

Developing a Transport Strategy for Climate Change Adaptation

09:30 – 16:15, 7th December 2007, Church House Conference Centre, SW1P 3NZ

1 Background to the event

UK sustainable development policy is now influenced at the European level by the EU sustainable development strategy, but is principally guided by the 2005 UK Sustainable Development Strategy *Securing the Future* and the associated UK Framework and strategies in the devolved administrations. The UK strategy identifies Climate Change and Energy as one of four immediate priorities for policy. There are also long-established trends in transport and urbanisation that present fundamental challenges as to how sustainable development can be delivered. To address these challenges, there is a need for policy-makers and researchers to understand each others' priorities, agendas and insights.

Transport is also one of the major contributors to carbon dioxide emissions; the key greenhouse gas responsible for climate change. Recent events also show the transport infrastructure to be highly vulnerable to the weather effects of climate change. For example, July 2007 rainfall caused the M50 and M5 to be closed due to flooding, and rail lines from Birmingham to the south west and south coast were cut off. High growth rates in tourism, both within and outside the UK, and dependency on transport means many of the sustainability indicators associated with transport are going in the wrong direction.

Climate change is becoming a significant driver of new policy and all the English regions and devolved administrations have conducted a climate change impact study of varying detail in preparation for addressing vulnerable sector areas. The next step is likely to be the consideration of activities which would ensure the economic growth of local areas and the wellbeing of inhabitants in a manner consistent with climate change targets and objectives.

Currently, local authorities are individually committing to tackling climate change by a range of means, including signing the Nottingham Declaration. The result of such declarations is often a local climate change strategy document. Many of the current strategy documents are biased towards mitigation, rather than adaptation. Many are also focussed on activities within certain sectors, such as the energy sector and individuals' choice of travel. In most English regions a significant proportion (in East Midlands 100%) of the local authorities have already signed the Nottingham Declaration committing themselves to tackling climate change and new strategy documents are being released frequently.

In 2006 Sir Rod Eddington was commissioned by the HM Treasury and Department for Transport to conduct a Transport Study examining the long-term links between transport and the UK's economic productivity, growth and stability within the context of the Government's broader commitment to sustainable development and the environment. Within this study, three strategic economic priorities for long term transport policy were identified: international gateways; cities and their catchments; and, national networks. The Department for Transport has taken on this suggested method of defining transport enthusiastically as a way of viewing the UK's complete network in a fresh light. Therefore, it would be beneficial to have broad understanding of the predicted climate change effects, particularly extreme events and range of effects that these might have. This will enable transport professionals to give climate factors the appropriate weighting in their decision making and planning. It is however, also recognised that there remains a need to encourage consideration and discussion of climate change in relation to the key transport modes, in particular to identify existing attempts to implement adaptation strategies/measures and to consider sector-specific gaps.

2 Objectives

This workshop was held to assist DfT and DEFRA in developing policies to deal with climate change adaptation and transport. It was commissioned by the Sustainable Development Research Network (SDRN¹) in collaboration with the Department for Transport and Department for Environment, Food and Rural Affairs, and specifically aims to help establish a better understanding of how the UK's transport system should adapt to climate change. Adaptation differs from mitigation in the respect that mitigation can be thought of as reducing your contribution to climate change while adaptation is about managing the impact climate change has on you.

Whilst the central government objective is sustainable transport, there are no overarching strategies currently in place for climate change adaptation. The national Adaptation Policy Framework pulls together a picture of what is currently happening but does not yet drive progress forward from a central perspective. The Climate Change Bill, currently progressing through Parliament, is intended to significantly raise the profile of adaptation to increase the UK's resilience to inevitable climate change. It is within this context that the Department for Transport (DfT) is currently developing a climate change adaptation strategy. This strategy aims to provide a framework for transport stakeholders in order for them to carry out risk analysis in relation to climate change adaptation. It is envisaged that the outcome of this workshop will contribute to the DfT Climate Change Adaptation Strategy. The workshop aimed to investigate following areas through stakeholder discussion:

- What are the likely risks associated with climate change?
- What are the likely economic and social impacts of climate change on the UK's transport system which will need to be adapted to?
- What policies would help the UK's transport system adapt to climate change, and promote the development of sustainable transport? What policies and activities are already underway? What are the gaps?
- What evidence is needed in order to support these policies?

