THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

DEBATE SUMMARY

How can the UK transport network be made more resilient to extreme weather events?

Held at The Royal Society on 22nd October, 2014.

The Foundation is grateful to the BRE Group, the Caparo Group, the Environment Agency, and the Transport Systems Catapult for supporting this debate.

Chair: **The Earl of Selborne GBE FRS**
Chairman, The Foundation for Science and Technology

Speakers: **Richard Brown CBE DL FCILT**
Chairman, Transport Resilience Review, Department for Transport
Doug Johnson
Deputy Director, Applied Science and Scientific Consultancy, Met Office
Jerry England
Group Asset Management Director, Network Rail

MR BROWN outlined the findings of his team's review of transport resilience. Resilience in the UK was so important because the rail and road networks were the most intensively utilized in the world. Heathrow is the world's busiest airport. All modes were used to capacity. They were increasingly dependent on IT networks; quick recovery from disruption was essential because of the effect on just-in-time delivery logistics and public expectations. Existing weather patterns cause extreme disruption; but as they change as a result of climate change – wetter winters, more intense localized rainstorms, hotter, drier summers and rising sea levels – extreme weather events will get worse.

Resilience strategies should cover physical assets which allow traffic to continue to flow; recovery processes when events cause disruption; and communication with passengers and stakeholders so they can make their own plans and choices to diminish the impact of any disruption.

Four principles should be followed to achieve higher resilience: first, a clear economic rationale on what to spend on resilience improvement; second, prioritize according to intensity of use; third, isolate critical nodes where failure can impact other networks (e.g. the Dawlish storm which affected both rail and road networks); fourth, prioritize "resilient networks" nationally and locally (e.g. integrate resilience strategies of strategic national roads and the gritting network developed by local authorities). Resilience should be a core part of asset management. Opex (operating expenditure) for the maintenance of existing assets – should not come second to Capex on new projects – although politicians always preferred the latter.

Analyse clearly the risks to the networks. All modes need to protect IT and power services and work with non-transport agencies to review flood risk. Hazards causing road disruption were snow and ice, and accidents – reduce the latter through better traffic management, but be clear on how to respond quickly to incidents to reduce impact. Local roads were a particular problem because there were 152 local highway authorities with assets of variable condition who set different priorities.

Risks to rail services are mainly from the uncertain condition of 150 year old embankments, danger from trees falling onto the track or trains, vegetation (leaves on track) and signalling systems vulnerable to water or flooding. Ports had to deal with rising sea levels and airports with snow, ice and flooding. Better contingency planning with airlines were now in place. The review's conclusions were that transport operators were generally aware of the problems and had done much work to meet them, but continued further improvements were needed. Particular issues were the uncoordinated responsibilities of local highway authorities and the lack of a national plan to agree a budget for opex and resilience work for interconnected networks.

MR JOHNSON said we must treat climate change seriously. The current rate of increase in global temperatures is unusual – it is not part of a natural cycle. The IPCC fifth assessment report left no doubt: the report asserted that it was 95% probable that the increase in temperature resulted from the rise in the emission of greenhouse gases through human activity. There will be increasing variability of weather, with some years being warmer or colder than others; but unless emissions are limited, summer temperatures in 2040 and 2060 could rise on average by 4°C to 5°C. The risk of a really hot summer similar to the 2003 summer will be doubled. Winters in the UK will be warmer, but with a 20 to 30 per cent chance of cold winters until 2020.

There are likely to be more extreme patterns of daily rainfall – leading to flash flooding - with

hotter and drier summers leading to periods of drought. Sea level rise will continue. These changes will impact strongly on transport networks – rails will buckle, road surfaces deteriorate, electrical equipment could overheat. There will be more flash flooding, landslides, with rivers overflowing; coastal defences will be breeched, more trees will be blown down and speed restrictions will need to be introduced. Drought may lead to subsidence. However, a possible benefit is that there may be fewer days of ice and snow. While network operators are already aware of the risks, the Met Office's aim is to increase the accuracy of forecasting to enable them to understand how and where specific hazards needed to be addressed in order to minimize disruption.

MR ENGLAND said he fully agreed with the other speakers that transport networks faced increased risks because of the effects of climate change. The rail network already had strategies in place to deal with major disruptions. The impressive speed with which the track was reopened after the Dawlish flood, which effectively cut the rail link with Devon and Cornwall, was impressive. The line was reopened in two months at a cost of £35m. This showed that Network Rail could cope with recovery from disruption quickly. But there were many smaller disruptions which had to be dealt with, and it was vital to keep up spending on both prevention of travel disruption and speedy recovery from failures.

Many of the networks assets were over 100 years old; failures were inevitable although it was noticeable that most remained effective – 150 failures of embankments annually, was a small figure given the number and scale of embankments on the rail network.

