

**Highways England**  
Climate Adaptation Risk Assessment  
Progress Update - 2016

November 2016

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# Foreword

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Highways England is the new company set up to operate and improve the nation's strategic road network. Comprising over 4,300 miles of motorways and major A-roads, the network is one of the country's most important infrastructure assets. A resilient and effective strategic road network is a vital part of a strong growing economy. It is our duty to keep it safe and operable by addressing risks posed by climate change. This Climate Change Adaptation Progress Update is our first such publication.

This report highlights to our stakeholders the work we have been doing to adapt, and the plans we have in place, to address the risks we identified through our risk assessment processes. By adapting the way we do things, we will ensure that we continue to deliver a resilient road network for our customers and meet our performance expectations.

The 2015-2020 roads period will be a time of significant investment in our roads. Through this investment, we will improve the condition of the network's assets and increase the network's ability to cope with change. Our assets are designed for a long service life using rigorous standards to produce infrastructure that lasts. The strategic road network is here to stay and it is our responsibility to make sure it will continue to serve our customer's needs both now and into the future.

# 1. Introduction

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Highways England, formerly the Highways Agency, is the new government owned company set up from April 2015 to operate and improve the 4,300 miles of motorway and major A-roads that form the strategic road network. Our primary role is to deliver a better service for road users and to support a growing economy. We recognise that we all have an important part to play in minimising the causes and managing the risks associated with a changing climate. With this in mind, our report focuses on our climate resilience. That is, how we are changing the way we do things and the decisions we make to prepare for the potential effects of climate change.

As a government owned company, we operate under the direction and guidance of the Secretary of State for Transport described in the Highways England Licence<sup>1</sup> and the Department for Transport's Road Investment Strategy<sup>2</sup>. The licence sets out our duties and obligations and states that Highways England should:

*“Adapt its network to operate in a changing climate, including assessing, managing and mitigating the potential risks posed by climate change to the operation, maintenance and improvement of the network”*

Our delivery plan for 2015-2020<sup>3</sup> sets out in detail how we will deliver the strategic vision set out in the Road Investment Strategy, how we will measure our success, and how we will identify future goals and plans to keep improving our customers' and neighbours' experience of the network. The eight areas in which our performance will be measured are:

1. Making the network safer;
2. Improving user satisfaction;
3. Supporting the smooth flow of traffic;
4. Encouraging economic growth;
5. Delivering better environmental outcomes;
6. Helping cyclists, walkers, and other vulnerable users of the network;
7. Achieving real efficiency; and
8. Keeping the network in good condition.

To achieve our objectives in each of these areas, we need to understand how changes in the climate can impact our operations and the network, and then address our vulnerabilities to these risks where we can.

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<sup>1</sup> Department for transport (2015) Highways England: Licence.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/431389/strategic-highways-licence.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/431389/strategic-highways-licence.pdf)

<sup>2</sup> Department for Transport (2015) Road Investment Strategy for the 2015/16-2019/20 Road Period.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/408514/ris-for-2015-16-road-period-web-version.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408514/ris-for-2015-16-road-period-web-version.pdf)

<sup>3</sup> Highways England (2015). Delivery Plan 2015-2020.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/424467/DSP2036-184\\_Highways\\_England\\_Delivery\\_Plan\\_FINAL\\_low\\_res\\_280415.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/424467/DSP2036-184_Highways_England_Delivery_Plan_FINAL_low_res_280415.pdf)

## 2. Background

### Our Climate Change Adaption Strategy

Highways England is committed to understanding and assessing the risks posed to the strategic road network from a changing climate, and taking appropriate management action to mitigate these risks. As the Highways Agency, we developed a climate change strategy and adaptation framework<sup>4</sup> which continues to guide Highways England's adaptation strategy today. The framework provides a consistent approach to assessing and understanding the risks posed to the strategic road network. Highways England's Adaptation Framework Model (see Figure 1) provides a seven stage process that identifies our activities, which will be affected by a changing climate, determines associated risks and opportunities, and identifies preferred options to address them.

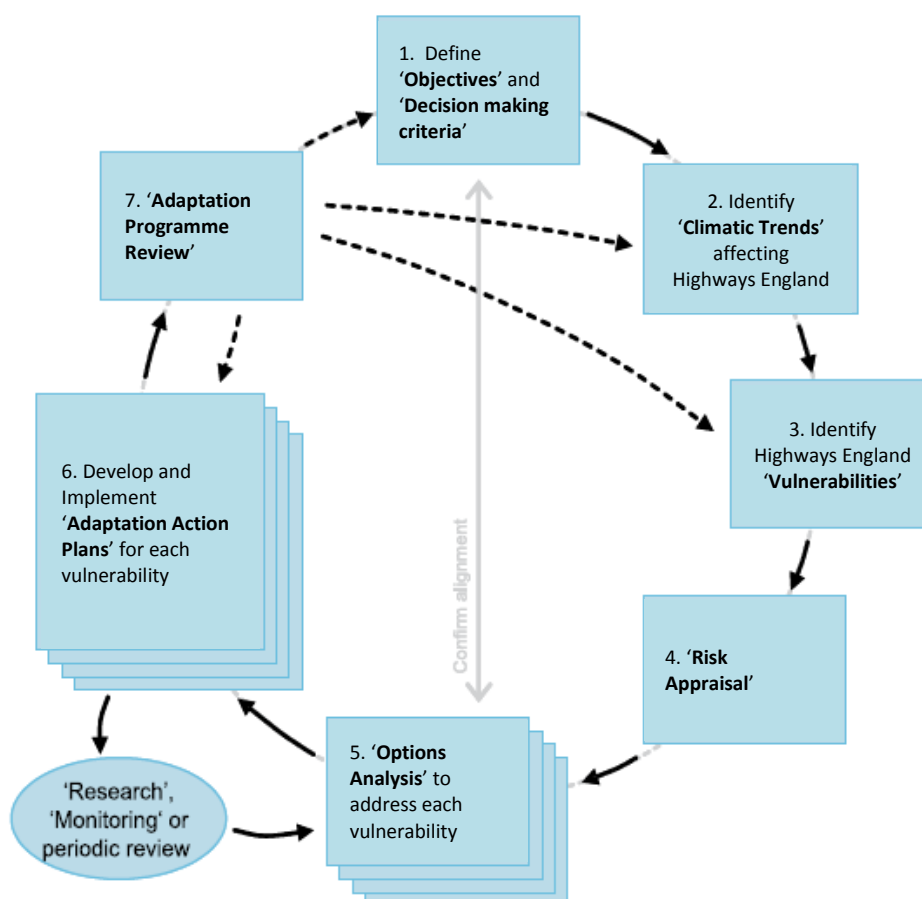


Figure 1: Climate Change Adaptation Framework Model

<sup>4</sup> Highways Agency. Climate Change Adaption Strategy and Framework. [http://assets.highways.gov.uk/about-us/climate-change/CCAF\\_Strategy\\_and\\_Vol\\_1\\_Rev\\_B\\_Nov.pdf](http://assets.highways.gov.uk/about-us/climate-change/CCAF_Strategy_and_Vol_1_Rev_B_Nov.pdf)

## Climate Adaptation Risk Assessments

The Climate Change Act 2008 gives the Department for Environment Food and Rural Affairs (Defra) the power to request that certain organisations report on how they are adapting to climate change. These reports should include:

- The current and future predicted impacts of climate change on the organisation; and
- Proposals for adapting to climate change.