3 Workshop Structure

The workshop brought together key researchers in the area of climate change adaptation and transport, policy makers (from all sectors related to transport, e.g. planning) and transport professionals in order to gain an understanding of the knowledge in each other's areas, and identify tools that exist which can assist decision-makers (transport and non-transport) and how and when they should be applied.

The aim of this activity was to investigate how to approach the creation of an adaptation strategy and to determine what could be done in the future to help the flow of information between research and policy, and at the same time encouraging knowledge transfer between sectors. It was within this context this workshop was organised to identify associated economic, social and environmental impacts of extreme weather. The workshop was divided in following two sessions:

- a) Plenary Session - Introduction of evidence currently available on climate change impacts on the transport sector, issues that need to be addressed, risk and vulnerability. This first session included presentations and talks.
- b) Break-out Group Session – To determine the needs of transport policy stakeholders, gauge whether these needs are currently being met, and the role of the DfT in addressing those needs. The second session consisted of interactive discussion and feedback.

¹ For more information on the work of the SDRN, visit: www.sd-research.org.uk/

4 Summary of guest speaker presentations and morning plenary

Delegates were welcomed to the event by **Michael Hurwitz** from DfT. Michael stated the main objective of holding workshop being to assist DfT and DEFRA in understanding their stakeholders' requirements in terms of developing policies on climate change adaptation.

4.1.1 Introductory by Professor David Bannister – Oxford University

The presentation highlighted what the likely impacts of climate change will be on the UK's transport system and what will need to be addressed. Impacts are likely to be sudden, unexpected and local – therefore there is a need for risk assessment and vulnerability analysis to develop adaptation strategy. Adaptation is concerned with appropriate responses to the predicted impacts of unavoidable climate change.

4.1.2 Climate science - Hazel Thornton – Met Office

Hazel presented a summary of the expected changes in temperature, precipitation, wind, weather extremes and frequency of extreme events. The presentation highlighted the scientific consensus on the issue and certainties of extreme weather and the contrast with how this is sometimes presented in the media debate on issues of climate change.

4.1.3 Climate change and the transport system – Evidence Base by Helen Woolston - LCCP

Helen's presentation reported on two major studies undertaken by London Climate Change Partnership (LCCP). These addressed the impact of climate change on transport infrastructure and its users and how the LCCP plan ahead to adapt in the context of these impacts. The study tackled issues related to the gathering of evidence, practice changes and policy changes. The following recommendations were suggested in her presentation:

- Evaluate integrated impacts on transport e.g. access problems, options for design adaptation and potential costs. Check flood risk adaptations against the Strategic Flood Risk Assessment;
- Assess the risks of flooding, including understanding of flood sources, pathways and receptors and how this might change in future;
- Identify areas (e.g. stations) which are most likely to flood and prioritise them;
- Measures to reduce flood risk should be implemented;
- Risk assessment and adaptation planning should involve all relevant agencies;
- Full costs should be captured including infrastructure rehabilitation and passenger delays;
- Research to assess impact of potential changes in groundwater levels;
- Cost the potential future impact of delays, repairs and renewals on the railways;
- Quantify the effect of better maintenance and improved standards - currently being undertaken by Network Rail;
- Review Network Rail's duty to maintain the network at 1994 'asset condition';
- Review impacts on long term infrastructure e.g. bridges;
- Explore indirect impacts to understand future risk of disruption to traffic through street works.

4.1.4 New DfT guidance on climate change impacts and adaptation for highways - Teresa Willway - TRL

A summary of the key findings and recommendations from a DfT funded research programme into the impacts of climate change on highways and an approach to adapting highways through maintenance practices was discussed in this presentation. The presentation also looked into climate change impacts on the highways network in depth,

based on evidence of impacts from extreme weather events over the past ten years. It was concluded that Networks are being affected today and climate change will exacerbate these effects. Historically-evolved roads are more vulnerable and every network is unique. Therefore adaptation strategies need to be designed bespoke to the network. The following recommendations were suggested:

- Related authorities need to record data on weather impacts and share the data within various multi modal authorities;
- Climate change impact should be considered as part of maintenance strategy;
- Climate change is a risk management
- Need to know present vulnerability to understand how this will change over time.

