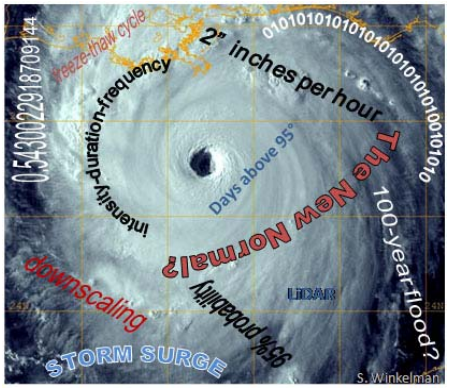
Environmental and Energy Study Institute

Report Summary

Climate Adaptation & Transportation: Identifying Information and Assistance Needs



Extreme weather events in the United States caused more than $60 billion in damages in 2011 – a year that saw record-breaking storms, droughts, and heat waves across the country. The National Oceanic and Atmospheric Administration (NOAA) projects that 2012 damages will exceed those of 2011, but final estimates are not yet available.[1] Damages from Superstorm Sandy alone may top $50 billion. The nation's uninsured transportation infrastructure often bears a significant share of the losses from extreme weather events. Sandy, for example, inflicted an estimated $7.5 billion in damages to New York's transportation infrastructure.[2] At a time when transportation agencies are already faced with deteriorating infrastructure and major budgetary constraints, increased risk from extreme events presents a substantial challenge to local officials and transportation planners. By improving the climate resiliency of infrastructure, governments could reduce long-term costs and limit transportation disruptions. To accomplish this, local planners need better information and decision-making tools to predict local long-range impacts and to build infrastructure to withstand these new risks.

This brief summarizes the May 2012 joint report from the Environmental and Energy Study Institute (EESI) and the Center for Clean Air Policy (CCAP), *Climate Adaptation & Transportation: Identifying Information and Assistance Needs*. The report synthesized the conclusions from a two-day workshop in November 2011 funded by NOAA. The workshop brought together transportation planners and climate scientists from around the country to discuss the critical support needs of surface transportation professionals as they prepare for climate change and shifting extreme weather trends. Participants in the November 2011 workshop sought to answer two questions:

- What kinds of information and assistance do transportation professionals need to more effectively adapt the transportation system to climate change and extreme weather?
- How can the climate science community help meet those needs?

BACKGROUND AND ECONOMIC CONTEXT

Transportation planning has typically been conducted based on historical data – with the underlying assumption that existing climatic conditions will continue into the future. However, climate change is expected to have far-reaching impacts on transportation infrastructure and associated systems. Extreme weather events, as well as changing average conditions and seasonal weather patterns, are projected to affect safety, cost-effectiveness, efficiency, and technical feasibility of transportation investment and asset management decisions. These impacts will vary from region to region and may even vary at the local and site scale. Anticipating the consequences of such disruptive changes and planning prudent responses before they become reality will help transportation agencies protect the infrastructure upon which communities, regions, and the national economy depend for the movement of goods and people.

The November 2011 workshop aimed to inform and address actions to increase the adaptive capacity of transportation officials. Transportation planners, transportation officials, project designers, budget managers and others will need specific guidance on how to translate climate change projections into actionable, quantitative

decision parameters and criteria. Meanwhile, the weather information community – and, to some degree, the climate science community – are well-versed in providing data and guidance to transportation system managers regarding extreme weather events, and they are pioneering new approaches to weather monitoring that will support enhanced climate-based decision making.

SUMMARY OF MAJOR FINDINGS AND RECOMMENDATIONS

1. Better information on local, non-climate factors is often equally or more important to adaptation decisions than climate science information.

Understanding local conditions and context, including natural local factors, is crucial. Adaptation starts with determining how well critical infrastructure is adapted to current conditions. The interactions among local factors can significantly exacerbate the effects of climate change and extreme weather but need to be considered outside the parameters of the model.

Recommendations

- Enhance data on local contextual factors including infrastructure, development, and environmental conditions.
- Develop extreme weather impact scenarios based on recent events, climate forecasts and local conditions to identify vulnerabilities and potential cascading effects.

2. Certain climate and weather information products are particularly important to adaptation efforts for transportation. Much of this information can be developed or significantly improved using current climate models.

3. The form in which climate and weather information is communicated is as important as its availability.

Clear guidance is needed on where to look for information and how that information should be used. Engineers and climate scientists do not speak the same language; improved cross-discipline communication is key.

Recommendations

- Establish a central clearinghouse of information sources and guidance including information on what agencies are doing and who to call for additional guidance, as well as best management practices.
- Provide guidance on navigating and using available datasets as well as how to select, use and interpret models.
- Improve the consistency and clarity of available information products to facilitate the use of data in transportation decision support systems.

4. Education, in addition to information, is critical to sound decision making and effective use of climate and weather information by the transportation community.

All agencies addressing climate adaptation, including transportation agencies, need to focus on education and "science"—i.e. a coherent understanding of how different knowledge and data fit together. Transportation professionals do not need to become scientists, but they need to be science-literate.

- Higher education and professional training need to support an evolution in the culture and paradigms of transportation and engineering practice.
- Government and NGOs have a role to play in peer-exchange and ongoing education.

5. Transportation officials need more and better tools for integrating climate and weather information with other multiple factors to make sound decisions.

Tools and guidance need to be able to analyze and plan for various scenarios. These scenarios should incorporate climate/weather variability, local development patterns, population growth, growth by economic sector, and other factors. Guidance should better address how to balance and incorporate community values (priorities, risk tolerance, etc.)