Organisations, primarily from the energy, transport and water sectors, including Highways England (then the Highways Agency), produced their first round reports between 2010 and 2011. The first round of reports provided a detailed assessment of the climate change risks identified by the reporting organisations, as well as the plans and activities that would be undertaken to prepare for these risks.

## Progress Updates

The second round of reporting is being conducted on a voluntary basis and is intended to provide an update on the progress made by first round reporting authorities. New organisations have also been invited to provide full risk assessments. Highways England is voluntarily providing a progress update. This includes a summary of the 2011 risk assessment, an update on adaptation work achieved to date and our plans going forward:

- **Chapter 3-5:** A summary of the 2011 risk assessment;
- **Chapter 6:** A validation of the risk assessment scores;
- **Chapter 7-11:** A progress update on our adaptation journey; and
- **Chapter 12:** Our plans going forward.

This report is intended to fulfil both Highways England's on-going commitment to the adaptation reporting power, and provide our stakeholders, including our employees, supply chain and our customers, with an overview of the work we have achieved to prepare our organisation and the network for the future impacts of climate change.

# 3. Climate Change Trends and Hazards

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The climatic changes likely to affect our business areas and activities over the next century are summarized in this chapter. We have considered the climate change projections and hazards, which have the potential to affect our business and users of the network. Reviewing climate projections forms stage 2 of our climate adaptation framework (Figure 1).

From first-hand experience, we know that some of our services are sensitive to current weather events. These services, plus others, are likely to become increasingly vulnerable as the climate changes in the future. We need to know what those changes are, in order to be able to prepare for them.

## **Weather Event Case Study: A303 at Deptford, Wiltshire. 2014**

The A303 trunk road provides a key strategic route between the M3 near Basingstoke and the A30 near Honiton in Devon, which in turn links to the M5 at Exeter. As it passes through Wiltshire, the A303 is a mix of single and dual carriageway, with one of the dual carriageway sections located at the junction with the A36 at Deptford.

Following an extended period of heavy rainfall over December and into January 2014, large volumes of groundwater began to run off from adjacent agricultural land, on the edge of Salisbury Plain, onto lane 1 of the eastbound A303 just west of its junction with the A36. Due to the exceptionally high groundwater levels in the area, and the rate of flow onto the eastbound carriageway, the floodwater overwhelmed the road's drainage system. The eastbound carriageway was closed to traffic just after 7 a.m. on 9th January, including the eastbound entry slip road from the A36. Eastbound traffic was diverted into Salisbury and then back to the A303, which added some 12 miles to road user's journeys, although there was no significant queuing of traffic on the A303.

By early evening on 10th January Highways England had removed the central reservation barrier and established a contraflow on the westbound carriageway, allowing traffic to remain on the A303 and travel past the flooded area in both directions. Traffic remained unable to join the A303 eastbound from the A36 until 16th January. The contraflow remained in place until late on 21 January, when the groundwater flows had reduced sufficiently to allow the eastbound A303 to safely reopen, some 12 days after it had closed. During this time the contraflow enabled traffic to continue using the A303 without any appreciable delay in either direction.

**Source:** Transport Resilience Review, 2014.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/335115/transport-resilience-review-web.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/335115/transport-resilience-review-web.pdf)

The UK Climate Impacts Programme (UKCP09) provides the latest projections on the future climate of the UK. UKCP09 data informed the Highways Agency Climate Change Adaptation Strategy (2010) and our Climate Risk Assessment (2011) and remains the best available published information. As such, we continue to use UKCP09 projections to inform decision making today.

There is a high degree of uncertainty related to climate projections; we therefore take a cautious approach by considering a high emissions scenarios. Headline projected climate changes suggests that England will experience the following trends up to 2080:

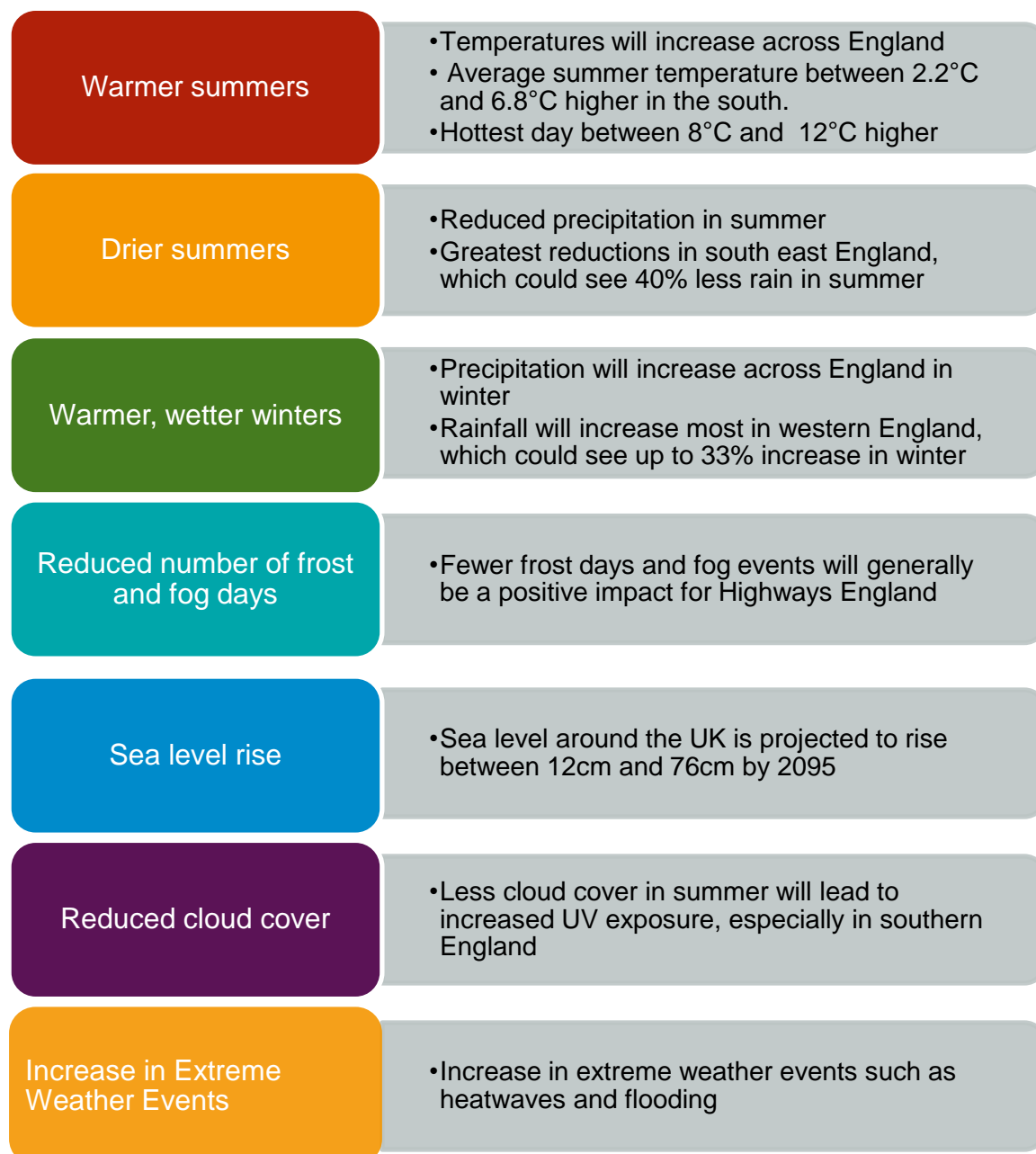


Figure 2: Headline Projected Climate Change Impacts from UKCP09



Using the UKCP09 projections, and research from the Conference of European Directors of Roads<sup>5</sup> (CEDR), we have highlighted climate change hazards with potential to impact our services and network users. We have categorised the hazards into primary climatic changes and secondary climatic change impacts, as shown in Table 1. Climate change hazards were used to identify Highways England vulnerabilities', which are listed in Appendix 1.

Table 1 Climate change hazards

Climate change hazards – Significance to Highways England		
Primary climatic changes	Secondary climatic change impacts	Importance for users
Increase in average temperature	Longer growing season Reduction in fog days in winter Reduction of icy days in winter	Low
Increase in maximum temperature	Extreme summer temperatures	High
Increase in winter rainfall	Flooding Increase in snowfall	High
Reduction in summer rainfall	Reduction in soil moisture	Low
More extreme rainfall events	Flooding	High
Increased wind speed for worst gales	Wind speed more frequently exceeding operational limits	High
Sea level rise	Higher Frequency of extreme storm surges	Low

## Thresholds for Action

Key to optimising the value of UKCP09 is identifying operational or other thresholds that are important to Highways England. It is important to know when these thresholds might be reached in order to determine priorities and timescales for action. Examples might include (but are not limited to):

- Incidence of ground frost;
- Temperatures above which asphalt surfaces rut or stripping occurs; and
- The length of the frost-free season (allowing reduction in winter maintenance standby requirements).

Where the information we have is not currently sufficient to inform the threshold for action, our risk appraisal methodology and options appraisal process identifies the need for further monitoring or research. Subsequently, a programme of research and monitoring actions are underway. For example, we have commissioned a report on the economic impacts of flooding to increase our knowledge in this area.

<sup>5</sup> Conference of European Directors of Roads (2012).  
[http://www.cedr.fr/home/fileadmin/user\\_upload/Publications/2013/T16\\_Climate\\_change.pdf](http://www.cedr.fr/home/fileadmin/user_upload/Publications/2013/T16_Climate_change.pdf)

# 4. Highways England's Vulnerabilities

Stage 3 of the Highways England adaptation framework (see Figure 1) is the identification of vulnerabilities. Vulnerabilities are the Highways England activities that could be affected by climate change. Whilst our assets are receptors of climatic events, it is the ways in which we design, maintain, operate and manage our assets that are defined as vulnerabilities. This distinction has been made to reflect that it is the way that Highways England works that needs to be adapted to meet the challenges of a changing climate, so we can continue to meet the needs of our customers and operate an effective and safe network.

Our list of vulnerabilities (see Appendix 1) presents the (primary) changes to the climate and the (secondary) associated impacts. Each vulnerability was considered, in turn, to identify if and how it will be affected by climate change and whether this will put our objectives, as set out in the Licence and Road Investment Strategy, at risk. Each vulnerability was then assigned into one of the following categories:

- Defining and managing network strategy and planning
- Design and construction of new and replacement assets
- Maintenance and management of existing assets
- Managing network operations
- Internal business management

The vulnerabilities were also assigned to the area of our organisation for which they are concerned with so that the appropriate technical experts could consider them. Table 2 shows the number of vulnerabilities we identified in each of our core business areas. These are the same as those presented in our 2011 risk assessment.

Table 2 - Vulnerabilities identified across each business area

Area	Number of Vulnerabilities Identified										Vulnerability Score (see Chapter 5)				
Drainage	High	High	High	High	High	Low	Low	Low	Low	Low	Low	Low	Low	High	Medium
Geotechnics	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	High	Medium
Pavements	High	High	High	Medium	Low	Low	Low	Low	Low	Low	Low	Low	Low	High	Medium
Structures	Medium	Medium	Medium	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	High	Medium
Traffic Management	Medium	Medium	Medium	Medium	Medium	Low	Low	Low	Low	Low	Low	Low	Low	High	Medium
'Other'	Medium	Medium	Medium	Medium	Low	Low	Low	Low	Low	Low	Low	Low	Low	High	Medium

# 5. Risk Assessment Methodology

This report provides a progress update regarding the adaptation activities we have undertaken, following the completion of our 2011 risk assessment. It does not focus on the risk appraisal methodology itself, as we continue to use the same process. This chapter, therefore, provides a summary of our current risk appraisal process, stage 4 of the adaptation framework (see Figure 1).

Since 2011, transport industry literature on climate change adaptation, such as the Conference of European Directors of Roads RIMAROCC methodology<sup>6</sup>, has helped to validate our approach to risk assessment and compare our identified risks with those of other European road operators. The objectives of our risk assessment methodology, stage 1 of our adaptation framework, are to:

- Provide a means of consistently scoring the vulnerabilities to form a ranking;
- Enable Highways England to determine where to focus efforts in adapting to climate change; and
- Provide a basis for future planning and prioritisation.

To make certain that we continue to meet our objectives, there are several ways in which we need to be able to prioritise risk. Prioritisation is based on a combination of the following and other factors:

- Risks that have the greatest potential effect on users;
- Risks expected to materialise first; and
- Risks with the greatest uncertainty for which further research would be beneficial.