4.1.5 Adapting to Climate Change: Where to start - Geoff Richards – Highways Agency

A key initial adaptation response identified by UKCIP, TfL and Highways Agency is to perform a full risk and vulnerability assessment for the assets of an organisation. The Highways Agency has started work on developing a risk methodology to be applied to transport infrastructure assets. Such an assessment is an important part of developing an adaptation response for any organisation. The Highways Agency Adaptation Strategy includes:

- An overview of climate change trends;
- Prioritisation of risks;
- A methodology for further risk assessment;
- Is user friendly and integrated with Agency processes;

The presentation also highlighted the areas which need to be included during adaptation process such as design life of assets and a need to determine "return periods" for design (and at what point in time). In particular, the following risk management initiatives were suggested:

- Review monitoring and maintenance regimes;
- Review of design standards, specifications;
- Improve infrastructure resilience;
- Consider need for major upgrades or re-routing;
- Avoid new development in 'at risk' locations;
- Develop a risk assessment methodology that can be applied across the HA's business.

4.1.6 Tools to help organisations assess impacts and adapt - Alex Harvey - UKCIP

Adapting to inevitable climate change requires an understanding of a range of issues and perspectives that do not fall within the norm for transport professionals. The UK Climate Impacts Programme (UKCIP) has developed a range of tools and techniques to enable practical solutions to be achieved. This presentation introduced the key tools with particular regard to the transport sector, and also introduced the UKCIP/EA report, "Risk, uncertainty and decision making", which provides a decision-making framework for managing climate risks. This framework describes processes for appraisal and management of risks and uncertainties similar to others used for corporate risk management. This framework enables climate risks to be 'mainstreamed' within existing processes.

In addition to above speakers **Dan Hamza- Goodacre from DEFRA** provided a short background to the Climate Change Bill. The Bill aims to combat climate change by setting annual targets for the reduction of carbon dioxide emissions until 2050. It specifies procedures to be followed if the targets are not met and also sets out targets for energy efficiency, sectoral emissions reduction, the generation of energy from renewable sources, combined heat and power and microgeneration.

5 Summary of break-out group discussions

The main objective of holding break-out group discussions was to assist DfT and DEFRA in understanding their stakeholders' requirements in terms of developing policies on climate change adaptation, in the context of:

- Risk assessment being key initial step the development of adaptation response for the predicted climate.
- the cross-modal approach suggested in the Eddington review, and
- A modal approach to thinking initiated by the introduction of a climate change scenario by the facilitator.

The discussions also aimed to encourage delegates to share best practice and identify gaps within their transport mode sectors (or between mode sectors) which they (and possibly DfT) need to address.

The groups were designed in order to reflect the cross-modal approach suggested in the Eddington Review. Delegates were split into 3 groups, each with a dedicated facilitator and rapporteur, reflecting the three key economic priority areas suggested in the Eddington review:

- Breakout Group 1: Congested and growing city catchments
- Breakout Group 2: National networks (Inter-urban corridors)
- Breakout Group 3: International gateways

Where possible delegates were assigned to groups according to the Eddington category most relevant to their role. This led to various modal clusters within groups, e.g. group 2 contained a roads cluster comprising representatives from the Highways Agency, road construction, and engineering consultants. This led to deeper discussions within the groups about particular modes, and helped to pick-up modal specific issues.

Format of break-out groups

Each group was presented with their own transport 'scenario' where several modes of the UK transport system were affected by weather events which could be associated with climate change. These aimed to expand participants thinking into all the aspects of how climate change can affect their responsibilities. The participants were challenged to think of the contingencies, plans and changes in ways of working or to the transport infrastructure which would need to be developed and put in place in preparation for dealing with such scenarios. This was based around four main questions:

- What are the risks and vulnerabilities?
- What are the key barriers and opportunities
- What are the principal policy enablers?
- What are the main research and policy gaps?

Participants were also be invited to comment as to whether the questions being asked were the correct ones to be considering when developing a strategic adaptive response to climate change and were also be invited to add their own key questions to those already listed. Facilitators posed the questions to the group in turn, while a Rapporteur recorded answers/comments from the group on a flipchart. Each participant then voted for their top 2 answers to each question; these were reported back to all delegates in a summary session following the breakout groups.

