organisation identifies, assesses, and manages climate-related risks.

- Metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

The TCFD fulfilled its remit in 2023 and has disbanded. The International Financial Reporting Standards (IFRS) Foundation will now take over the monitoring of the progress on companies’ climate-related disclosures from TCFD. Many transport operators were obliged to report under TCFD due to the size of the organisation, while others chose to report although not mandated to.

TCFD was an important and beneficial mechanism that complemented ARP. The ARP process requests detailed risk assessments, action plans and progress not captured by TCFD. It is government’s view that there is value for organisations to report in ARP alongside other financial disclosures, as outlined in the ARP4 guidance.⁴⁸

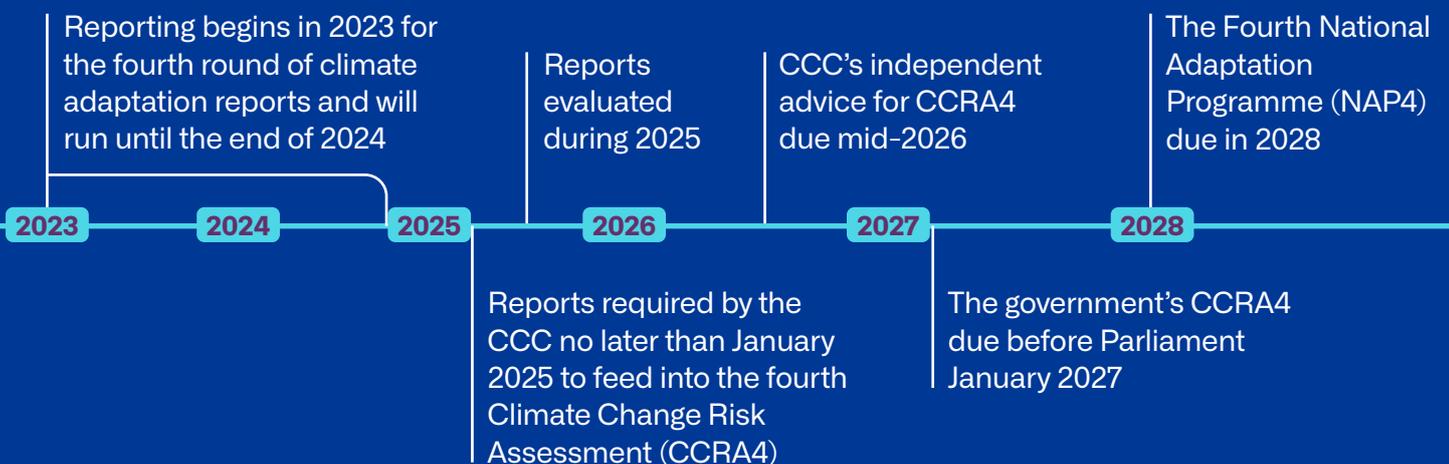
Cross-sector actions

- **In 2024, TIOs to undertake reporting** as set out in the fourth climate adaptation reporting strategy, including named highway authorities as part of the local authority pilot scheme. DfT will engage across the transport sector, with a specific focus on ports and aviation, along with transport regulators such as the ORR and the CAA to enhance uptake and quality of reporting.
- **By 2026, all TIOs to undertake and publish climate risk assessments.** These risks should be embedded in governance processes and included in risk reporting mechanisms such as risk registers.

Targeted interventions

- **In 2024, ask UK airports not captured in the fourth round of climate adaptation reporting, to voluntarily report to government** on adaptation action.
- **In 2024, ask Train Operating Companies (TOCs) and Freight Operating Companies to voluntarily report to government** on adaptation action.
- **Explore incorporating appropriate adaptation requirements into rail licences and contracts** in accordance with recommendations in the Roadmap following the Rail Safety and Standards Board (RSSB) 2023 Climate Change Maturity Matrix project.

Figure 1 – Timeline of ARP Reporting



4.2 Strategic approach to risk

Goal

Adaptation to climate change is embedded in the governance procedures of TIOs, demonstrating accountability for managing climate risks. In DfT, climate risks are considered within wider national security and resilience risk management.

Why this action is needed

As the climate continues to change, we need a strategic approach to managing climate risk by embedding it within wider risk management and resilience planning. This is a whole of society endeavour, with roles for government, the public sector, the private sector, and community action.

In government

The UK Government Resilience Framework (UKGRF)⁴⁹ set out the government's plan to **strengthen the systems and capabilities** that underpin collective resilience to all risks. UKGRF defines chronic risks, such as climate change, as 'enduring challenges that gradually erode elements of our economy, society, way of life and national security'.

Aligning with the three core principles of the UKGRF, this strategy promotes a **strategic and prevention led approach to climate risks** whilst acknowledging the benefits for passengers, freight, and the economy of investing in risk prevention and resilience.

The latest National Risk Register (NRR)⁵⁰ was published in 2023 and along with CCRA3 builds our shared understanding of climate risk. **Climate risks are identified amongst the most serious risks that could have a significant impact** on the UK's safety, security or critical systems at a national level. The NRR and CCRA3 provide resilience professionals, businesses and other organisations with information about the risks the country faces to inform their own planning, preparation and response.

DfT is well-versed in working with the transport sector to prepare for, respond to and recover from extreme weather events. The transport adaptation strategy provides the opportunity for DfT to go further on **integrating climate risks within the wider resilience framework**, taking a strategic and long-term view to ensure DfT's ways of working are prepared for climate change.

This is important as climate risks do not occur in isolation. The strategy will help to bridge the gap between responding to acute and discrete risks in the short-term, such as individual extreme weather events like flooding, and chronic risks in the long-term, such as shifts in climate patterns resulting in higher temperatures.

Example: DfT benefits from an internal risk assessment tool which is used to capture over 1000 risks and feeds into the Cabinet Office's National Security Risk Assessment (NSRA) and NRR. It is an important tool in **identifying and assessing civil contingency risks to the transport network**, as well as for understanding interdependencies across climate change risks and other malicious and non-malicious risks, such as major transport accidents, supply chain disruption, infrastructure and utility failure.

UK Government Resilience Framework Commitments, 2022

The Resilience Framework sets out a series of commitments, many of which are complementary and will support the achievement of the goals of this strategy. For a full list of commitments in the UKGRF please refer to the Framework itself. This figure highlights those commitments which are of relevance to the transport adaptation strategy.

1. Risk

- Refreshing the NSRA process, so it will look over a longer timescale, include multiple scenarios, consider chronic risks and interdependencies, and use the widest possible range of relevant data and insight alongside external challenge. The NSRA was updated in 2022 based on the new methodology.

2. Partnerships

- Review existing regulatory regimes on resilience to ensure they are fit for purpose. In the highest priority sectors that are not already regulated, and for the highest priority risks, consider enforcing standards through regulation.

3. Responsibilities and accountability

- Expand the scope and use of standards and assurance in the public sector to support better contingency planning and risk management.

4. Investment

- Have a coordinated and prioritised approach to investment in resilience within the UK government, informed by a shared understanding of risk.
- Consider options for funding models for any future expanded responsibilities and expectations of Local Resilience Forums in England.
- Offer new guidance to community organisations and individual householders, to help those people to make more informed decisions about investing in their own resilience and preparedness.

Across the transport sector

As some extreme weather events related to climate change become more frequent and/or severe, TIOs should ensure that climate risks are incorporated within organisational governance processes so that there is accountability at a senior management level. This will incentivise active review and management of present and future risks associated with climate change as part of regular resilience risk management.

Cross-sector actions

- **By 2024, TIOs to identify to DfT a senior responsible officer for adaptation.** This will ensure that senior leadership are accountable and have ownership for managing their climate risks.
- **By 2026, TIOs and transport industry associations to include adaptation and climate resilience in their organisation objectives,** to promote climate risk management across the sector.
- **DfT will regularly review and assess climate risks to the transport sector** in line with other risks as part of the Department's internal risk assessment tool. This evidence-based work will inform the Department's engagement with the transport sector on risk and support policy development.
- **DfT will review how it works across chronic and acute risks,** ensuring this aligns with the refreshed National Security Risk Assessment.
- **DfT will fulfil related commitments made in HMG strategies and policy frameworks relevant to climate risks,** such as the 2022 UK Government Resilience Framework.

Targeted interventions

- **By 2025, implement recommendations from DfT's individual report following the RSSB 2023 Climate Change Maturity Matrix project.** This will improve DfT's ability to provide advice to rail industry bodies in managing their climate risk.
- **The CAA to explore the opportunities to enhance adaptation action within the aviation sector** such as developing guidance for the sector on climate adaptation and ways of working to embed adaptation across organisations.

5

Economics

Making the case
for adaptation



Flooded road in Cumbria, 2009

Effective adaptation across the transport sector requires a systemic change in how we understand climate risks and take them into account in investment decisions. This set of actions will equip the transport sector with the tools, guidance and evidence to make informed decisions and monitor progress.