The risk appraisal methodology sets out a series of steps to enable the above priorities to be considered. There are four primary criteria against which all vulnerabilities are appraised, as shown in Table 3. These risk categories are referred to throughout the appraisal process.

**Table 3 Primary criteria for risk appraisal**

Primary criteria	Definition
Uncertainty	Compound measure of current uncertainty in climate change predictions and the effects of climate change on the asset/activity.
Rate of climate change	Measure of the time horizon within which any currently predicted climate changes are likely to become material, relative to the expected life/time horizon of the asset or activity.
Extent of disruption	Measure taking account of the number of locations across the network where this asset or activity occurs and/or the number of users affected if an associated climate-related event occurs. Therefore, an activity could be important if it affects a high proportion of the network, or a small number of highly strategic points on the network.

<sup>6</sup> Conference of European Directors of Roads (2010). [http://www.fehrl.org/index.php?m=32&mode=download&id\\_file=10736](http://www.fehrl.org/index.php?m=32&mode=download&id_file=10736)

Severity of disruption	Measure of the recovery time in the event of a climate-related event e.g. flood, or landslip. This is separate from 'how bad' the actual event is when it occurs, e.g. how many running lanes you lose; it focuses on how easy/difficult it is to recover from the event, i.e. how long it takes to get those running lanes back into use.
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The process for appraising each vulnerability is shown in Figure 3.

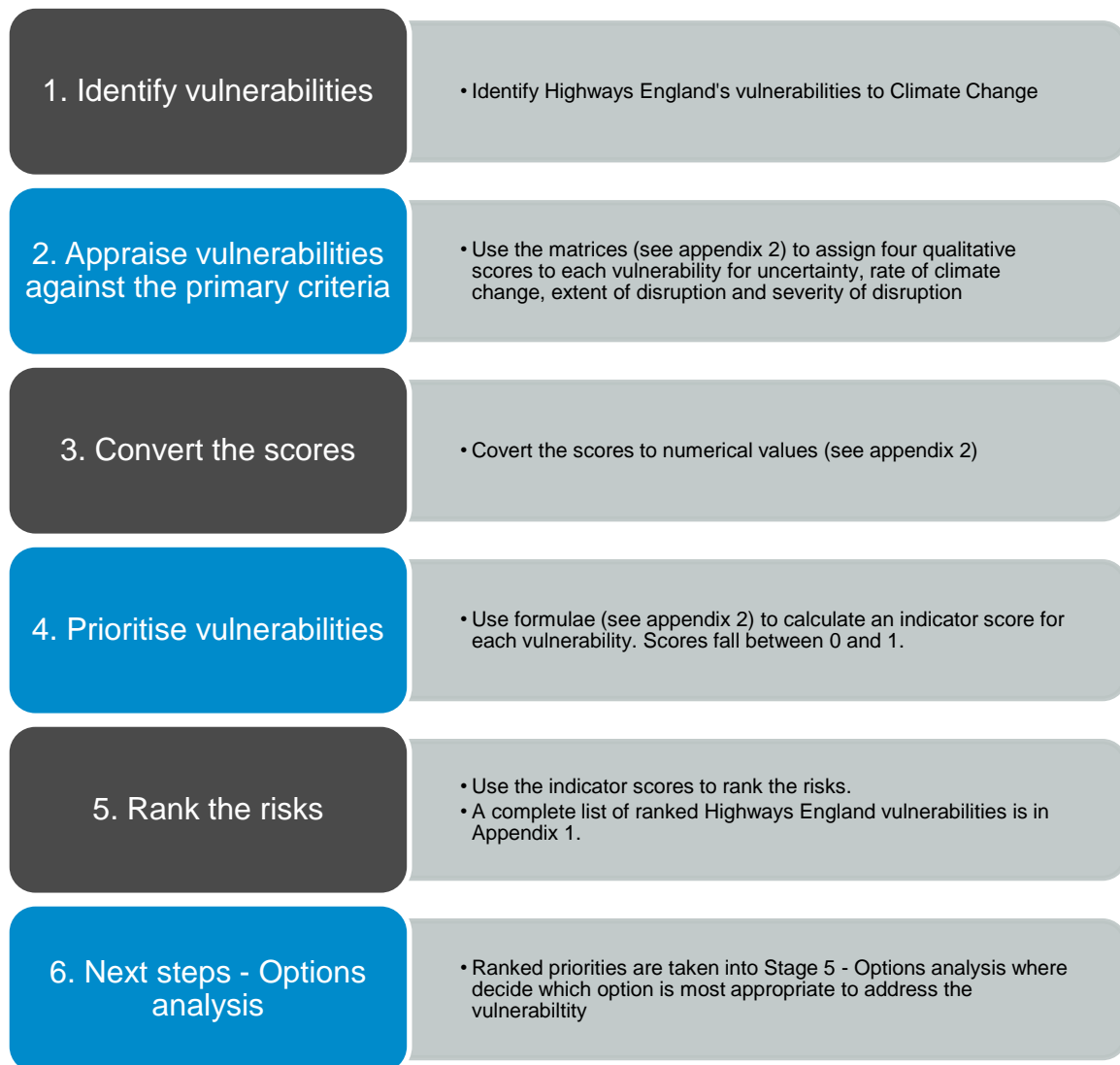


Figure 3 Highways England risk appraisal process (Stage 4 of the Highways England Adaptation Strategy Model)

An example of how we applied the risk assessment methodology to a vulnerability is included in Appendix 3. The output of the risk appraisal methodology is a fully ranked and prioritised list of vulnerabilities which were taken to stage 5 of our adaptation framework, Options Analysis.

# 6. Vulnerability Scores

## Vulnerability Scores

This chapter provides a summary of the vulnerabilities identified through the 2011 risk assessment process, using the methodology described in Chapter 4.

Table 44 contains some of the most highly disruptive and time critical with high confidence vulnerabilities. Consideration of adaptation action planning becomes a priority when the threshold, a score of 0.44 or above, has been reached. These areas of our activities have been the focus for adaptation planning; however adaptation planning has not been limited to these. See Appendix 1 for the full table of vulnerabilities and adaptation actions.