A summary table of the comments and responses collected during the break-out groups is shown below. The two issues selected as the most important by each group for the four questions are shown in bold.

Table of responses collected during break-out groups

	Break-out group 1: Congested and growing city catchments	Break-out group 2: National networks	Break-out group 3: International gateways
Q1: Risks and Vulnerabilities	<ul style="list-style-type: none"> - Congestion - Severance - Emergency services - Social services - Education - Knock-on effects: rail line stations; businesses; rat running; public transport. - Communications (local radio) - Diversions - Help from others - Lack of flexibility and resources 	<ul style="list-style-type: none"> - Lack of alternative routes - Variability of standards – driven by funding - Communications : users; organisations; warning mechanisms - Emergency response capacity (using the hard shoulder) - Co-location of multiple modes 	<ul style="list-style-type: none"> - Financial loss and reputation of that sector. - Financial loss to number of modes - Overload on capacity of mode - Communication risk - Coordinating communication between modes and then people. - Control of time log to adapt. - Social welfare of user of transport. - Impacts on supply chain management. - Local issue will become international issues.
Q2: Barriers and opportunities	<p><u>Barriers:</u></p> <ul style="list-style-type: none"> - Fragmented policy making (public and private sector) - Split responsibilities inhibit having aligned goals and funding priorities. - Short-termism - Uncertainty about risk/probability <p><u>Opportunities:</u></p> <ul style="list-style-type: none"> - Climate change bill - Recent local flooding/hot weather - Public interest 	<p><u>Barriers:</u></p> <ul style="list-style-type: none"> - Split responsibilities: e.g. drainage, knowledge. - Short-term decision making. - Understanding high-impact/low probability events - Need to take issue seriously - Funding <p><u>Opportunities:</u></p> <p>(None discussed)</p>	<p><u>Barriers:</u></p> <ul style="list-style-type: none"> - Coordination of different stakeholders and other private sectors - Reluctance of investors - Lack of information on scenario <p><u>Opportunities:</u></p> <ul style="list-style-type: none"> - Contingency planning - Opportunity to learn from best practice - Innovation in technology and technology transfer
Q3: Principal policy enablers	<p><u>Enablers:</u></p> <ul style="list-style-type: none"> - New guidance & bills (for businesses also) - Provide incentives – e.g. fund research - more ‘win-wins’ - develop best practice, - update design guidance <p><u>Gaps:</u></p> <ul style="list-style-type: none"> - Locally relevant climate data to help planning - Application specific CC data - Knowing our climate analogues - Costing impacts of extreme events – transport, society, economic etc - human behaviour – modal impacts 	<ul style="list-style-type: none"> - Appropriate reliable sources of information; - Understanding of individual behaviour in extremes - Keys to unlock solution – architects and engineers - Political will - Clear definition of problem - Misconception of rural vs urban agenda 	<p><u>Enablers:</u></p> <ul style="list-style-type: none"> - Provision of accurate data and information on scenarios - Undertaking & recording of the events/impacts - Climate Change Bill - Provision of appropriate training at all levels to manage risk. - Provision of tools <p><u>Gaps:</u></p> <ul style="list-style-type: none"> - Gap in accurate data and scenarios, - Lack of climate proof design standards of built structures. - Lack of behavioural studies to cope with different climate change impacts. - Long terms implication versus one off events. - New set of skills will be required.
Q4: main research and policy gaps	<p><u>Research gaps:</u></p> <ul style="list-style-type: none"> - Science - Societal impacts <p><u>Policy gaps:</u></p> <ul style="list-style-type: none"> - Coherent resource of CC information (being worked on) - Internet forum to share ideas: modal specific; cross-modal; share best-practice; would highlight gaps - bringing together experts from within - insufficient knowledge gain from other countries – lead from gov. 	<p><u>Research gaps:</u></p> <ul style="list-style-type: none"> - Comprehensive understanding through education. - Inventory of infrastructure and environment assets - Black-spots - Understanding of costs and benefits <p><u>Policy:</u></p> <p>(None additional to Q3 discussed)</p>	<ul style="list-style-type: none"> - Cost: Economic cost, Social cost (equity), Environmental cost. - Decision making process of individuals to chose the travel mode. - What and how contingency planning could work. - Innovative technology - Communication mechanism between different modes (high speed). - Evaluating the local climate change impact to international impact and developing policies at local and international levels.
Further questions and comments	<ul style="list-style-type: none"> - What impact do transport options have on GHG emissions? - How to link mitigation and adaptation within transport sector? - Identify areas of leadership – should we promote more internationally? - Export knowledge on adaptation to help other countries. - Governance – who should take charge? 	<ul style="list-style-type: none"> - Individuals need to recognise their own contribution to climate change. 	<ul style="list-style-type: none"> - Cost of adaptation Vs mitigation relationship Competitiveness Value of transport (socio- economic) - How to present to senior decision makers (how to convince) - Embedding in day-to-day practices Current practice / new practice Investment and appraisal - Why people make particular decisions?