5.1 Providing the tools required

Goal

The transport sector understands the impact the changing climate will have on their business, operations, and the wider economy. Risk assessments are used to build understanding and integrate adaptation into operational plans as well as long-term planning and investment decisions.

Why this action is needed

We want infrastructure owners and operators to have the guidance, tools, evidence, and knowledge to consider climate risks thoroughly and successfully make the case for action. This will help to ensure adaptation spending can be effectively targeted.

The transport sector needs to make appropriate adaptation interventions. Providing the tools required to conduct climate risk assessments and make investment decisions will support the sector in managing and mitigating their risks.

Example: DfT commissioned a review of existing tools, mechanisms and guidance used by the transport sector for climate risk assessments.⁵¹ The review identified that some stakeholders found the current landscape of risk assessment tools to be overwhelming, with numerous tools at each stage of the risk assessment process and varying levels of complexity.

The review concluded that while there is no single tool that is considered perfectly suited to every organisation's needs, there are examples of good practice. The report recommended an industry-wide best practice approach to climate risk assessment. DfT is taking action in response to this recommendation.

Example: DfT are working with the Met Office to make it easier for the sector to use climate projections. In 2023 the Met Office conducted a series of interviews to identify requests for climate projection tools from the transport sector. The primary request was for information to better understand the frequency of extreme weather events. This was identified as a key barrier to decision making and primary area of uncertainty.

DfT is collaborating with the Met Office and across government on the development of such a tool, and the sharing of knowledge around existing tools such as the UK Climate Projections User Interface⁵² and the Met Office Climate Data Portal.⁵³

Adaptation pathways

Adaptation pathways can be used to decide whether, when and how to make adaptation interventions and are considered global best practice in adaptation planning.⁵⁴

An adaptation pathway is a decision-making approach, that allows decision-makers to take actions under uncertainty. It enables decision-makers to identify what actions can be taken now and in the future. This flexible approach allows for the escalation in scale and scope of adaptation measures as the severity of climate impacts intensify, and social and economic contexts evolve.

This approach is already being used in parts of the transport sector. For example, Network Rail's Environmental Sustainability Strategy commits regions to developing long term climate change 'Adaptation Pathway' strategies and investment plans by 2029.⁵⁵

Cross-sector actions

- DfT will develop tools so the sector can identify adaptation measures:
- **By 2024, we will develop an online database with best-practice adaptation measures**, working in partnership with transport stakeholders through the Transport Research Innovation Board.
- **By 2025, we will develop a tool to provide additional climate information for the transport sector**. This could be used by the transport sector to inform climate adaptation investments, risk assessments and asset designs.
- **By 2025, DfT will enhance climate risk assessment guidance**, in line with Green Book Supplementary Guidance⁵⁶, so infrastructure operators can identify risks and prioritise action. This will increase uptake, reduce uncertainty, and improve consistency in assessment. It will also support local authorities to fulfil the third National Adaptation Programme (NAP3) commitments to improve asset management plans.

Floodwater on the A555 Manchester Airport Relief Road, 2019



5.2 Building the evidence base

Goal

DfT has identified knowledge gaps across the transport sector which are preventing action and is unlocking solutions with targeted research funding. We have created an enabling environment for the sector to make effective evidence-based investment decisions.

Why this action is needed

We know through stakeholder engagement that **knowledge gaps exist across the sector** in understanding how the future climate might interact with the transport system and how adaptation can effectively mitigate associated risks.

Where research does exist, there are challenges in translating detailed data and academic research into understandable outputs and practical solutions. This is a barrier when building successful business cases for investment in adaptation measures.

DfT can usefully cut through some of the uncertainty which may be inhibiting decision-making and adaptation spending. Building the evidence base on the costs of climate change to the transport sector is one area where the economic case for adaptation can be strengthened. Understanding where costs are likely to be most acute will enable action to be prioritised, and better account for the benefits of adaptation relative to the costs of climate risks.

Changes to transport systems to reach net zero should also be resilient to climate impacts.

The CCC considers, for example, an increasing reliance of road transport on electricity could make the transport system more vulnerable to power outages.⁵⁷ This is known as a transition risk. There is limited guidance and tools which take account of these potential risks for the transport sector.

The Local Electric Vehicle Infrastructure (LEVI) Fund supports local authorities in England to accelerate the roll out and commercialisation of public charging infrastructure. Public chargepoints will support residents without off-street parking to transition to electric vehicles. The fund includes capital funding to contribute to the costs of delivering chargepoints, and funding for local authority resource. The LEVI Fund application form asks local authorities to consider the location of chargepoints in relation to extreme weather impacts, such as flooding hotspots. This is supported by an article in the Knowledge Repository, a resource designed to upskill local authorities on chargepoint infrastructure delivery.



Case study

Cross-sector actions

- **Between 2023 and 2027, deliver the £10 million Decarbonised, Adaptable, Resilient Transport Infrastructures (DARe) hub, in partnership with UKRI.** The Hub, delivered by Newcastle University, Heriot-Watt University, University of Cambridge and University of Glasgow, is taking a systems approach to developing and implementing sustainable, low carbon, adaptation solutions for resilient transport infrastructure and streetscapes. It will consider transition risks, building solutions for resilience including rethinking existing transport infrastructure to reduce emissions. This work is complemented by a £15 million research programme between Defra and UKRI, which will also contribute to the evidence base on effective adaptation action.
- **By 2024, undertake a review of policies and proposals that are being delivered or developed to decarbonise transport** to identify transition risks and update existing guidance on climate risk assessments, where necessary.
- **By 2025, review approaches to valuing the costs of climate risks to transport systems and assets.** This work will explore approaches and evidence to factor climate risks into analysis as part of DfT business cases, supported by associated Transport Analysis Guidance.
- **By 2025, explore how and where funding for R&D, trials, and adaptation measures could be effective** in removing barriers to adaptation action and where that funding could come from, taking an evidence-based approach and working in partnership with all parts of the transport sector.

5.3 Incentivising action

Goal

Resilience to climate change is considered from the outset when developing new, and reviewing existing, policy and infrastructure schemes. Early movers are incentivised to adapt, demonstrating and receiving the benefits for others to learn from.

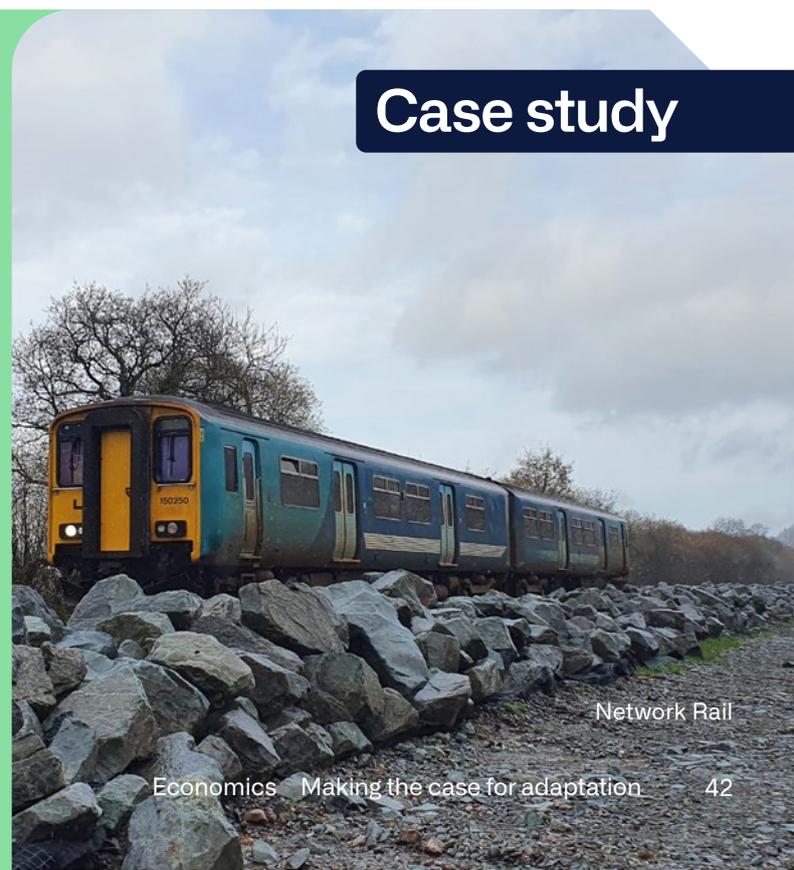
Why this action is needed

Climate risks have the potential to change the viability of a project, policy, or scheme, particularly those that operate over a long timeframe. For example, with sea level rise, it will not be economically viable to maintain the resilience of some coastal roads and railways.

Climate resilience can and should be built in from the outset by considering climate risks in scheme development. This is already happening in some projects, such as HS2 which is being built to withstand climate impacts into the next century. HS2's climate risk assessments identified potential risks to the project and adaptation actions are embedded, such as designing drainage to accommodate one in 100-year rainfall events.⁵⁸ This approach should also be applied to existing infrastructure, when asset managers are considering maintenance, enhancements and renewals.