Disruption cannot be eliminated but effort can be focussed on certain high risk areas, such as providing bigger culverts to reduce flooding, heated conductor rails and putting more effort in reducing trees near tracks. But no work is without problems – environmentalists love trees, heating rails uses carbon dioxide, and bigger culverts can lead to problems in neighbouring rivers, unless there is close coordination of flood management plans. Fortunately, new infrastructure is being built to much higher standards, and so will have resilience built in. The great bulk of the assets are legacies from the past. Contingency plans have been developed for disruptions – reduced services, alternative routes and, above all, better communication with passengers and stakeholders. The key is better use of technology, better understanding of assets, the use of IT and social networks – and innovation. But we still need to build the economic case for further intervention if we are to limit disruptive events.

Participants, in the following discussion, were concerned that the presenters had not made it clear whether there was a real concern that not enough was being done to mitigate the likely effects of climate change, or whether the full scale of the efforts necessary to deal with it, in terms of both resources and public satisfaction, had been realized. Inevitably, there could never be certainty that enough had been done because events were unpredictable, public attitudes changed and there was a lack of knowledge of the condition of historic infrastructure, and resource constraints.

There was, moreover, the problem of 153 local highway agencies, the numerous drainage and river and water authorities, and other agencies whose work should be coordinated with the major transport network operators.

Above all there was a lack of a master plan related to the needs of the existing infrastructure so that it could be managed in such a way as to become more resilient to the effects of climate change. Such plans should consider the governance of all the bodies concerned in transport networks, decide where expenditure was essential because of the effect on the economy (e.g. major logistic routes) and where it had lesser priority (Welsh coastal routes). No one in the room disputed that the risks from climate change were great, but the variability of weather patterns made it impossible to forecast when and how these risks might result in major disruptions.

But new techniques such as performance monitoring of embankments should enable operators to understand better the condition of the assets. The tasks were to prioritize, develop better methods of recovery from disruption, and, understand how the public need and receive information. Participants suggested that engineers concentrated on physical works, but often saw managing passengers and the public as a secondary pursuit. Further effort was needed to ensure that good communication was seen as important as physical recovery.

A particular problem was the lack of integration across the networks on communication. There was far too little information about alternative modes of transport – use roads instead of rail, and which services are available – and how one disruption could set off a series of further disruptions. The Met Office could make good forecasts over five to ten day periods which would give operators enough warning to alert passengers. A good example where this worked well was at Heathrow where meteorologists were able to give sufficient warning to airlines about the prospect of cancelled flights, who in turn could advise passengers.

But the problems of pinpointing particular trouble spots at specific times and forecasting weather conditions over a three to six month period were still great, although new super computers at the Met Office should help to improve forecasts. But they would still be probabilistic; would businesses want forecasts which could still be, say, wrong 40% of the time? However, seasonal forecasts were improving. It was not true that the Met Office was too reliant on only UK sources and research. It had international links on research and used many global observations. The review,

had more time been available, would have liked to research how other countries responded to transport disruptions.

A key question was whether people were failing to take adequate responsibility for their own actions and plans when disruptions were likely or forecast. There was a temptation to think that it was the responsibility of the operator to safeguard people from any misfortune. But with better spread of information, the use of mobile phones and social media, there was little excuse for people setting out for an airport when they should be aware that disruption and cancelled flights were likely.

There were also other ways of moving about other than by car or train. In urban areas, cyclists and walkers could make a considerable impact on transport needs, and more effort should be given to encourage people to use such modes, particularly at rush hours. Had sufficient thought been given to the use of river transport in London?

Participants asked if there was an integrated transport policy, such as existed in Switzerland where rail and bus services were coordinated. Should we have one? We do not, and it is doubtful if we could have ones such as Switzerland (which is mandated by law). We certainly need greater collaboration between agencies, and local highway agencies and drainage authorities need to establish coherent plans to cope with disruptions. They should ensure that a network of local roads are kept open in bad weather so that disruption can be minimized if major routes are interrupted.

There is a particular need to understand the impact of disruption from ports or airports on road and rail leading to industrial areas, and plan in advance of congestion to reduce economic loss. Indeed, the absence of any reporting of economic loss from congestion is surprising. The Highway Agency may know, but it is a major factor affecting the economy, which should be the concern of Ministers

Extreme weather conditions will affect mortality rates, apart from any deaths caused on transport networks. The Met Office now inform the NHS of likely extreme conditions which may affect hospitalization, so that medical services can be forewarned.

The conclusions were: first, that a national plan for covering expenditure and budgets on maintenance of existing assets so that they can cope with climate change, is essential; second that while great progress has been made by operators in seeing maintenance of assets as good asset management and having contingency plans to speed up recovery and reduce impact, there was still much work to do in communicating information to the public; third that the large number of local highway authorities and local drainage authorities means that a coordinated response to disruption on local roads and disruption through flooding will continue to be complex.

Sir Geoffrey Chipperfield KCB

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BRE Group
www.bre.co.uk

Caparo Group
www.caparo.com

Department for Transport
www.gov.uk/government/organisations/department-for-transport

The Environment Agency
www.gov.uk/government/organisations/environment-agency

First Great Western
www.firstgreatwestern.co.uk

The Foundation for Science and Technology
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