6 Discussion of findings from break-out groups

The break-out groups were successful in provoking meaningful discussion of modal and cross-modal issues and responses relating to climate change adaptation. Delegates contributed a variety of comments which should prove useful to policy development. Responses to the four questions can be summarised by looking at the answers voted for by the groups as the most important.

The scenarios given to each group at the start of the session to prompt thinking are attached at the end of this document.

Question 1 – What are the risks and vulnerabilities?

The congested and growing city catchment group (group 1) responded to the scenario they were presented with, seeing congestion as a key vulnerability. With urban systems already under strain the congestion caused by an extreme event could cause serious problems. The group saw knock-on effects, mainly in terms of additional pressure on other modes such as public transport, with financial losses for businesses and problems for individuals caused by rat-running.

A key view of the National Networks group (group 2) was that there is a lack of alternatives when faced with a scenario which knocks out parts of the network. It is difficult for users of these networks to quickly find an alternative means/route by which to reach their destinations, as they, unlike users of local networks have a lack of 'redundancy' and 'diversionary options', owing to the restrictive nature of these corridors. The group also felt that there were likely to be communications issues, both between professionals working to manage the situation, and in informing customers about the situation in hand.

The third group (international gateways), saw that there could be significant financial loss to the sector in the scenario given, and that the welfare of the users of the gateway could be at risk.

Question 2 – What are the barriers and opportunities?

Group 1 felt that the most significant barrier is the uncertainty still surrounding the level of risk and probability of events such as that given in their scenario actually occurring. This is a theme that was picked up in the other two groups as a need for greater understanding and information. Groups 2 and 3 both raised practical issues concerned with coordination as their main barriers: group 2 felt that there was a need for greater coordination where responsibilities are split such as for drainage; group 3 raised the need for coordination between key stakeholders and wider private sector organisations.

A useful opportunity highlighted by group 3 reflected the overall value of hosting events such as this one – the group selected the opportunity to share best practice among stakeholders, helping organisations to make more rapid progress in the identification and evaluation of risks and vulnerabilities.

Question 3 – What are the principal policy enablers?

The need for accurate and reliable data and information was raised by all three groups as an important policy enabler, with specific data on climate analogues and possible scenarios mentioned by groups 1 and 3 respectively.

Question 4 – What are the main research and policy gaps?

The issue of information and knowledge sharing came up again in group 1, with a particular need suggested to share best-practice both between stakeholders and at a governmental level by learning from other countries who may have made advances in key areas. The

group felt that internet forums would be a useful way to share both modal-specific and cross-modal ideas, experiences and practices.

The discussion in group 2 centred the need for greater understanding of practical issues of infrastructure and environmental management through the implementation of a national inventory of assets. A discussion thread that ran throughout group 2 was that of the need for the public and politicians to fully buy-in to the potential seriousness of climate change, with some feeling strongly that real political will would only follow from greater public pressure. The need for greater education of the public from the government was felt to be crucial in starting this process.

Groups 2 and 3 both saw a need for greater understanding of the real costs to be expected as a result of climate change – not just financial, but also the wider social and environmental costs.