The Conwy Valley railway line runs through fields which are prone to flooding. Historically, flooding events have washed away sections of the earthwork, leading to prolonged line closures. Network Rail installed additional resilience during the repairs following a flooding event in 2019 and rock armour was used to slow the flow of flood water and protect the track from washout. The line flooded four times since the work was completed with little damage to the track. The total spend on this work in 2019/2020 was around £10 million, of which around £6 million was spent on resilience. This added resilience has avoided a loss of over £8 million as of November 2022 and therefore the investment in resilience has already paid for itself in less than two years.⁵⁹

Case study



Network Rail

DfT has an influential and important role in the transport sector as it provides funding to operate, maintain and enhance a lot of our transport infrastructure. DfT is responsible for one of the largest infrastructure portfolios across government, with £15 billion spent on transport infrastructure in 2021 by central government (including roads, airports, harbours and railways), out of the £23.8 billion total government investment in infrastructure.⁶⁰ As a funder, DfT approves business cases for schemes to maintain and enhance transport infrastructure.

We also create guidance and policy documents that promote sustainable infrastructure development for all modes of transport. We can influence the supply chains we use, enhancing capability through requiring best practice.

DfT has a responsibility to ensure climate risks are embedded in scheme development from an early stage and are considered in decision making. This approach should be applied to schemes of all sizes, both public and privately funded, however the weighting and importance of the climate impacts will vary due to the lifecycle and cost of scheme.

The Port of Felixstowe has recognised both the predicted impacts of climate change from rising sea levels and the importance of developing sustainably and with resilience. Their most recent infrastructure work has been informed by a detailed Flood Risk Assessment. Proposed development works at the time of scheme design were assessed to significantly improve the standard of protection from a 1 in 100 year to be in excess of the 1 in 1,000 year standard of protection. The standard of protection was designed to take into account climate change over the 60 year lifetime of the development and consider predicted sea level rise.



The **Greening Government Commitments (GGCs)** aim to reduce the impact that government departments and their agencies have on the environment. The latest framework, covering the 2021-2025 financial years, introduced additional commitments such as the requirement for departments to develop and deliver climate adaptation plans for how they will address climate risks to their estate. DfT and our ALBs continue to implement these commitments and contribute to future development of the GGCs.

Cross-sector actions

- From 2024, consider adaptation actions necessary in relevant planning policy documents, including national policy statements and sector specific guidance.
- Following the launch in 2024, explore opportunities for how the £2 million Rural Innovation Fund for Transport can promote adaptation action when implementing innovative solutions to rural transport challenges.
- By 2025, embed consideration of climate risks in DfT business case process and decision-making, supported by associated guidance, including Transport Analysis Guidance.
- By 2025, incentivise adaptation measures through funding agreements, such as the Road Investment Strategy and Network Rail Control Periods, and explore options through contractual agreements and licences. This will require action to be taken by National Highways, Network Rail, other licence holders and ORR.
- By 2025, promote greater adaptation action across the DfT estate, informed by policy expertise, and demonstrate leadership across government.

Targeted interventions

- Explore opportunities for rail adaptation enhancement projects to enter the Rail Network Enhancements Pipeline, such as at future spending reviews.



Safety advice on A19, 2022

5.4 Measuring progress

Goal

Data is collected on the impacts of extreme weather and effectiveness of adaptation measures to aid monitoring, evaluation, and learning (MEL). Indicators measure the impact of damage and disruption, improving understanding of the interaction between climate and the transport system.

Why this action is needed

Data is fundamental in providing insights on climate adaptation. Understanding which adaptation actions are efficient and effective is critical to good decision-making. General principles for monitoring and evaluation of NAP3 adaptation actions have been set out by Defra⁶¹ and work is ongoing to develop a MEL framework based on these principles.

High quality evaluation allows decision-makers to better target interventions; reducing delivery risk, maximising the chance of achieving objectives, and increasing our understanding of what works.⁶² Evaluation is closely related to monitoring of data and indicators. Indicators can help us assess whether adaptation actions are being delivered efficiently and progress is being made in mitigating climate impacts.

We cannot effectively measure the impacts of extreme weather and condition of assets across the whole of the transport sector without appropriate data. Weather hazards data exist for rail and strategic roads, however the causal link to climate change remains challenging. For other transport modes, more data are needed. CCC evaluation of progress for ports, airports and local roads was not possible due to lack of indicators.⁶³

Monitoring

Tracking progress of the implementation of an intervention by collecting data on its inputs, outputs, and outcomes.

Evaluation

A multi-disciplinary, systematic assessment of an intervention's design, implementation, and outcomes.

Example: Transport Infrastructure Efficiency Strategy (TIES) Living Lab examined climate resilience benchmarking and performance management practices for transport. The study found climate resilience and adaptation planning is still in its infancy. Some modes have developed metrics to monitor the impact of extreme weather on their assets and operations – for example, Network Rail calculate delay minutes due to weather-related impacts. However, there is not a well-defined methodology for measuring and meeting resilience ambitions or targets through programmes and projects. The TIES Living Lab work will inform the development of indicators to measure adaptation outcomes and impacts for transport.

Output indicators, such as the number of adaptation solutions, are relatively simple to measure and so are more common. Indicators that measure outcomes and impacts, such as level of disruption and impacts to the economy are harder to measure.

Given the complexity of adaptation, it is challenging to identify and develop appropriate indicators. Key barriers to overcome include proving cause and effect in a complex system with multiple drivers of change; tracking progress across modal and infrastructure level networks with interacting and cascading risks; accessing high quality, affordable data; and the mismatch between short evaluation cycles and time needed to observe change and deliver value for money.

Indicators can be divided into three groups representing different stages of the adaptation process: **output indicators, outcome indicators, and impact indicators.**⁶⁴

We will use output indicators to measure the success of this strategy, whilst in parallel developing outcome and impact indicators for parts of the sector where there is not an established approach to monitoring.

Cross-sector actions

- **By 2027, collate the data that transport stakeholders capture on weather and climate related disruption and costs**, to support them to enhance their data sets and better understand the impacts of climate change on their business. The data will also enable government to better support the sector in risk management.
- **By 2028, progress the development of indicators**, in partnership with the sector, to measure adaptation outcomes and impacts with the view to having more effective metrics for local roads, airports and ports to inform NAP4.

Targeted interventions

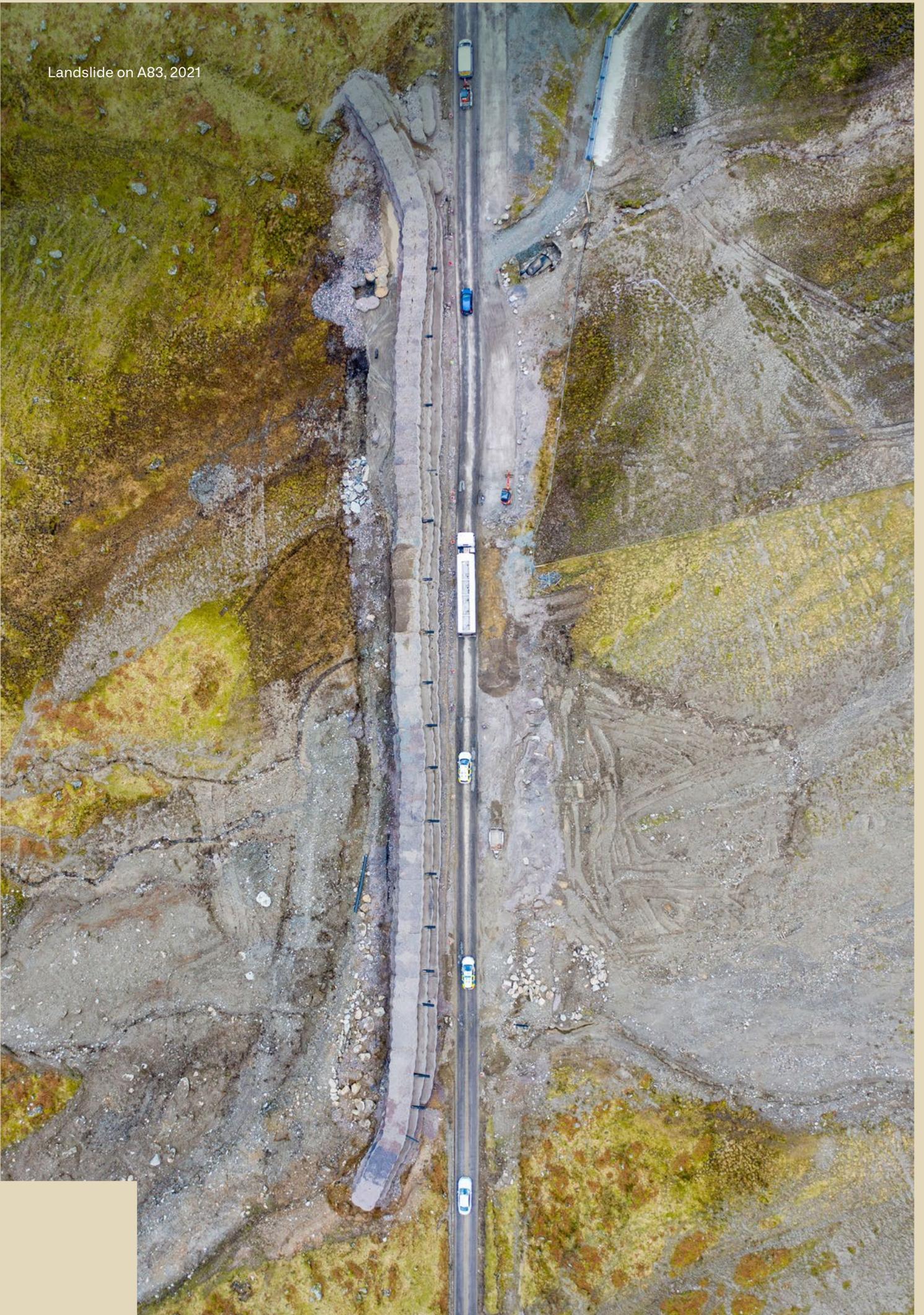
- **Between 2025 and 2030, DfT is minded to require National Highways** to monitor, through its performance specification, how susceptible the SRN is to flooding. This is subject to final decisions on the third Road Investment Strategy.
- **From 2025, ports in England** will trial a regular monitoring survey to gather information on the frequency of disruption to port operations from weather.
- **Network Rail will improve the quality and quantity of its data analysis** to better understand the costs and impacts of climate change.