Key Issues for Decision Making

- Ask the Climate Question: integrate climate decision making into existing processes over the full transportation lifecycle such as planning, design, siting, construction, operations, and maintenance.
- Evaluating costs and benefits of adaptation options: new design, retrofit, manage, harden, retreat, etc.
- Determining thresholds, decision points, and action timetables
- Funneling: conducting sketch analyses to identify hot spots and criticalities to determine where more detailed analysis is needed

Managing Uncertainties and Risk

- When does uncertainty matter; when are directionally-correct measures enough?
- How do planners operationalize their responses to probabilities, ranges and worst case scenarios?
- Tools must better integrate other uncertainties
    - Spread between emissions scenarios is greater than climate model uncertainties
    - Sometimes the dominant source of uncertainty is not even climate-related
- Draw from risk analysis best practices in other fields

6. There are areas where more research and higher-resolution climate and weather information would be very useful for transportation planning, particularly information on rainfall intensity during extreme events and more information about small events.

For example, current projections of extreme events are provided at the 24-hour level, but hydraulic engineers are more interested in events of 6-hour or less duration. Small-scale events can be significant in terms of storm water management. There is a need for ways to relate projected model results (for precipitation) to water flow/runoff, land use and other projected changes.

7. Climate adaptation efforts for transportation need to be addressed in the context of other management, economic, and institutional issues.

Climate adaptation is as much a management and economic issue as it is an engineering one. Urban governments should ask: if you plan it, fund it, build it or do it, how do your decisions affect local resilience to climate impacts?

Economic Analysis

Workshop participants noted that maintaining the existing system is challenging even in good economic times. Transportation practitioners will need to assess which climate impacts are most threatening to the local economy and determine the costs and benefits of adaptation measures. They seek guidance on how to best incorporate climate impacts into asset management processes and how to direct funds in the most cost-effective manner. Decision tools and guidance for economic analysis should be enhanced to include:

- Climate impacts including the opportunity costs of inaction and the total economic value of assets at risk
- Costs of preparedness measures including preventative costs, new design, and retrofitting
- Economic and social benefits of preparedness as measured by different stakeholders

Engaging the Public

Workshop participants noted that it is much easier to prepare for and respond to climate change impacts if the public has a better understanding of the likely threats and effective responses. They noted that it is also critical that adaptation solutions resonate with local values and key concerns, such as quality of life and the economy.

8. Federal agencies should continue to enhance state and local capacity to prepare for severe weather and a changing climate.

Federal agencies are actively engaged in climate change adaptation efforts, with the Interagency Climate Change Adaptation Task Force providing regular progress updates. The report provides the following recommendations on federal transportation climate change adaptation efforts:

Research and Analysis

- Conduct detailed analysis of the costs and benefits of climate change preparedness measures (economic, social, environmental), including cross-sector interactions between infrastructure (transportation, energy, water, telecommunication) and natural systems (e.g., rivers)

- Convene a multi-agency effort (NOAA, NASA, U.S. Department of Transportation (DOT), U.S. Geological Survey (USGS), and U.S. Environmental Protection Agency (EPA)) to determine and provide appropriate data for climate preparedness analyses in the transportation sector
- Develop a hierarchy of risk management methods for different levels of decision-making
- Study the transportation sector's structural and material vulnerabilities to a variety of climate stressors

Capacity Building

- Provide technical assistance and guidance to help states, metropolitan planning organizations (MPOs) and local governments to "Ask the Climate Question" when planning, siting, designing and constructing transportation infrastructure by assessing climate vulnerabilities and the costs and benefits of adaptation/preparedness measures. Continue to develop and enhance technical assistance and guidance on a variety of practices related to climate.
- Support enhanced climate preparedness pilots and their integration with MPO long-range transportation plans

Policy

- Explore options for integrating climate preparedness into transportation planning processes and asset management
- Consider how to integrate climate adaptation with other environmental goals and efforts such as greenhouse gas (GHG) mitigation and streamlining
- Consider potential performance management guidelines for climate change vulnerability and adaptation preparedness in the transportation sector

CONCLUSIONS

Transportation practitioners need tools and methodologies for making decisions with imperfect data and perpetual uncertainty. A significant portion of the data uncertainty has to do with limited information on non-climate factors and the variable nature of climate and weather events in general, more so than the limits of climate science.

The good news is that transportation experts already have much of the relevant experience needed to prepare for climate change impacts through their experience in hazard mitigation, emergency response, flood management, and land-use planning. Thus, focusing on things that are knowable at the local level goes a long way. And, while climate science is complex, it is certainly not beyond useful understanding. It is, therefore, important for transportation practitioners to educate themselves on climate science, and to articulate their unique data and technical assistance needs. Similarly, climate adaptation efforts would be improved by using experiential input from transportation experts. We hope that *Climate Adaptation & Transportation: Identifying Information and Assistance Needs* is a constructive step in that direction.

The full report is available at: files.eesi.org/Climate_Adaptation_Transportation.pdf
Workshop presentations are available at: www.ccap.org/adaptation.html

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For more information, contact John-Michael Cross at jmcross@eesi.org or (202) 662-1883
Summary prepared by Brian Lutenegger

The Environmental and Energy Study Institute (www.eesi.org) is a non-profit organization founded in 1984 by a bipartisan Congressional caucus dedicated to finding innovative environmental and energy solutions. EESI works to protect the climate and ensure a healthy, secure, and sustainable future for America through policymaker education, coalition building, and policy development in the areas of energy efficiency, renewable energy, agriculture, forestry, transportation, buildings, and community planning.

[1] Billion-Dollar Weather/Climate Disasters. NOAA National Climatic Data Center (NCDC). Accessed: 7 Feb 2013.

[2] "Christie Pitches Obama for More Storm Recovery Aid." *Associated Press*. 6 Dec 2012.