7 Chairman's summary notes

The event Chairman (Prof David Banister) made several key observations he felt summarised the plenary and break-out sessions, summarised in the following notes:

1. **Uncertainty** – less than in the past – for example on the science of climate change – but there is much greater unpredictability with greater extremes (temp and water) – the turbulent environment – how can this complexity be presented to decision makers. We need to think in new ways – we are familiar with predictability and the certain – but not with the unpredictable and uncertain
2. **Risk Management** – our attitudes to risk and how this is presented
 - a) Identify critical points above which it becomes a substantial cost – to business – this relates to vulnerability of systems
 - b) Time over which severe events take place – could be 1 in 50 years now, but this might reduce to 1 in 5 years in 10 years time – how to encompass this thinking in policy making?
 - c) See upgrading as part of the maintenance cycle for existing projects and infrastructure to take count of potential events – easier to achieve in new investment, but costly to retrofit
3. **Policy and Institutional Issues** – the Climate Change Bill and Statutory Guidance
 - a) Description of best practice
 - b) Learn from experience elsewhere
 - c) Tools are available – UKCIP
 - d) Cumulative effects – links back to risks and complexity of interactions
 - e) Links between sectors – transport facilitates access and business, but it is a major contributor to climate change and must be a strong candidate for strategies for mitigation and adaptation – there is a new integration needed across all sectors and government departments

The longer term perspective requires continuity in thinking and approach – could it provide an example of a common goal to all political parties?

4. **Resilience of the System** – to explore the redundancy and capacity of the transport system to see whether it can function effectively if particular links are taken out of the network (road and rail) – the need for real time information on alternatives and the possibilities for rerouting.
Included here would be the costs of a catastrophic failure – the need for strong contingency planning – proactive and reactive.
Reliability is key to the user of the system – can we talk about notion of acceptable failures – if so at what levels – and what are the implications for business and people?

8 Overall summary and recommendations

Climate change has become a real and current issue and the effects will become more intense with time. The infrastructure we are providing today will need to be resilient to the climate of at least 2050 and probably beyond. If we continue to design for today's climate, as our current guidance requires, we will be designing infrastructure that is unlikely to be "fit for purpose" well before the end of its design life.

Adapting our transport infrastructure need not require significantly extra resources, maybe no extra. It is primarily about how and when we do things – timing is critical. For example, when designing the drainage for a new piece of infrastructure, the additional capital cost of increasing the capacity of the system to cope with future conditions is relatively small. The cost of replacing or upgrading it in the future to cope with changed conditions, or dealing with infrastructure failure, could be very large and result in significant disruption.

Adaptation is fundamentally about risk. We need to understand where we are vulnerable, particularly where the critical points are, and how that vulnerability will change over time. This can then be assessed alongside other risks to decide whether an engineering intervention is required immediately, intervention can wait for the relevant point in the maintenance cycle, or a management response is appropriate.

The presentations at the workshop indicated the high-level of expertise and knowledge of climate change impacts and adaptation response. It is clear from the responses of the breakout groups that the general level of awareness of the impacts of climate change is not high. However, this contrasts with their level of understanding of what needs to be done when presented with a scenario. Accordingly, communication of the potential effects of climate change is the most important action, as opposed to providing standard solutions. In this the developing of new climate scenarios for the UK will be helpful.

It is important that clear messages are given out to policy and decision makers as to the importance of taking account of climate change in decision making; where reliable scientific evidence can be found (e.g. UKCIP, Tyndall Centre); importance of communication between the various actors involved both politically and operationally.

Key recommendations:

Issue	Recommendations
Uncertainty and unpredictability of extremes (temperature/water)	Research is required to increase understanding of 'climate analogues' and fill uncertainty and unpredictability gaps through development of new climate scenarios.
Improving risk management approaches	Developing bespoke risk assessment and management strategies in relations to climate change adaptation across key transport sectors
Optimising existing knowledge and ensuring joined-up approaches across Policy and Institutional Issues	Promote and establish new cross-sectoral/modal knowledge-sharing networks, forums and opportunities
Resilience of the system	Carry out cross-sectoral studies to identify redundancy and capacity, particularly considering potential links between alternatives (with appropriate contingency planning) in instances of extreme events.

Closing comments from DfT

DfT expressed their gratitude to all those who took part in the event and for helping to make it a successful and worthwhile activity, which will help them to shape further the adaptation strategy for transport. A priority moving forwards will be to include adaptation within stakeholder dialogue on "Towards a Sustainable Transport System: Supporting Economic Growth in a Low Carbon World". Decisions on how best to move forwards on transport adaptation strategy will be made in light of developments in the Climate Change Bill, which has had its second reading in the House of Lords and is currently at committee stage.