6

Regulatory

Setting the
long-term
direction

Landslide on A83, 2021



This set of actions will consider how DfT can use its unique position in the transport sector to explore untapped or under-utilised policy levers to identify new opportunities and reduce uncertainty for the sector by setting a clear direction for adaptation ambition.

6.1 Standardising the approach

Goal

Government has reduced uncertainty by taking action, in partnership with industry, to standardise how to approach adaptation. Through communicating our adaptation vision and identifying effective policy levers this gives the sector certainty to confidently implement adaptation measures.

Why this action is needed

The benefit of guidance

Adaptation is a complex process, with many uncertainties and knowledge gaps which can be a barrier to adaptation action at every stage of the process. Challenges to overcome throughout the process include understanding how the climate could change, determining the best approach to assess risk and identifying the most effective measures to implement.

Operators can overcome some of these challenges by utilising best practice guidance, such as adaptation pathways, and applying standards like ISO 14090. DfT is also working to give infrastructure operators the tools and evidence they need, supporting a consistent approach to identifying climate risks and adaptation measures (see section 5).

Planning for future climate change relies on climate projections, the outputs of which vary based on the warming scenario (Figure 3). The CCC suggests that we should adapt to a global warming level of 2°C and assess the risks for a 4°C warmer world.⁶⁵ This approach builds in flexibility and actively works to a reasonable assumption, whilst proactively considering the implications on adaptation plans if the rate of warming changes.

It is for transport operators to identify and plan for the most appropriate warming scenario. This can be challenging and, in many cases, it makes sense for multiple operators to use the same warming scenario in their planning. DfT will continue to bring operators together to share their methods, exchange best practice, and expand adaptation capability.

Climate Scenarios

Climate projections are used to help build a better understanding of the different scenarios which may occur due to global warming.

UKCP18 is an example of a climate change projection tool which has been developed by the Met Office to provide projections out to 2100 in the UK and globally. It contains a set of tools for assessing how the UK's future climate is likely to change on land and in its surrounding waters. This includes data on temperatures and rainfall and forecasts how far sea levels around the UK could rise.

The CCRA3 looks at climate scenarios corresponding to a 2°C and 4°C rise in global temperatures.

Enhancing standards

Standards are agreed ways of working and could be utilised to set expectations of the transport sector when adapting to climate change. Developing effective and affordable standards is complex as it requires detailed understanding of the existing asset base and current levels of resilience. However, standards can be effective in providing greater certainty for investment and enabling adaptation action. As such, we are keen to explore what role they should play in enabling adaptation action in the transport sector.

Parts of the transport sector have standards, a level of quality or attainment usually set by the industry, some of which already include resilience to extreme weather events and climate change. Other TIOs are incentivised to build climate resilience into their business plans, investment and service delivery as it is necessary for their ongoing economic viability.

There are different approaches to setting resilience standards and these can be categorised in three groups:

- Process standards, which embed resilience into planning and decision-making processes;
- Service-level standards, which agree the performance or level of service of the system;
- Engineering/technical standards, which set requirements for how infrastructure should be built and maintained.

Example: There are existing standards available to support TIOs to consider risks related to the potential impacts of climate change. The International Organization for Standardization brings together experts to share knowledge and develop voluntary, consensus-based, market relevant International Standards that provide solutions to global challenges. ISO 14090:2021 describes how to develop and implement a sound risk assessment in the context of climate change.

Acknowledging the need for greater action in this space, the UKGRF committed that government departments will work with regulators and infrastructure operators to:

- By 2025, expand the scope and use of standards and assurance in the public sector to support better contingency planning and risk management.
- By 2030, review existing regulatory regimes on resilience to ensure they are fit for purpose. In the highest priority sectors that are not already regulated, and for the highest priority risks, consider enforcing standards through regulation.
- By 2030, introduce standards on resilience across the private sector where these do not already exist, adjusted to consider the current landscape, priorities and needs across and between sectors.

- By 2030, build upon existing resilience standards for critical national infrastructure (CNI) to create common but flexible resilience standards across CNI, and do more on the assurance of CNI preparedness.
- By 2030, provide the wider private sector with better guidance on resilience to support contingency planning and risk management.

As public bodies, **National Highways and Network Rail are governed through regulatory cycles**. The CCC and NIC advise adaptation policy, such as implementation of climate resilience standards, should align with these regulatory cycles to maximise the window of opportunity for investment and should be in place by 2025. We recognise the need for standards that are informed by data and appropriate for the operating contexts, priorities, and interlinkages between different parts of the transport network.

Cross-sector actions

- **By 2025, support the sector to take a consistent approach when using climate scenarios and climate risk assessments**, by facilitating cross sector collaboration to enable a joined-up approach.
- **By 2027, explore the role of adaptation standards** for the transport sector and determine what information is required to inform these.
- **Work across government to implement commitments in the Resilience Framework** aligning with regulatory cycles to maximise the window of opportunity for investment, where possible.

Targeted interventions

- **By 2027, Network Rail will agree levels of service in extreme weather conditions with government and regulators**. In determining levels of resilience, the balance between the costs of resilience, impacts of disruption and consumer expectations will be considered.

6.2 Reviewing the role of regulators

Goal

Regulators have the powers they need to effectively support their sectors to adapt to climate change.

Why this action is needed

Transport regulators have an important role in ensuring safety standards are upheld across the transport system.

Currently transport regulators do not have a specific mandate for ensuring climate resilience. However, this does not prevent them from taking steps to promote adaptation action within their sectors. For example:

- The ORR holds Network Rail to account through its network licence that enforces relevant health and safety legislation. Since 2013 the licence has required Network Rail to, amongst many other things, produce weather resilience and climate adaptation plans, which set out priorities and high-level approaches for eight geographical routes covered by Network Rail regions.
- As the UK's aviation regulator, the CAA works to ensure that: the aviation industry meets the highest safety standards; consumers have choice, value for money and fair treatment; the environmental impacts of aviation are managed, mitigated, and reduced; and the aviation industry addresses security risks effectively. The CAA positively influences the industry to lead on the impacts that aviation activity has on the environment, both globally and locally. The CAA plays an important role in specific areas, including noise, air quality, climate change and biodiversity, by taking into account the environment in regulation and oversight, sharing best practice, and contributing to the development of international initiatives that target climate risks.

The CCC recommends designating transport sector regulators with consistent remits for climate resilience as this could ensure long-term investment decisions incorporate, and are resilient to, the future impacts of climate change.

Example: The water sector has adopted recommendations from the National Infrastructure Commission to make water supplies resilient to a drought with an annual probability of 0.2 per cent.⁶⁶ The water sector regulators, Ofwat and the Environment Agency, support long-term planning in the sector by requiring water companies to produce 5-yearly Water Resources Management Plans (WRMPs). WRMPs set out how they will invest in infrastructure and technology to manage supply and demand, taking a proactive approach to adapting to the risks posed by climate change.

The CAA and ORR acknowledge they have a role in supporting their sectors to address climate risks and both will report in the fourth round of adaptation reporting in 2024. The Maritime and Coastguard Agency and lighthouse authorities reported in ARP3.

The Joint Committee on the National Security Strategy's report⁶⁷ recommends government formalises collaboration between critical national infrastructure regulators on climate adaptation to facilitate information-sharing and support in early planning. We will work with Defra, Cabinet Office and others to encourage and strengthen collaboration amongst regulators and operators with an adaptation remit, including through the IOAF.

Targeted interventions



By the start of 2027, consider the CCC recommendation for climate resilience remits for regulators, working closely with the ORR, the CAA and relevant stakeholders.