**Table 4: Highly disruptive and time critical vulnerabilities where there is a high confidence the risk will occur together with the target risk ambition following action.**

Category	Area	Aspect	Climate Risk	Action	Target Risk
Design + construction of new + replacement assets + Maintenance and management of existing assets	Structures (including gantries)	Wind actions (loads) applied to	0.67	Monitor	Medium
		Design for increased scour risk	0.67	Do Minimum	Low
		Design of bearings and expansion joints	0.44	Do Minimum	Medium
	Pavements	Design of foundations	0.44	Development of future proof designs	Medium
		Skid Resistance	1.0	Update operating procedures	Low
		Existing Foundations	0.44	Monitor	Medium
		Existing Concrete	0.67	Update operating procedures	Low
	Drainage	Surface Water Drainage	0.44	Development of future proof designs	Medium
		Attenuation	0.44		Medium
		Outfalls	0.44		Medium

## Validation of Vulnerability Scores

As part of our progress update, we have undertaken a validation check of the risk assessment scores from our 2011 risk assessment. This is to check whether the criteria they are based on, or our activities which are being assessed, should change in any significant way.

Our vulnerability scores are based on a discrete number of criteria, as described in Table 3 (see Chapter 5). The validation process highlighted that the key influence on the scoring of

these criteria is the accuracy of climate projections. As outlined in Chapter 3 of this report, the latest climate projections available are UKCP09. Given that the projections have not changed since the 2011 risk assessment, it is not considered necessary to revisit the risk scores based on the criteria which make up the scores.

The validation process did highlight however, that since the 2011 risk assessment was completed, a significant change has occurred to Highways England. We are now a government owned company rather than a government agency. This has resulted in changes to the structure of our organisation and the objectives we work towards; although it must be noted this has not changed the boundaries of our control and the areas for which we are responsible.

In light of our organisation's revised objectives, an internal review has been held to ensure the current list of vulnerabilities is appropriate to Highways England as an organisation and to check if any new vulnerabilities need to be added. The result of this review was that the current list of vulnerabilities is still considered sufficient and appropriate for Highways England.

# 7. Options Analysis

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A Highways England technical specialist was assigned to each vulnerability, to identify potential adaptation options.

For each vulnerability, six adaptation options were considered using the broad themes outlined below. These are similar to the measures identified by the ROADAPT guidelines<sup>7</sup> as the 'building blocks of an adaptation strategy':

- Do minimum;
- Monitor;
- Update operating procedures;
- Development of future proof designs;
- Develop contingency plans; and
- Retro-fit solutions.

A systematic evaluation process was then applied to all options, to identify the most effective actions to address and minimise the risk to the vulnerability.

Appendix 1 provides the full list of climate change vulnerabilities identified in the 2011 Climate Change Risk Assessment and the corresponding adaptation actions chosen to address them. An explanation of the decision making process and an example of each of the adaptation options are provided below.

## Do minimum

After completion of the options analysis process, a number of vulnerabilities were considered to already have sufficient measures in place that address this risk. It is often the case that the requirements placed on our construction and maintenance supply chain are already rigorous enough, and historical design practice has often been to err on the side of caution. Therefore, in instances where a 'do minimum' approach has been selected, the thresholds or tolerances involved are considered already suitable to cope with the current climate change projections.

**Example from Geotechnics:** An increased frequency of soils and sub soils drying out, followed by increases in extreme precipitation, could destabilise material and lead to erosion. This is not considered a significant risk in the design and construction of new and replacement Geotechnics assets, because erosion at present is limited to a few isolated areas. Existing specifications allow for the use of topsoil retention systems where deemed relevant and any risks are already addressed on a project specific basis.

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<sup>7</sup> Conference of European Directors of Roads (2015). Road for today, adapted for tomorrow – Guidelines. [http://www.cedr.fr/home/fileadmin/user\\_upload/en/Thematic\\_Domains/Strat\\_plan\\_3\\_2013-2017/TD1\\_Innovation/I1\\_Research/TGR\\_TPM/Transnational\\_calls/CEDR\\_Call\\_2012/CEDR%20Call%202012%20Climate%20Change/ROADAPT/ROADAPT\\_integrating\\_main\\_guidelines.pdf](http://www.cedr.fr/home/fileadmin/user_upload/en/Thematic_Domains/Strat_plan_3_2013-2017/TD1_Innovation/I1_Research/TGR_TPM/Transnational_calls/CEDR_Call_2012/CEDR%20Call%202012%20Climate%20Change/ROADAPT/ROADAPT_integrating_main_guidelines.pdf)

## Monitor

Monitoring was considered the most appropriate option for vulnerabilities where we do not yet have sufficient data to inform other actions. By monitoring the situation we will increase our understanding of the vulnerability and the opportunities that exist to address it.

**Example from Pavements:** During extended periods of hot, sunny conditions, asphalt can become susceptible to permanent deformation affecting profile. In the case of hot rolled asphalt surface course (not used at present on the trunk roads) with added pre-coated chippings, this may affect texture depth. The thin surfacing materials in the current standard are considered adequate to meet the impact of climate change as they are not susceptible to the projected increases in temperature. However, to ensure robustness of the standards on surfacing materials, we research how these materials are performing on the network by monitoring the performance of thin surfacing. A small group of experts visit various sites to examine their relative performance, including the climate change impact on the material's behaviour. The main purpose of this research is to ascertain the factors and thresholds involved which cause the sudden failure of thin surfacing.

## Update operating procedures

Updating operating procedures involves changing the way we do things to take account of the impacts of climate change.

**Example from Pavements:** Prolonged periods of dry weather, followed by rainfall, will lead to a reduction in skid resistance due to oil and detritus build-up on the carriageway. Conversely, prolonged periods of wet weather will lead to a reduction in skid resistance due to the wet surface reducing adhesion between tyres and the surfacing. Higher average summer temperatures may also adversely affect skid resistance as measurements for resistance on asphalt surfacing are lower at higher temperatures. A review into the current skid policy to ensure that it is fit for purpose taking into account predicted climate change has been conducted and a new skid policy for maintenance assessments was published in 2015<sup>8</sup>.

## Development of future proof designs

New and improved assets on the network are designed according to technical standards and specifications which are followed by our construction and maintenance contractors. Future proofing these designs involves providing additional capacity or functionality. These updated requirements could apply to all 'designs', e.g. designs for new structures or new roads, as well as the designs for maintenance, renewal and improvement works when these are implemented within the normal cycle for such activities. Typically it will be appropriate to adopt a precautionary approach in future-proofing designs, so that the asset/activity will perform satisfactorily throughout its life in the event of climatic changes.

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<sup>8</sup> Highways England (2015). Design Manual for Roads and Bridges HD 28 Volume 7, Section 3, Part 1. <http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol7/section3/hd2815.pdf>



**Example from Drainage:** Updates are currently being undertaken to the Design Manual for Roads and Bridges (DMRB) guidance to ensure that all new drainage assets are provided on a consistent basis, using updated critical design storm guidance, to assure serviceability and minimise the risk. Provision of clear, unambiguous assessment & design guidance in DMRB Volume 11, Section 3, Part 10 (HD45)<sup>9</sup> and DMRB Volume 4, Section 2, Part 1 (HA106)<sup>10</sup> will ensure consistency of design approach for new and improved assets, providing robust design parameters to accommodate climate change parameters. Implementation of formal guidance will improve network resilience in the event of extreme events. Guidance on the run off from adjacent land is already included in HA106, which allows for run off from external catchments.