Attendees

Name/Group	Organisation
Group 1 – Congested and growing city...	
Chris Fry	AEA Energy and Environment
Graham Catt	Department for Culture, Media and Sport
Geoff Latham	DfT
Mark Gaynor	DfT
Vicky Waite	DfT
Helen Woolston – Presenter	London Climate Change Partnership
Hazel Thornton – Presenter/Facilitator	Met Office
Kathy Findlay	Rail Safety and Standards Board (RSSB)
Jacque Berry	TRL
Alex Harvey – Presenter	UKCIP
Group 2 - National Networks	
Steve Biczysko	Atkins Global
Isabella Earle	DEFRA
Alan Paterson	DfT
Andrew Gilheany	DfT
Colin Morris	DfT
Edward Bunting	DfT
Michael Hurwitz – Introduction	DfT
Matthew Chell	East of England Development Agency
Simon Price	Gifford
Geoff Richards – Presenter	Highways Agency
Tony Sangwine	Highways Agency
John Mayhew	Hyder Consulting
Dinos Kyrou	Hyder Consulting
Wayne Elliott - facilitator	Met Office
John Dora	Network Rail
Andy Porter	Parsons Brinckerhoff
Ben Shaw	PSI
Simon Barnes	SSMT
Angela Gilmour	South East Rural Community Council
Professor John Whitelegg	Stockholm Environment Institute, University of York
Colin Loveday	Tarmac
Dan Rapson	TRL
Teresa Willway - Presenter	TRL
Gavin Harrison	Turner & Townsend Management Solutions
Group 3 – International Gateways	
Heather Crocker	Advantage West Midlands
Sarah Winne	AEA Energy and Environment
Dr Victoria Williams	Centre for Transport Studies, Imperial College
Dan Hamza-Goodacre	DEFRA
Chris Brown	DfT
Philip Williams	Gloucestershire County Council
Anurag Kher	Government Office of the South East
Greg Marshall	Home Office General Property
Caroline Scott	London Borough of Islington Council
Kirstine Dale - Facilitator	Met Office
Abigail Frost	Parsons Brinckerhoff
Rubina Greenwood	TRL
David Banister	Oxford University - Chair

Note: Delegates were assigned to the three break-out groups in advance of the event as per the attendee list, though they did not all remain for the break-out session.

Programme

- 09:30** Registration and tea & coffee
- 10:00** Welcome (**Michael Hurwitz – DfT**)
Introductory talk (**Prof David Banister, Oxford University**)
- 10:15** A review of climate science and the expected impacts on the UK
(**Hazel Thornton, The Met Office**)
- 10:40** Plenary Question and Answers
(**Moderated by Prof David Banister, Oxford University**)
- 11:00** BREAK
- 11:15** Climate Change and Transport System
(**Helen Woolston, London Climate Change Partnership**)
- 11:50** New DfT guidance on climate change impacts and adaptation for highways
(**Teresa Willway, TRL**)
- 12:10** Adapting to climate change: where to start
(**Geoff Richards, Highways Agency**)
- 12:30** LUNCH
- 13:15** Current research programmes and tools within the UK
(**Alex Harvey, UK Climate Impacts Programme**)
- 13:45** Facilitated group discussions
- 15:00** Debate of key issues identified throughout the day
(**Chaired by Prof David Banister**)
- 15:45** Summary and close
- 16:15** END

Scenarios given to break-out groups

Group 1 - Congested and Growing City Catchments

The modes of transport which fit into the Congested and Growing City Catchments category are local rail, bus, waterway, private road travel, cycling, horse-riding and walking.

A typical vulnerability for city catchments is where a major dividing feature has a limited number of crossings. Such a feature could be a river with bridges crossing it, a railway line with bridges or underpasses, and so on. One scenario is that of a town with a population of 35,000 within a borough of 150,000 people. The town has a railway running through the centre, dividing it, and is the main retail centre for the local area/borough. The railway is crossed via two underpasses which is part of a one-way system. Being the main retail centre means the travel network expanding out of the town is mainly arterial and the main routes from one side of the borough to the other takes the user through this town.