7

Collaboration

Sharing
knowledge

Heavy snow at Tonbridge
West Yard, Kent, 2010



Understanding of the impacts of climate change, and preparing for them, varies across the transport sector. This set of actions will bring transport operators together to collaborate, share best practice, expand their knowledge and address their interdependencies within transport and wider infrastructure.

7.1 Working in partnership

Goal

Transport operators will enhance their knowledge and capability on adaptation and utilise expertise from organisations who are leading on adaptation progress. Collaboration plans are developed to address the interdependencies impacting their infrastructure.

Why this action is needed

Transport modes do not operate in isolation so face similar challenges in managing their climate risks, however they are at varying stages of their adaptation journey. Working in partnership creates opportunities to collaborate on adaptation solutions, strengthen relationships, share expertise and improve the overall adaptive capacity of the sector.

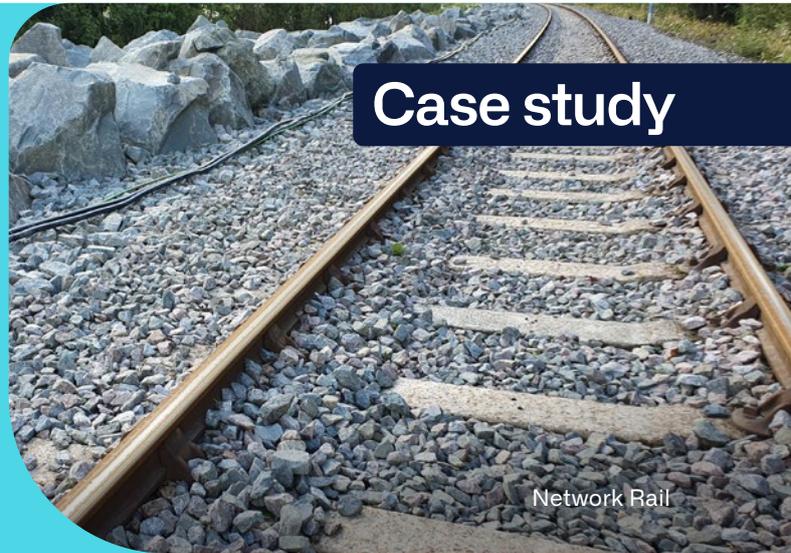
In NAP3, the Cabinet Office and Defra, working with HM Treasury, committed to establish a new, senior officials' Climate Resilience Board. The Board oversees strategic, cross-cutting climate adaptation and resilience issues and promotes further government action to increase UK resilience to climate change.

Interdependencies

Collaboration is essential if the transport sector is to improve its understanding of interdependencies. CCC analysis identified that interdependencies are not consistently assessed⁶⁸ and improvement is needed across the economy. DfT has a key role to play in facilitating collaboration between transport operators who are making strong progress in adapting to climate change and those that need to go further.

Interdependencies exist within transport modes and across cross-cutting industries such as energy, water and telecommunications. If interdependencies within the infrastructure network are not sufficiently addressed, there is a risk of cascading failures. Taking a systems-based approach to adaptation can help build knowledge across the transport sector by understanding interdependencies.

TfL, Network Rail, HS1 Ltd, HS2 Ltd and other transport bodies are working together to deliver a joined-up approach to their ARP4 submissions. They have identified interdependencies as a key area to develop further and TfL has appointed consultants to undertake an interdependencies assessment for London's land-based transport sector.



Case study

Network Rail

Cascading failures

A 'cascading failure' is when one or multiple parts of a system of interconnected parts fails, which leads to the failure of other parts of the system, growing progressively because of positive feedback.

In December 2015, Storm Desmond brought between 150 and 200mm of rain. The River Lune in Lancaster set a new record flow rate for an English river at the time and flooded the main city substation. Network Rail's Overhead Line Equipment draws power from sources outside of the flooding, so

trains could still run, but the station was closed for safety due to a lack of lighting and there were impacts on signalling systems and operational controls. The ability to respond to these issues was reduced by the loss of power to the Vodafone centre which provides emergency mobile signal coverage. Such reductions in service have wide economic and social impacts due to the impact on people's ability to travel, in this case magnified as there were also flooded roads, closed bridges and cancelled bus services.⁶⁹

Working in partnership

In line with the whole of society approach to resilience, there is value in taking a localised approach to managing climate risks, for example through local resilience forums (LRFs). LRFs plan, prepare and respond to localised incidents and catastrophic emergencies, identifying potential risks and producing emergency plans for incidents in their local communities.⁷⁰ They operate via multi-agency Category 1 partnerships including emergency services, local authorities, and the Environment Agency. LRFs are also supported by Category 2 responders which includes TIOs such as National Highways, Network Rail, TOCs, TfL, airport operators and harbour authorities.

Example: The Infrastructure Operators' Adaptation Forum is a cross-sector working group of infrastructure owners and operators (transport, energy, water, telecoms, waste) and academia, **who share best practice on reducing vulnerabilities between infrastructure systems.** It meets quarterly and is supported by the Environment Agency's Climate Ready team. The IOAF mainly focuses on the reduction of chronic climate risk rather than response to individual acute weather events.

Keadby Pumping Station, near Scunthorpe, improves flood resilience for around 500 square kilometres across North-East England. The station, which protects over 28,000 homes, 30,000 hectares of agricultural land and 22 miles of the M18 and M180 from flooding, needed renewal. National Highways partnered with the Environment Agency to replace Keadby's diesel pumps with electric pumps and reduce the station's carbon footprint. The new pumps will also be safer for fish and eels passing through the station on their natural migration.⁷¹

Keadby Pumping Station protects from flooding:



28,000+
homes



30,000
hectares of agricultural land



22 miles of the
M18 and M180

Case study



National Highways

Collaboration on research is essential. DfT is an active member of the Climate Adaptation Research and Innovation Board (CARIB) and works closely with Defra who lead the UK government's approach to adaptation science. This work includes the development of the evidence base for the CCRA4, cross-sector thinking on interdependencies and the development of adaptation indicators.

Skills and knowledge sharing

Feedback from stakeholders has highlighted the need to enhance adaptation capability and skills within TIOs. This applies at all levels of an organisation, from senior leaders to those involved in the day-to-day delivery of operations. A survey conducted by the University of Birmingham on adaptation training within the transport industry showed 92% of respondents thought transport professionals need additional training to create resilient transport systems.⁷²

There is also an important opportunity for transport operators to collaborate with international counterparts, who have similar climates to the UK and have faced disruption to their transport network following extreme weather events to learn from their response and recovery.

Manchester Airports Group (MAG), which owns and operates Manchester, London Stansted, and East Midlands Airports engages at a local, national, and international level on climate adaptation. MAG participates in the European Aviation Climate Change Adaptation Working Group – a joint international forum organised by ACI (Airport Councils International) Europe and EUROCONTROL every six months. This forum has allowed MAG to further develop its understanding of climate risks across a range of climate scenarios, as well as the interdependencies impacting UK and European aviation networks.

