

## Implementing climate change allowances in drainage standards across the UK railway network <sup>[1]</sup>

Image from Climate Adapt about this case study

[2]

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The UK is generally projected to experience increases in extremes of the precipitation regime as a result of climate change, especially in terms of higher occurrence and intensity of heavy summer rainfall events. An important resilience action to mitigate the impacts from such increases is the improvement of drainage management. Climate change resilience within Network Rail, the national railway infrastructure managing authority in Great Britain, is driven by corporate strategic objectives defined by the Weather Resilience and Climate Change Adaptation Strategy (WRCCA), finalized in 2017. Objectives set in the WRCCA are detailed into actions at the rail route level, through individual Route WRCCA plans. The wider sustainable development vision of the Network Rail including lower carbon footprint, lower pollution of air and water, higher energy efficiency and sustainable land management is set out in the Network Rail Sustainable Development Strategy.

Network Rail' published WRCCA plans for all routes cover the whole rail network for the Control Period (2014–2019; CP5). These plans are being updated for the successive Control Period (2019 – 2024; CP6). Recently, three new WRCCA plans have been developed, namely for North West and Central Route, South East Route and Wales Route. The plans reflect upon the impacts from weather variability, regional climate change projections, and actions being taken to increase resilience, including investment in drainage systems and implementation of an Integrated Drainage Management Policy.

### Case Study Description

#### **Challenges:**

The effective control of water is essential for the management of infrastructure to support safe and efficient railway services. Water has a role in many degradation mechanisms that affect infrastructure; such as the scour of bridges and embankments, and the long-term softening of materials that form the Track Support System. Drainage problems can result in speed restrictions or temporary closures of the line, as well as increasing maintenance costs. In the period 2012–2017, frequent and severe flooding was the main weather factor affecting train delays in the UK. According to Network Rail, weather impacts £50-£100 million per year in delays and cancellations alone, with the overall cost being higher when the costs of weather-specific maintenance and repairs are included.

The future challenges for the rail network imposed by climate change are outlined in the UK Climate projections (UKCP) released in the year 2009 (UKCP09), which have been updated in 2018 (UKCP18). The global (60km), regional (12km) and local (2.2km) models provide alternative views of the climate in the future. According to UKCP18, all areas of the UK are projected to be warmer by the end of the 21st century, more in summer than in winter, with increasing frequency of hot spells. Despite overall summer drying trends in the future, data from UKCP Local (2.2km) suggests future increases in the intensity of heavy summer rainfall events. Specifically, UKCP Local suggests significant increases in hourly precipitation extremes in the future. Winter precipitation and the frequency and intensity of winter and summer storms are likely to increase. In the winter months this could mean greater ground saturation, higher groundwater levels, increased run off and higher river levels.

In response to expected precipitation changes Network Rail has developed a coherent policy across the drainage system and has started to improve the asset information held on the drainage system. Network Rail continues to pursue improved assets knowledge, and to seek a clearer understanding of how changes in rainfall intensity and frequency will impact on new asset specification and maintenance regimes. New findings of the future UK climate development indicated in the UKCP18 are reflected in the WRCCA plans for the Control Period (2019 – 2024).

### **Objectives:**

Climate change resilience within Network Rail is driven by the following corporate strategic objectives:

- Understand the current weather resilience, and seek to optimise resilience and enhance adaptation capability;
- Develop a thorough understanding of the potential impacts of climate change in terms of infrastructure performance, safety risks and costs;
- Embed climate change adaptation within asset policies and investment decisions;
- Communicate the role the rail network plays in supporting weather and climate resilience across Great Britain, and support efforts to increase national resilience.

### **Solutions:**

To be effective, railway drainage systems need to be designed and built to appropriate standards, maintained regularly and, when required, improved. The revision and implementation of the drainage standards is a key asset management instrument within Network Rail's drainage policy. The drainage standards adopt a precautionary approach, by increasing the design flow and providing further capacity in new and refurbished drainage systems. The implementation of climate change allowances is a part of the solution for Network Rail to increase weather and climate change resilience.

Network Rail drainage standards have been updated to include allowances for impacts from future climate, according to the recent UKCP18 projections, in the design of railway assets. Climate change allowance is an increase in the capacity of the drainage system to enable it to be effective in future as the weather changes due to global warming. These allowances have been developed and drainage standards updated in line with recommendations for flood and coastal risk management provided by the UK Government, and more specifically by England's Environment Agency.

The drainage standards are applied across the network; however the location-specific nature of weather impacts requires analysis and response at route level to ensure investment in drainage is cost effective. For example, the Scotland Route Weather Resilience and Climate Change Adaptation Plan for the CP5 (Network Rail, 2014) reports on some concrete actions already undertaken:

- The flood site at Dalmarnock Station was remediated through major works by providing an attenuation system.
- The flood site at Drem station was remediated under a Business Plan with a new pipe work and an attenuation pond.
- Remediation of the flood site at Penmanshiel siphon was completed. Initial remediation was provided

through enhanced inspection and cleaning. A major works scheme to raise the wall heads of siphon chamber and install new screens was successively completed. Further enhancement to provide an attenuation pond was implemented afterwards within the CP5 (Control Period 2014-2019) and has already been completed.