## Develop contingency plans

Development of contingency plans involves the pre-planned response for when/if climate change risks are realised so that their immediate effects can be managed. This option is applied where nothing can reasonably be done to mitigate an identified risk, during the period until other measures are put in place, or where there is a residual risk, despite adaptation actions being employed.

Contingency plans have not been considered necessary at this stage for any of the vulnerabilities identified. We will, however, continue to monitor our vulnerabilities and update contingency plans where they are considered necessary and appropriate.

## Retro-fit solutions

A retro-fit solution is proactively applying modifications to existing assets/activities outside of the 'normal' cycle for renewal/replacement. For example, replacing/fitting additional equipment or components or providing additional provision/capacity to existing assets before its renewal/replacement becomes critical. Retrofitting could potentially be applied everywhere on the network, or just at high risk sites. Work could start now, or only once climate change effects meet certain threshold criteria. Where the criteria for such a threshold is not yet fully understood monitoring is necessary.

Through the options analysis process, we have not yet identified a situation where retro-fitting has been considered the most appropriate option available. Highways England has a programme of regular renewal and improvement schemes in place; therefore retro-fitting is unlikely in many cases to be the most cost effective option of adaptation.

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<sup>9</sup> Highways England (2015). Design Manual for Roads and Bridges HD45 Volume 11, Section 3, Part 10. <http://www.standardsforhighways.co.uk/ha/standards/dmr/vol11/section3/hd4509.pdf>

<sup>10</sup> Highways England (2004). Design Manual for Roads and Bridges HA106 Volume 4, Section 2, Part 1. <http://www.standardsforhighways.co.uk/ha/standards/dmr/vol4/section2/ha10604.pdf>

## 8. Adaptation Plans

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The outcome of the options analysis process was the creation of adaptation plans. These draw together the preferred options that would be taken forward from the categories set out in Chapter 7. Each adaptation plan takes the form of a database of actions which is monitored to ensure committed actions are achieved by targeted completion dates.

We have embedded a culture of climate change adaptation planning across Highways England, by giving ownership of the adaptation plans to the areas of our operations at risk from climate change. Figure 4 shows the topics these plans currently cover; the relative size of each circle represents the number of adaptation actions we are currently undertaking related to each topic area:

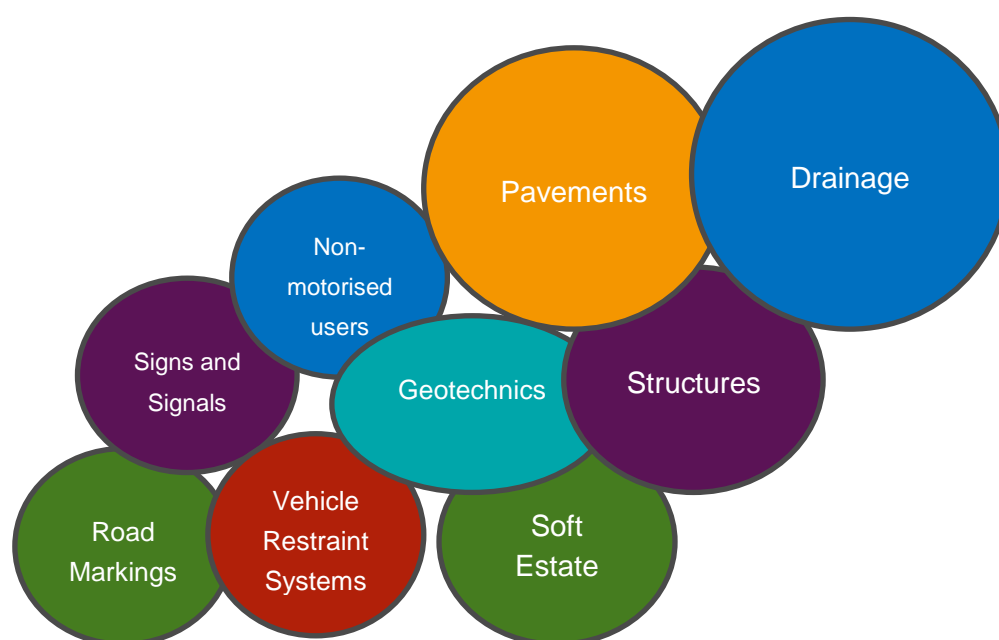


Figure 4 – Adaptation Plan Areas

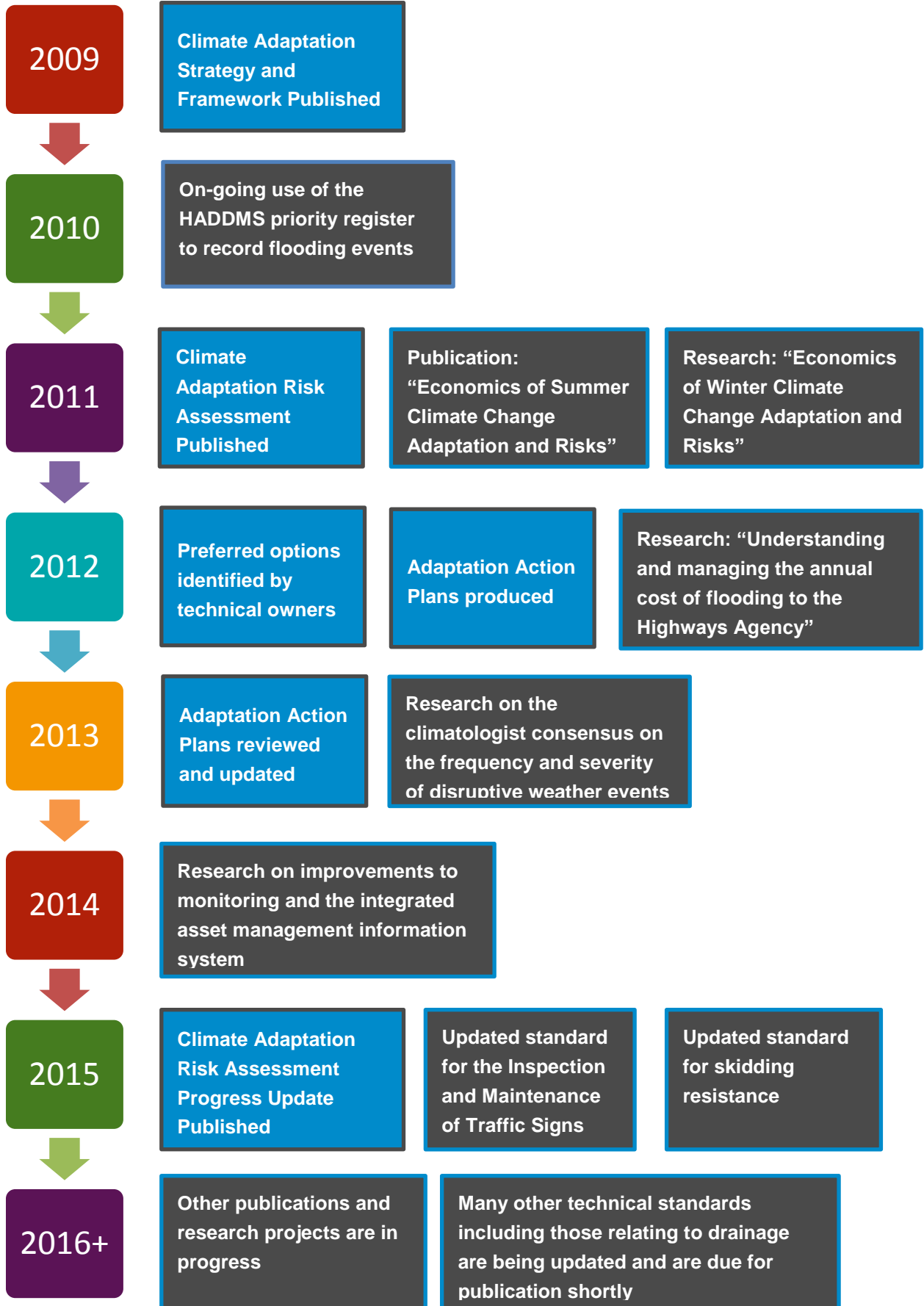
For some risks it was decided that doing the minimum is appropriate because the rigorous design standards or procedures we have are already sufficient to cope with the predicted impacts of climate change. For example following a review, the standards for Vehicle Restraint Systems were considered to be sufficient to cope with the risks posed by climate change and thus a do minimum approach was agreed. In other cases it has been considered necessary to take action to ensure we are prepared. For example, updating the DMRB or the Manual of Contract Documents for Highway Works (MCHW) to ensure new designs and projects are prepared for the future climate.

We will continue to monitor all our vulnerabilities to ensure the option for adaptation that we have chosen remains the most suitable, and that the network remains resilient.

Since publishing our climate risk assessment in 2011, we have made significant progress towards ensuring our strategic road network is resilient to climate change. A timeline of our actions is provided in Chapter 9.

# 9.

# Adaptation Timeline



# 10. Interdependencies

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## Stakeholder Engagement

To effectively manage the wider uncertainties and opportunities that climate change presents, Highways England is committed to maximising value from stakeholder engagement. We have close links with a large number of stakeholders, including owners of other UK infrastructure systems.

Some of our other key relationships include freight organisations, local authorities, technology and innovation partners, sustainability and environmental bodies and motorway service operators. The launch of Highways England has presented an opportunity to strengthen relationships with these existing stakeholders and to work with new ones. Engagement with our stakeholders and neighbours provides us with an opportunity to work together to increase our resilience to climate change and share examples of good practice. To formalise our agreed understanding with our stakeholders we have a number of longstanding Memorandums of Understanding's, for example with Natural England, the Freight Transport Association and the Environment Agency. These Memorandums of Understanding ensure that we have common objectives and provide a resilient and safe network. We also continue to seek to deepen our relationships with our supply chain to deliver outcomes more effectively.

## Environment Fund Partnership Projects

Highways England is delivering a designated Environment Fund that will be used to improve environmental outcomes in a number of areas including flood risk, landscape, carbon, cultural heritage, noise and biodiversity. This will include funding for partnership projects; these are projects where we work with our stakeholders to identify where joint action and funding will be the most effective method to achieve the desired environmental outcome. For example where flooding is an issue on part of the network it may also be an issue for adjoining land owners; by working together we are much more likely to be able to deliver a solution that increases ours and our stakeholder's resilience, both now and into the future.

## European Road partnerships

Contributions have been made to the CEDR research and technical group programmes. Information has been shared among the member road authorities to support the CEDR report on Adaptation to Climate Change published in 2012<sup>11</sup>. Risks relating to climate change have been shared and received, along with proposed adaptation planning and examples of good practice. We also continue to learn from our European counterparts through their contributions to CEDR publications, most recently the 'Roads for today, adapted for

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<sup>11</sup> Conference of European Directors of Roads (2012). Adaptation to Climate Change. [http://www.cedr.fr/home/fileadmin/user\\_upload/Publications/2013/T16\\_Climate\\_change.pdf](http://www.cedr.fr/home/fileadmin/user_upload/Publications/2013/T16_Climate_change.pdf)

tomorrow – guidelines<sup>12</sup>. This report sets out methods and approaches for the climate risk assessment of roads, from which we can make comparisons and align our own risk assessment process where beneficial.

## **National Transport and Infrastructure Systems**

The strategic road network is made up of over 4,300 miles of motorways and major A-roads in England. It makes up just 3% of the total roads in England, yet carries nearly a third of all road traffic and two-thirds of large goods vehicle traffic. The economic and strategic value that the network provides makes it one of the most important infrastructure assets in the UK. The importance of adapting the network for future climate change is therefore of paramount importance to the UK. However, the network, and its resilience cannot be viewed in isolation due the numerous interdependencies that exist between the strategic road network and the wider transport and infrastructure systems.

The risks that climate change poses to infrastructure assets could include, at its worst, severance of infrastructure links and potentially prohibit the safe use of infrastructure. This could necessitate changes in how people use infrastructure and ultimately lead to the need to switch transport mode, alter energy use or limit their use of communications. Highways England needs to understand how impacts on all infrastructure assets, not just the strategic road network, could affect its users and their safety.

Use of the network is facilitated by access from local roads managed by Local Highways Authorities. Furthermore, our customers often travel along motorways and trunk roads to reach the next part of their journey; for example to reach train stations, sea ports or airports. It is therefore important that Highways England and other transport operators are aware of the wider resilience of the transport system and how the implications of climate change for one part of the system can have wider implications. For example a decrease in capacity in one transport mode may result in users choosing an alternative transport method. We must work together with the Department for Transport (DfT), infrastructure owners and transport operators to consider climate change adaptation from the strategic to the local level. In light of this, we have signed a Memorandum of Understanding's with Transport for Greater Manchester to ensure a strategic approach to the management of highways across the city region.