Case study



Manchester Airport Group

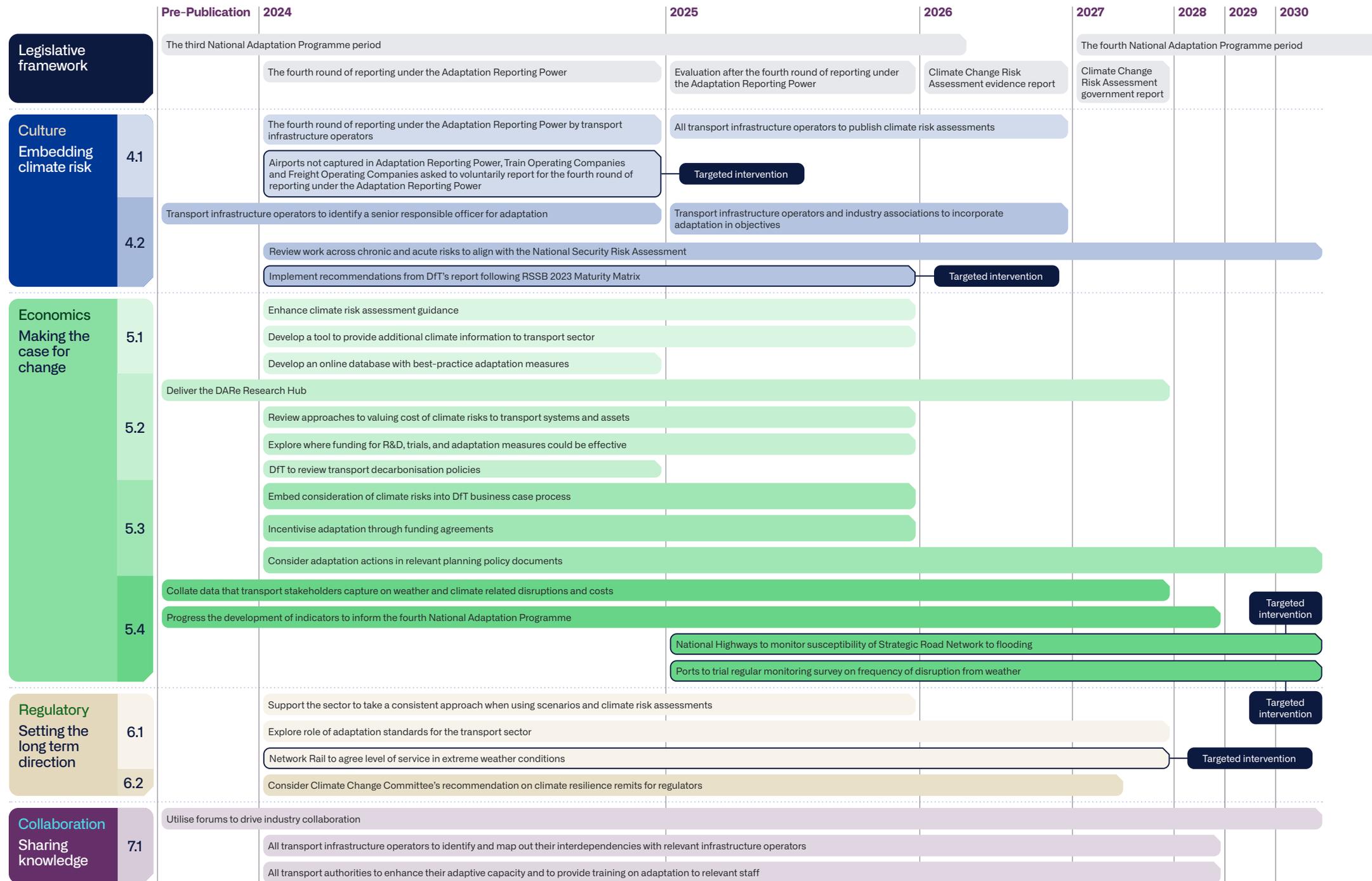
Cross-sector actions

- **From 2023, utilise forums to drive industry collaboration** including the IOAF, Transport Research Innovation Board and the UK Roads Leadership Group.
- **By 2028, all TIOs to identify and map out their interdependencies across the transport sector and with relevant infrastructure operators.** This will include plans for addressing potential points of failure.
- **By 2028, all TIOs to enhance their adaptive capacity by providing training on climate adaptation** and what it means for their infrastructure to relevant staff.
- **Strengthen the role of the IOAF**, as committed to in NAP3, working with Defra and other government departments to share best practice on managing sector interdependencies including the risk of cascading failures.
- **TIOs to consider engaging with international counterparts to learn best practice on response and recovery from extreme weather events**, utilising forums including but not limited to, Conference of the Parties (COP), International Transport Forum (ITF), International Civil Aviation Organisation (ICAO), International Maritime Organisation (IMO), World Association for Waterborne Transport Infrastructure (PIANC), Conference of European Directors of Roads (CEDR), European Organisation for the Safety of Air Navigation (EUROCONTROL), NATO, and OECD.
- **Build capability and skills for adaptation in government**, as committed to in NAP3, working with Defra.

Targeted interventions

- **Explore establishing a framework for cross-aviation collaboration on climate adaptation**, providing a cross industry forum for airlines, major airports, the CAA and NATS that encourages the coordination and engagement of industry members with international forums and best practice on climate adaptation.
- **Rail industry to facilitate sharing best practice** with transport operators as leaders on adaptation.

8 Timeline of adaptation action for transport



9

Consultation approach

We are consulting on this strategy and welcome your views and comments on it. The strategy is informed by the risks identified to transport infrastructure in the Climate Change Risk Assessment.

As set out in the UK Government Resilience Framework⁷³, resilience requires a whole of society approach. As such, effective adaptation of transport will only be achieved through coordinated sector-led action. Through this strategy, government is providing the strategic direction for the transport sector to drive adaptation action, providing the tools needed and fostering cross-sector collaboration.

Government will tailor its approach, identifying common solutions, utilising multiple policy levers and different interventions to overcome the unique challenges of individual transport modes. Ultimately this strategy will enhance adaptation planning across the sector, ensure these plans are delivered and lead to all parts of the sector improving their climate resilience.

It is acknowledged in due course that we will need to consider how we adapt transportation vehicles and consider perceptions of climate hazards. Any potential national security risks of net zero transport policies are not within scope.

Consultation – what we’re asking

We are seeking your views on:

- Whether you support the policies included in the strategy,
- How effective you consider the policies will be at enhancing the adaptation action taken by organisations responsible for transport infrastructure, and
- What more you think government could do to adapt transport infrastructure to the impacts of climate change.

How to respond

The questions we are asking are listed in Annex 2. You can respond to the consultation in three ways:

- Online through a survey, a link to which can be found on the gov.uk webpage.
- By email, to DfTAdaptationTeam@dft.gov.uk
- By posting your response to:

Adaptation Strategy Team
Department for Transport
Floor 1, Great Minster House
London SW1P 4DR

The consultation began on 3 April and will run until 31 May. Please ensure that your response reaches us before the closing date.

When responding, please state whether you are responding as an individual or representing the views of an organisation.

Consultation principles

This consultation is being conducted in line with the government’s key consultation principles.

If you have any comments about the consultation process, please contact:

Consultation Co-ordinator
Department for Transport
Zone 1/29 Great Minster House
London SW1P 4DR

Email consultation@dft.gov.uk

Freedom of Information

Information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the Freedom of Information Act 2000 (FOIA) or the Environmental Information Regulations 2004.

If you want information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a statutory code of practice with which public authorities must comply and which deals, amongst other things, with obligations of confidence.

In view of this it would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information, we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the department.

The Department will process your personal data in accordance with the Data Protection Act (DPA) and in the majority of circumstances this will mean that your personal data will not be disclosed to third parties.

Privacy Notice

The Department for Transport (DfT) is carrying out this consultation to gather feedback on the Transport Adaptation Strategy. This consultation and the processing of personal data that it entails is necessary for the exercise of our functions as a government department. If your answers contain any information that allows you to be identified, DfT will, under data protection law, be the controller for this information.

As part of this consultation, we're asking for your name, email address and organisation. This is in case we need to ask you follow-up questions about any of your responses and to enable us to understand the context of your response. You do not have to give us this personal information. If you do provide it, we will only use it for the purpose of asking follow-up questions and for understanding the context of your response. We will not use your name or other personal details that could identify you when we report the results of the consultation.

To receive this information by telephone or post, contact us on 0300 330 3000 or write to Data Protection Officer, Department for Transport, Ashdown House, Sedlescombe Road North, St Leonards-on-Sea, TN37 7GA.

Your information will be kept securely within DfT and destroyed within 12 months after the consultation has closed. More information about DfT's privacy policy can be found at: www.gov.uk/government/organisations/departments-for-transport.

Annex 1

State of the sector

The legislative framework

The Climate Change Act 2008 sets the legal framework for addressing climate change in the UK, by reducing the greenhouse gas emissions produced and adapting to the impacts of climate change.

For adaptation in England, there are three aspects to the legislation:

Climate Change Risk Assessments (CCRA)

are five-yearly assessments of the risks of climate change to the UK. The risk assessment considers UK-wide climate risks and opportunities cutting across multiple sectors of the economy.

National Adaptation Programmes

are produced every 5 years by government and identify proposals and policies to meet the government's objectives in relation to adaptation, with those objectives being informed by the risks identified in the CCRA.

The Adaptation Reporting Power

gives the Secretary of State for Environment, Food and Rural Affairs (Defra) the power to require infrastructure providers and bodies with functions 'of a public nature' to submit a report every 5 years on how they are addressing the impacts of climate change on their business.

Defra is the overall lead government department for domestic adaptation to climate change, responsible for the adaptation requirements set out in the CCA 2008. Each government department leads their sector's adaptation action by managing the relevant risks. Details about how each of these aspects of the CCA 2008 influence the transport sector is set out below.

The CCC publishes biennial reports to UK Parliament on progress in adapting to climate change. The most recent report was in March 2023 and included an assessment of how well the transport sector is adapting to climate change.⁷⁴ Defra have previously commissioned the CCC to evaluate the reports submitted under the Adaptation Reporting Power, most recently in 2022.⁷⁵

Buckled carriageway on A14, Cambridge, 2022



Climate Change Risk Assessment

As required by the CCA 2008, the government published CCRA3⁷⁶ in January 2022, informed by an independent assessment undertaken by the CCC.⁷⁷ The technical report for the independent assessment identified 61 climate risks and opportunities impacting multiple sectors of society, including risks to businesses, health and lives, buildings and communities, infrastructure and the natural environment.

The following climate risks to transport infrastructure were identified:

- Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures
- Risks to infrastructure services from river, surface water and groundwater flooding
- Risks to infrastructure services from coastal flooding and erosion
- Risks to bridges and pipelines from flooding and erosion
- Risks to transport networks from slope and embankment failure
- Risks to subterranean and surface infrastructure from subsidence
- Risks to transport from high and low temperatures, high winds, lightning

Source: Sustainability West Midlands (2021) Transport Sector Briefing. Findings from The Third UK Climate Change Risk Assessment Technical Report [Betts, R.A., Haward, A.B. and Pearson, K.V.(eds.)]. Prepared for the Climate Change Committee, London.