In a case of higher than usual rainfall, the underpasses can be flooded, essentially severing one side of town from the other. This has the knock-on effect of cutting one side of the borough off from the other. The issues here would be similar to those described for inter-urban corridors, such as diversionary routes, welfare of users and how to interact with other modes of transport in order to move users on should one mode become totally impassable. There is the additional complication of a much larger mixture of transport modes and users with differing levels of vulnerability. Again, economical cost and additional emergencies (such as a major shop fire) are further likely variables to add to the situation; participants are expected to identify more.

Group 2 - Inter-Urban Corridors

The modes of transport which fit into the Inter-Urban Corridor Eddington category are national rail, national road travel and domestic air travel.

A possible scenario affecting these corridors could be based on the extreme rainfall experienced during summer 2007. This could render trunk roads, such as the M5 and M50, impassable and key rail routes shut. This disruption may be caused indirectly. For example, the M1 was shut in 2007 because of fears of the imminent collapse of the Ulley Reservoir dam due to high levels of water. In this respect, corridor sections vulnerable to extreme weather may not be the first places to look when preparing contingencies. Domestic air travel may be grounded in the locality of the rainfall due to visibility problems and lack of skid resistance on the runways.

The modal issues from such a scenario would be the stranded users on their networks, having to decide whether to shut a corridor completely and divert on to a local network (interaction with catchments), how to set up alternative routes of travel within their own mode. How does one set up diversion routes complete with signs if access to the area is limited? How can a rail or bus station provide extra staff for organising such situations when access is limited or non-existent? There are also the issues of infrastructure damage and repair or development of infrastructure in vulnerable areas to prevent a foreseen disruption.

Inter-urban corridor users may have the option of transferring to an alternative mode of transport, such as transferring from rail to bus when the rail service is disrupted. How would the rail service provider and those responsible for rail infrastructure work together with bus service providers and local taxi services in order to transfer passengers?

Another key question is the economic cost of inter-urban corridor disruptions (some examples of the cost can be estimated from the calculated economic benefit submitted for major road schemes, found in Appraisal Summary Tables typically used by the Highways Agency), and how to deal with an additional emergency such as a major crash when key routes of access have been cut off, etc.

Group 3 - International Gateways

The modes of transport which fit into the International Gateway Eddington category are international air transport, international sea transport and, to a lesser extent, international rail.

A possible scenario affecting these gateways, yet probably not planned for, is a severe inland storm (for example, the great storm of 1987, or extreme rainfall in 2007). Such a scenario would include significant disruption on the trunk road network and to rail lines.

The key effect of such disruptions would be the lack of access into and out of the gateway node ('node' being an airport, port or international rail station such as St Pancras) from the land side. The consequences of this would be that there may be freight, passengers and vehicles arriving (from ships, airplanes or Eurotrains) but they have no means for leaving the gateway node. What do the responsible parties for the node do with the incoming traffic? How quickly will the gateway reach capacity? What happens then? How does one deal with welfare issues of people trapped within the gateway, such as feeding them? What about perishable shipments? These are some of the questions which a gateway operator would need to be planning for.

In addition, there is a greatly reduced amount of traffic arriving at the gateway in order to leave the UK. Services using the gateway, such as ferry operating companies, are either operating with greatly reduced passenger/cargo numbers or may wish to temporarily change their service timetabling due to reduced customers. How is this dealt with?

The questions posed above are mostly focused on the individual mode of the gateway and is likely to generate modal information from the participants. However, it is the effect of the service provided by other transport modes, such as road and rail, which have caused an issue for the gateway. The gateway is a linking node transforming international traffic into national traffic and vice versa (i.e. passengers transfer off a plane, pass through an airport and embark on a train trip towards their ultimate destination). If the facilitator were to pose the following question: "How does one go about moving international traffic onto the national networks when those networks have failed?" the participants are forced into thinking how they would need to interact with modes other than their own. The activities they would need to consider would include communication with existing rail and bus services, the emergency set-up of ad-hoc services, methods of obtaining extra food, blankets etc. for people who cannot be moved on, ad-hoc movement or storage solutions for freight, and so on.

A classic example of this would be that UK ports have established practice for when extreme storms (or other disruption) prevents the sailing or docking of ships. What is their practice for when there are no problems "sea-side", but transport modes "land-side" are cut?