The safe operation of the network involves the use of communication systems to monitor conditions and inform road users. It also involves the use of energy to operate technology assets such as lighting and variable message signs. The continued resilience of the road network is therefore intrinsically linked to the resilience of energy and communications infrastructure. We therefore continue to consider the wider resilience of our operations where possible. For example in the event a control centre in one area being unable to operate, another control centre will temporarily be able to cover both areas.

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<sup>12</sup> Conference of European Directors of Roads (2015). Road for today, adapted for tomorrow – Guidelines. [http://www.cedr.fr/home/fileadmin/user\\_upload/en/Thematic\\_Domains/Strat\\_plan\\_3\\_2013-2017/TD1\\_Innovation/I1\\_Research/TGR\\_TPM/Transnational\\_calls/CEDR\\_Call\\_2012/CEDR%20Call%202012%20Climate%20Change/ROADAPT/ROADAPT\\_integrating\\_main\\_guidelines.pdf](http://www.cedr.fr/home/fileadmin/user_upload/en/Thematic_Domains/Strat_plan_3_2013-2017/TD1_Innovation/I1_Research/TGR_TPM/Transnational_calls/CEDR_Call_2012/CEDR%20Call%202012%20Climate%20Change/ROADAPT/ROADAPT_integrating_main_guidelines.pdf)

# 11. Reviews

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This chapter looks at published reports on resilience and adaptation progress in the transport sector. We intend here to demonstrate how we have taken on board the advice and guidance of such literature to further improve our adaptation programme.

## **Managing climate risks to well-being and the economy – Adaptation Sub-Committee (ASC) Progress Report**

The Adaptation Sub-Committee's Progress Report 2014 is part of a series of reports to assess how England is preparing for the risks and opportunities of climate change and shows how the National Adaptation Programme prepared under the Climate Change Act is being implemented. The report looks at the resilience of national infrastructure including the strategic road network. There are three broad areas where improvement was advised. Below is a brief overview of this advice and a summary of the work that is underway or actions that have been achieved which address these concerns.

**1) Detailed actions plans had not been published.**

Detailed action plans are in place within the relevant business areas. These plans are internal technical documents that record the risk score, options appraisal process and the targeted adaptation option. Appendix 1 of this report provides an overview of the work on-going with regard to each vulnerability.

**2) No Publically available information on resilience spending plans**

As part of the first roads period there will be significant investment to address resilience with a specific focus on flooding and pollution through measures to attenuate and improve flood resilience on the strategic road network. This investment is part of a £300m designated environment fund. We published plans for this fund in our Delivery Plan<sup>13</sup> which noted the following areas of focus:

- Improving resilience to flooding and reducing flood risk to communities adjacent to the network. Activity will focus on addressing all identified high priority flood risk locations recorded in our Drainage Data Management System;
- Improving water quality through better environmental protection and specifically improving surface and groundwater quality by addressing priority locations of known pollution;
- Reviewing opportunities for specific measures to contribute to a coherent and resilient ecological network; and
- Working with our stakeholders to identify opportunities for delivering wider environmental benefits in partnership with other land-owners, and communities.

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<sup>13</sup> Highways England Delivery Plan 2015-2020.  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/424467/DSP2036-184\\_Highways\\_England\\_Delivery\\_Plan\\_FINAL\\_low\\_res\\_280415.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/424467/DSP2036-184_Highways_England_Delivery_Plan_FINAL_low_res_280415.pdf)

### 3) **Progress with implementing resilience measures is not reported for the strategic road network**

This report is intended to report our progress with implementing resilience measures for the strategic road network.

## **Transport Resilience Review – Department for Transport (DfT)**

The DfT's Transport Resilience Review<sup>14</sup>, published in 2014 in response to extreme weather experience during the winter of 2013/2014, provided an independent review of the UK's transport network's ability to cope with extreme weather, a key impact of climate change. The report notes that the majority of the strategic road network was designed and constructed to modern engineering standards, and therefore has a good level of physical resilience to extreme weather compared to other transport infrastructure assets.

The Transport Resilience Review does, however, provide us with specific recommendations to increase our resilience. These included recommendations for Highways England to:

*“Consult with the Freight Transport Association, Road Haulage Association and other affected groups in developing proposals to restrict vulnerable vehicles from using exposed sections of the strategic road network” and “Work with the Met Office to agree how best to utilise the improving granularity of wind forecasts to give the best possible wind forecast information to lorry fleet operators”.*

We are reviewing the effectiveness of trials to identify whether the Commercial Vehicle Incident Prevention Programme could deliver improved management of High Sided Vehicles during high winds.

*“Conduct a flooding risk assessment exercise using the newly updated Environment Agency flood risk maps and other data to identify potential flood risk locations on the strategic road network, to supplement its log of actual flooding events” and “Complete its drainage asset inventory”.*

We are producing a new Flood Risk Strategy. In addition to this, we are also increasing our drainage asset inventory and condition data coverage to better understand the condition of drainage assets on the strategic road network.

*“Review the range and wording of messages displayed on variable message signs” and “Continue to improve and refine the content of its website.”*

We included the objective “To understand the overall information provision that is given to road users about the weather ranging from roadside infrastructure to the winter driving campaign” in our Severe Weather Programme for 2015/16.

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<sup>14</sup> Department for Transport (DfT) 2014. Transport Resilience Review.  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/335115/transport-resilience-review-web.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/335115/transport-resilience-review-web.pdf)



## 12. Conclusions and Next Steps

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Overall, it has been considered that the risks and vulnerabilities set out in our 2011 Climate Change Risk Assessment remain unchanged. Our climate change adaptation review process has highlighted that many of the vulnerabilities identified during the first round report are already being addressed through our current programmes, improvements and planning activities. The review has also, in some cases, identified where this is not the case and has resulted in us undertaking further action to correct this. There are a number of next steps we will now take to continue our efforts to adapt to climate change, as outlined below.

### **Communication**

We are producing a communications plan which will help to continue embedding adaptation in all areas of the organisation and communicate this to those that work with us. We will communicate the work we have done, the work we are continuing to do and encourage future adaptation planning to take place where necessary. The communication plan will also identify how all our staff are able to contribute to this process, by continually questioning and reviewing the way in which we do things.

### **Monitoring the Risks**

To make sure our vulnerabilities are prioritised accurately, we will continue to monitor any changes in climate projections and update our risk scores accordingly.

### **Continue to Adapt**

In many cases, climate change adaptation is inherently considered as part of our current standards, practices and procedures to ensure the resilience of the network. In addition to this, we have a number of specific adaptation actions that are on-going and will be delivered in the near future, as well as longer term research and monitoring which will inform future adaptation. We will continue to maintain and improve a resilient network that continues to serve its customer's needs both now and into the future.