National Adaptation Programme

In July 2023 the third National Adaptation Programme (NAP3) was laid in Parliament. NAP3 marks a step-change in the UK government's approach to climate adaptation, with a focus on enhanced ambition, implementation and evaluation.

Actions were identified across the transport sector to address the risks in CCRA. The development of this strategy was a key action in NAP3, committing to take a holistic approach to addressing the transport-related risks in CCRA3. The strategy will maintain the momentum and focus on adaptation in the five years between national adaptation programmes, supporting progress and ambition.

Adaptation Reporting Power

The CCA 2008 introduced the Adaptation Reporting Power (ARP), a legislative lever designed to ensure that climate risks are being considered across the economy and that action is being taken to address them. The Secretary of State for Defra can require infrastructure providers and bodies with functions 'of a public nature' to submit a report every 5 years on how they are addressing the impacts of climate change on their business.⁷⁸

In 2011, reports were mandated under the ARP. Subsequent reports, however, have been provided on a voluntary basis rather than in response to a legally binding direction under the ARP. This has built a collaborative approach between government and industry and allows for a degree of flexibility of reporting by different sectors. DfT works closely with Defra to secure reporting from transport operators, industry bodies and regulators.

The strategy for the fourth round of climate adaptation reporting under the Adaptation Reporting Power was published in NAP3. Defra have invited organisations in line with that strategy.

The fourth round of reporting will operate on a shorter timescale than previous rounds, in order for reports to more effectively inform the next CCRA. This will help to maximise its value to both government and the transport sector.

Newhaven, 2020



In addition to the requirements under the CCA 2008, the following government policies form the foundation of our approach to adaptation and resilience.

UK Government Resilience Framework

The Cabinet Office leads the UK government's approach to resilience, including the 2022 publication of the UK Government Resilience Framework. This sets out the government's plan to strengthen the systems and capabilities that underpin our collective resilience to all risks, including climate change. The framework primarily outlines action for England and the UK in areas where responsibilities are reserved to the UK government.

The framework is built around three core principles: that we need a shared understanding of the civil contingency risks we face; that we must focus on prevention and preparation; and that resilience requires a whole of society approach. These principles are underpinned by a package of measures to broaden and strengthen the resilience system, including actions to strengthen the assessment and management of risks, as well as the ability of the whole of society to respond to them.

The Cabinet Office is responsible for setting the strategic direction for government's policy approach to Critical National Infrastructure (CNI), with lead government departments. This includes the Department for Transport, which is responsible for sector governance, assurance and identification of CNI systems, and for policy, legislation and guidance which improves security and resilience of their sectors.

National Risk Register

The government published the 2023 National Risk Register (NRR)⁷⁹ which sets out 89 of the most serious risks that would have a significant impact on the UK's safety, security or critical systems at a national level, including climate risks such as wildfires. It also includes information on what is required to respond to and recover from the emergency, should the risk materialise.

In line with the UK Government Resilience Framework's commitment to develop a shared understanding of the risks we face, the NRR provides more information from the government's internal and classified National Security Risk Assessment than ever before, providing greater transparency. A new digital National Risk Register tool has also been launched to make the information more accessible to businesses, operators, and the public.



How is the transport sector already responding to climate change?

This section outlines what we mean by transport infrastructure, the organisations responsible for managing the risk of climate change – whom we call transport infrastructure operators (TIOs) – and the positive action TIOs are already taking to respond to climate change.

It should be noted that TIOs have different regional boundaries and DfT's responsibility for adaptation varies by mode. For example, DfT has no responsibility for roads outside of England, as roads are a devolved matter. However, aviation policy is largely a reserved matter, while planning and surface access policies are devolved.

Rail sector

Passenger and freight services on Britain's railway are provided by train and freight operating companies on infrastructure owned and maintained by Network Rail. Network Rail is a non-departmental public body which manages Britain's railway infrastructure, including 20,000 miles of track, 30,000 bridges, tunnels and viaducts, and thousands of signals, level crossings and stations.⁸⁰

Many climate risks have the potential to impact the railways including from slope and embankment failure, flooding and coastal erosion, high temperatures which can cause rail tracks to warp, and storms or high winds which can cause debris to obstruct or damage tracks. It is the responsibility of rail infrastructure managers, including Network Rail and others such as HS2 and Transport for London (TfL), to manage these risks to their infrastructure. Network Rail, HS2 and TfL all regularly report on adaptation to government.

As a public body, Network Rail receives its funding from DfT. The Secretary of State for Transport set out his objectives for Network Rail's operation, maintenance, and renewal of railway infrastructure between 2024 and 2029 in the 2022 High-Level Output Specification⁸¹ (HLOS) – tied to a £44.1 billion funding settlement. The HLOS requires the rail network to be as resilient as possible to the effects of climate change and extreme weather. Network Rail produces regional Weather Resilience and Climate Change Adaptation (WRCCA) strategies to inform how it maintains, updates and improves rail infrastructure.

The rail sector is comparatively advanced in adaptation planning. Analysis by the CCC found that the rail sector was one of only five sectors across the economy to have credible policies and plans to adapt to a changing climate. However, the CCC found that there is mixed progress on the implementation of these policies and plans. CCC also noted an increasing impact on rail infrastructure from heat and wind compared to their previous assessment.

In addition to designing regional adaptation pathway strategies as part of its WRCCA plans, Network Rail committed in NAP3 to:⁸²

- upgrade physical infrastructure by investing in earthworks and drainage systems through the current funding period, known as Control Period 6 which spans 2019 to 2024, and into Control Period 7 (2024 to 2029).

- implement recommendations from the Rail Accident Investigation Branch report into the 2020 Carmont derailment, and the Mair⁸³ and Slingo⁸⁴ reports following this incident into earthworks management and weather science respectively, over the NAP3 period and beyond.
- implement recommendations from the extreme heat taskforce reports following the July 2022 heatwave, based on availability of funding.

To support the sector's ongoing approach to adaptation, the RSSB led a sector-wide Maturity Matrix project in 2023 looking at leadership across rail organisations to ensure structures are in place to address climate risks and develop action plans for improvement, increasing adaptive capacity in the industry.

Roads and highways sector

The ubiquitous nature of the highway network in England means it is exposed to all of the transport related risks identified in the CCRA. As the risks and vulnerability of the network varies by location, the relevant highway authority is responsible for identifying and addressing the risk to their assets. All highways authorities, including National Highways, are transport infrastructure operators.

National Highways is a government-owned company responsible for operating, maintaining, and improving England's strategic road network (SRN). This is comprised of motorways and major A roads in England, as well as associated assets such as bridges, tunnels, and signage. The SRN is the most heavily used part of the national road network, carrying a third of all traffic and two-thirds of all freight.

Adapting to climate change to ensure safety and a high level of service is an explicit component of the licence under which National Highways carry out their duties. For example, National Highways continue to deliver a safety programme, as set out in the second Road Investment Strategy, which seeks to enhance all-weather resilience of the SRN, to minimise the risk of incidents and their impact on road users.

National Highways also regularly report on their progress on adapting to climate change. CCC analysis identified the SRN as having a well-developed strategic adaptation plan. However, the CCC found that there is mixed progress on the implementation of policies and plans. Overall road condition of National Highways-managed roads is unchanged since the CCC's previous assessment in 2021. The condition of 'critical' road structures is slightly improving, but average condition of all structures is declining.⁸⁵

Local highway networks are managed by the relevant local authority and some London roads are managed by TfL. Local highway authorities have a duty under Section 41 of the Highways Act 1980 to maintain the highways network in their area however the Act does not set specific standards of maintenance. This includes the maintenance of walking and cycling infrastructure such as footways. Local highway authorities are responsible for implementing adaptation measures and funding them from their highway maintenance funding provided by DfT.

Most highway authorities are not as advanced as other parts of the transport system in adapting to climate change. Although some may report as part of the wider local authority pilot in the fourth round of ARP, they have not reported nor been invited to do so in previous rounds. The CCC 2023 Progress Report noted a lack of credible adaptation plans for the local road network.⁸⁶ In NAP3, DfT committed to work with the UK Roads Leadership Group to devise a framework for local authorities to implement the extreme weather recommendations from recent incident reports by the end of 2024. This will go some way in supporting local authorities to respond to extreme weather events but much more is required if they are to take a strategic approach to managing the risk of climate change on their networks.

Aviation sector

The UK aviation sector plays a critical role in ensuring international and union connectivity, while also contributing significantly to the UK economy through the movement of passengers and freight.

The UK aviation sector operates in the private sector; therefore, each business is responsible for managing their own operations and commercial entities to ensure resilience across a range of climate scenarios. The sector is regulated by the Civil Aviation Authority (CAA) who ensure safety and provide guidance on operations, whilst DfT set the policies and legal framework that industry must operate within.