The updated plans for CP6 (2019–2024), currently available for 3 out of 8 Routes, report the CP5 progress, set out the plan for the CP6 and beyond. They also update vulnerability and impact assessment taking into account the changes in the Network Rail WRCCA Strategy.

For instance, in the South-East route (Sussex and Kent routes) an additional 20% capacity in drainage designs will be incorporated to allow for expected climate change. Route Drainage Management Plans will be reviewed on annual basis from 2019. A programme of inspection of the Route's drainage is currently underway. The Route plans to spend £40 million on drainage improvements throughout CP6.

### **Importance and relevance of the adaptation:**

PARTFUND\_AS\_CCA;

Additional Details

### **Stakeholder engagement:**

There are three main stakeholder groups involved in the implementation of the Network Rail's Weather Resilience and Climate Change Adaptation Strategy:

- Government and regulators: Department of Transport (DfT), Department for Environment, Food and Rural Affairs (Defra), Environment agency (EA), Scottish Environmental Protection Agency (SEPA).
- Internal Network Rail Stakeholders: Routes representatives in charge of routes asset management including delivery and monitoring of drainage plans, project developers, Weather Resilience Group, Safety Technical and Engineering group etc.
- External stakeholder groups: National Weather Forecast Service, Infrastructure Operators, RSSB – Rail Safety Standards Board, NERC – National Environment Research Council, National Flood Resilience Forum, CIRIA – Construction Industry Research and Information Association.

Key elements of communications and engagement with internal and external stakeholders include:

- Developing a shared understanding of current and future risk, vulnerability and costs associated with weather impacts on the railway
- Facilitating sharing of knowledge, lessons learned and best practice between Routes;
- Reporting to Defra on Adaptation under Climate Change Act (2008)
- Collaborating with Environment Agency/ SEPA and Natural Resources Wales on designing and implementing resilience measures
- Participating in the National Infrastructure Resilience Council, National Flood Resilience Forum, Infrastructure Operators Adaptation Forum; TRaCCA Implementation Group and other discussions.

### **Success and limiting factors:**

Success factors include: (i) Long-term vision and strategy; (ii) Collaborative relationships with stakeholders across governance levels and within the national government; (iii) Robust asset management policies and compliance processes.

The main limiting factors are related to the complexity and extension of the British rail system. Upgrading of current drainage conditions to the new standards will need to be accommodated to the availability of resources, and action will have to be prioritised accordingly. Furthermore, the decisions taken may have system wide implications, as activity on one asset group (such as track, for drainage), may impact on another part of the overall railway system (e.g. signalling).

### **Budget, funding and additional benefits:**

Recognizing additional pressures to the railway induced by climate change, a specific WRCCA Fund will be used

for CP6 (2019–2024) to support implementation of this strategy. The activities and projects eligible to receive a subvention from the fund include:

- Projects that fall outside the day to day functioning of the railway in order to provide additional resilience, including the enhancement of the drainage system on existing infrastructure;
- Detailed analysis of climate change risk and vulnerability;
- Identification and development of innovative resilience technologies and approaches, and testing them through pilot projects
- New decision support tools.

This fund is not intended for any work that should be driven by normal policy or standards, e.g. vegetation maintenance, asset inventories or emergency response/repairs after an event.

It is anticipated that investments through the fund are expected lead to the following direct benefits associated with additional savings:

- Improving passenger transport performance as emergency situations and associated traffic disruptions will be minimized;
- Reducing costs due to cancellation and delays;
- Maintaining weather-related safety risk, reducing maintenance costs, including cleaning up of railway and structural repairs after extreme weather events;
- Implementing decision support and pilot projects (allocation 10-15 % of the total fund).

#### **Legal aspects:**

Network Rail operates under a Network Licence which sets out the conditions under which it must operate. In particular, Licence Condition 1 sets out Network Rail's core obligations to secure the operation, maintenance, renewal and enhancement of the network in order to satisfy the reasonable requirements of persons providing services to railways and funders. This condition also includes some specific obligations for Network Rail to produce a delivery plan, establish and maintain route utilisation strategies (RUSs), and develop asset management policies and criteria to maintain, renew, replace, enhance and develop the assets. There are no specific provisions within the Network License on climate variability and climate change. However, it can be understood that its purpose to secure the operation and the improvement of the network in accordance with best practice includes the need to adapt to changes in climate.

#### **Implementation time:**

Implementation started in 2011. It is continuing in the current Control Period 2014-2019 and will progress in the upcoming Control Period CP6 (2019–2024).

#### **Reference Information**

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##### **Websites:**

<https://www.networkrail.co.uk/communities/environment/climate-change-and...> [4]

##### **Sources:**

UK Network Rail and Borders Railway

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[3] <mailto:lisa.constable@networkrail.co.uk>

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