The UK aviation sector is exposed to a number of climate risks which have the potential to create challenges for operations, infrastructure, and business. These risks can range from severe winter weather such as snow and storms to extreme heat affecting air density and developing thunderstorms. These risks will have varying impact to aviation operations and infrastructure depending on location and airport characteristics.

Many parts of the UK aviation sector are already undertaking processes to respond to the changing climate, including regular risk assessments across their organisations. UK airports, airlines and NATS also maintain robust contingency plans in the event of severe weather, such as standing up command structures and enhancing monitoring of operations to maintain safety.

Major UK airports, NATS and the CAA report under the Adaptation Reporting Power. This includes reviewing existing infrastructure and assets alongside maintenance schedules and mitigations in place for severe weather conditions. However, as this process is determined by individual transport infrastructure operators, the level of data for airports and NATS are varied. Information is held in various strategies and documents and is sometimes incomplete. This prevents a full picture of how well adapted the aviation sector is to climate risks.

In NAP3, DfT committed to working closely with the UK aviation sector to encourage them to undertake climate risk assessments and further embed their findings into business planning and operating procedures ahead of the fourth round of reporting in 2024.



Doncaster Airport during 'Beast from the East', 2018

Ports

Ports provide a crucial entry and exit point for goods and people arriving in or leaving the country. Around 95% of British imports and exports in goods are moved by sea, including 25% of the UK's energy supply and 48% of the country's food supplies.⁸⁷ Therefore, the resilience of ports is particularly important for the integrity of supply chains and transportation of critical goods across the UK. Ports include landside infrastructure such as docks, wharfs, cranes, and cargo storage, as well as seaward infrastructure including aids to navigation, moorings, and navigable channels.

Ports across the UK operate in a competitive market in the private sector, servicing and supporting specific customers. Their success as businesses is dependent on being able to respond and adapt to a changing economic and environmental landscape.

Given their inherent location, ports can be exposed to significant risk of coastal flooding, particularly along the east coast of England, which can disrupt port operations and the road and rail connections needed for onward transport of goods. High winds can also lead to the suspension of port and vessel operations.

Many ports in England and Wales are already responding to changing weather patterns through climate adaptation reporting and regularly reviewing their processes. Each port is unique and faces different challenges when adapting to climate change. As with airports, the risk assessment process is determined by individual ports and therefore the information provided is varied and sometimes incomplete. This prevents a full picture of how well adapted the ports sector is to climate risks and limits the ability to identify where further action is required.

The Maritime and Coastguard Agency (MCA) and lighthouse authorities also undertake climate adaptation reporting to ensure they can maintain their duties with regards to navigation and seafarer safety in a changing climate.

In NAP3, DfT committed to work with the ports sector to develop a regular monitoring survey to gather information on the frequency of disruption to port operations from weather. Further work is required to understand the direct impacts of climate change on the ports sector and the knock-on impacts to the UK's supply chain and freight systems.

Transport regulators

Some TIOs are regulated by transport regulators. The responsibilities are different for each regulator and no regulator specifically has climate resilience and adaptation within their remit:

- The Office of Rail and Road (ORR) has safety and economic regulatory duties for Britain's railway along with monitoring and enforcing the performance and efficiency of National Highways, who operate England's strategic road network. The ORR does not have a legislative mandate for climate resilience however climate resilience is integrated into performance measures for Network Rail and National Highways.
- The CAA works to ensure safety standards in the aviation industry are met and that security risks and the environmental impacts of aviation are effectively managed.
- The maritime sector does not have a regulator. Navigational safety is managed by lighthouse authorities and the MCA enforce standards including for ship safety and security.

Systems that rely on transport infrastructure

As well as considering transport as a system, we must also consider the networks that are built around the transport system including freight, supply chains and border control.

The multi-modal freight and logistics sector is critical to every supply chain into, across and out of the UK and is fundamental to our economic wellbeing. Supply chains rely upon a network of road, rail, air and maritime freight infrastructure and routes, with goods transferred, consolidated, or disaggregated at ports, airports, rail freight interchanges and warehousing for onward transport to the end customer.⁸⁸ The COVID-19 pandemic highlighted the vulnerability of the network to shocks and to the importance of building resilience within the sector. With a reliance on all modes of transport, the freight and logistics sector has a strong interest in effective adaptation to climate change.

The Future of Freight Plan⁸⁹ set objectives for a freight and logistics sector that is economically efficient, reliable, resilient, and environmentally sustainable. It also included an action to model the vulnerabilities of the freight system from climate change and develop adaptation plans to ensure it can withstand a changing climate, both in the UK and globally.

As a small island nation, the UK is dependent on our border to deliver the food, fuel, and materials we need to prosper and promote economic growth. The COVID-19 pandemic and resulting global supply chain issues demonstrated the importance of ensuring that passenger and freight flows across the border are as resilient as possible.

In December 2020 the government published the 2025 UK Border Strategy⁹⁰ which set out the government's ambition to have the most effective border in the world. The strategy aims to simplify and streamline border processes to facilitate international transport, with an ambition to digitise border processes and encourage greater border fluidity. A key element of this is establishing resilient 'ports of the future' at border crossing points to make the experience smoother and more secure for passengers and traders, while better protecting the public and environment.

In January 2024, government published the first Critical Imports and Supply Chains Strategy⁹¹ setting out government's further steps to ensure access to the vital goods and materials needed for the UK's prosperity both now and in the future. It includes a programme of work to look at the risks to critical imports and supply chains, posed by climate change and develop policy measures to respond.

Summary

While there is some planning for adaptation underway, this is not consistent across the sector and is not being translated into action at sufficient pace. As transport is a system there is limited benefit of only some parts of the system being well-adapted. For example, most people rely on the local road network to access their homes, schools and workplaces, and to connect to the railways, motorways and airports. Therefore, we need all aspects of the transport system to be resilient to climate change if we are to stay connected.

Annex 2

Consultation questions

Personal details

- Q1: What is your name?
- Q2: What is your email?
- Q3: Are you responding on behalf of an organisation?
Yes/No

Organisation details

- Q4: What is your job title?
- Q5: What is your organisation's name?
- Q6: What best describes your organisation?
*Transport infrastructure operator/
Transport industry group/Transport
regulator/Transport arm's length
body/Non-transport arm's length
body/Local transport authority/Non-
government organisation/Academia/
Consultancy/Other*

Organisation-only questions

- Q7: Does your organisation currently assess climate risks?
Yes/No/Don't know. Please explain your response.
- Q8: Do climate risk assessments currently inform your organisation's operational plans, long-term planning and investment decisions?
Yes/No/Don't know. Please explain your response.
- Q9: Does your organisation currently submit reports to government as part of the Defra-led process known as the Adaptation Reporting Power?
Yes/No/Don't know
- Q10: Does your organisation currently measure the impact of extreme weather on operations?
What does your organisation measure, and how is that information used?

Culture: Embedding climate risk

- Q11: Overall, will the actions in 'Culture: Embedding climate risk' make organisations responsible for transport infrastructure more or less likely to report on climate risks?
More likely/No change/Less likely/Don't know. Please explain your response.
- Q12: In your view, what more, if anything, could government do to further encourage reporting on climate risks?

Economics: Making the case for adaptation

- Q13: Overall, will the commitments in 'Providing the tools required' support organisations responsible for transport infrastructure in taking adaptation action?
Yes/No/Don't know. Please explain your response.
- Q14: Overall, will the research commitments in 'Building the evidence base' support organisations responsible for transport infrastructure to make evidence-based investment decisions on climate adaptation?
Yes/No/Don't know. Please explain your response.
- Q15: Overall, will the actions in 'Incentivise action' support organisations responsible for transport infrastructure to embed adaptation into projects, policy and/or schemes?
Yes/No/Don't know. Please explain your response.
- Q16: Overall, will the commitments in 'Measuring progress' help organisations responsible for transport infrastructure in measuring progress on adaptation?
Yes/No/Don't know. Please explain your response.

Regulatory: Setting the long-term direction

- Q17: Overall, do you support or oppose the actions in the strategy aimed at standardising the approach to climate adaptation?
Support/Oppose/Don't know. Please explain why you support or oppose the actions.
- Q18: What role, if any, would you like government to take in setting climate adaptation standards, including why?
- Q19: Do you support or oppose a review of transport regulators' remits regarding climate adaptation?
Support/Oppose/Don't know. Please explain your response and provide your suggestions, if any, as to how this review should occur.

Collaboration: Sharing knowledge

- Q20: Overall, will the actions in 'Working in partnership' support organisations responsible for transport infrastructure to expand their capability on climate adaptation?
Yes/No/Don't know. Please explain your response.
- Q21: Overall, will the actions in the strategy help organisations, understanding of interdependencies across different infrastructure?
Yes/No/Don't know. Please explain your response.

Final comments

- Q22: What, if any, further comments do you have on the transport adaptation strategy?
- Q23: Any other comments

References

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