

Climate Change and Adaptive Strategies for State and Regional Transportation Decision Making

**Eric Lindquist, Ph.D.
Associate Director and Associate Research Scientist
Institute for Science, Technology and Public Policy
Texas A&M University**

November 13, 2008

Presentation objectives

- ❑ Focus on questions: “Are state and local transportation agencies paying attention to the potential impacts of climate change? If so, are they considering adaptation to climate change as a solution?”
- ❑ SWUTC project
- ❑ UTCM project
- ❑ Revised question: “What can an MPO do about adaptation to climate change?”
- ❑ MPSA Capstone project
- ❑ Conclusions and outlook for the future

Evolution of an issue and Institute research agenda: climate change and variability

U.S. Environmental Protection Agency project

- ❑ Gulf Coast and climate change in decision making

NOAA projects

- ❑ NOAA 1 – national scope: general public, climate scientists, decisions makers
- ❑ NOAA 2 – climate change decision making at the federal decision making, CC/CV policy network

USDOT/USGS project

- ❑ Transportation decision making and planning at state DOTs and MPOs (US Climate Change Science Program Synthesis and Assessment product 4.7)

Evolution of an issue and Institute research agenda: climate change and variability

- ❑ Southwest University Transportation Center (SWUTC) – *Climate Change/Variability Science and Adaptive Strategies for State and Regional Transportation Decision Making*
- ❑ University Transportation Center for Mobility (UTCM) - *Transportation Planning, Policy and Climate Change: Making the Long Term Connection*
- ❑ Spring 2009 climate change adaptation workshop with relevant federal, state and local stakeholders

Southwest Region University Transportation Center (SWUTC) – *Climate Change/Variability Science and Adaptive Strategies for State and Regional Transportation Decision Making*

- ❑ Why is adaptation to climate change impacts an important consideration for transportation?
- ❑ Current thinking on this issue
- ❑ Project description
- ❑ Findings and project conclusions

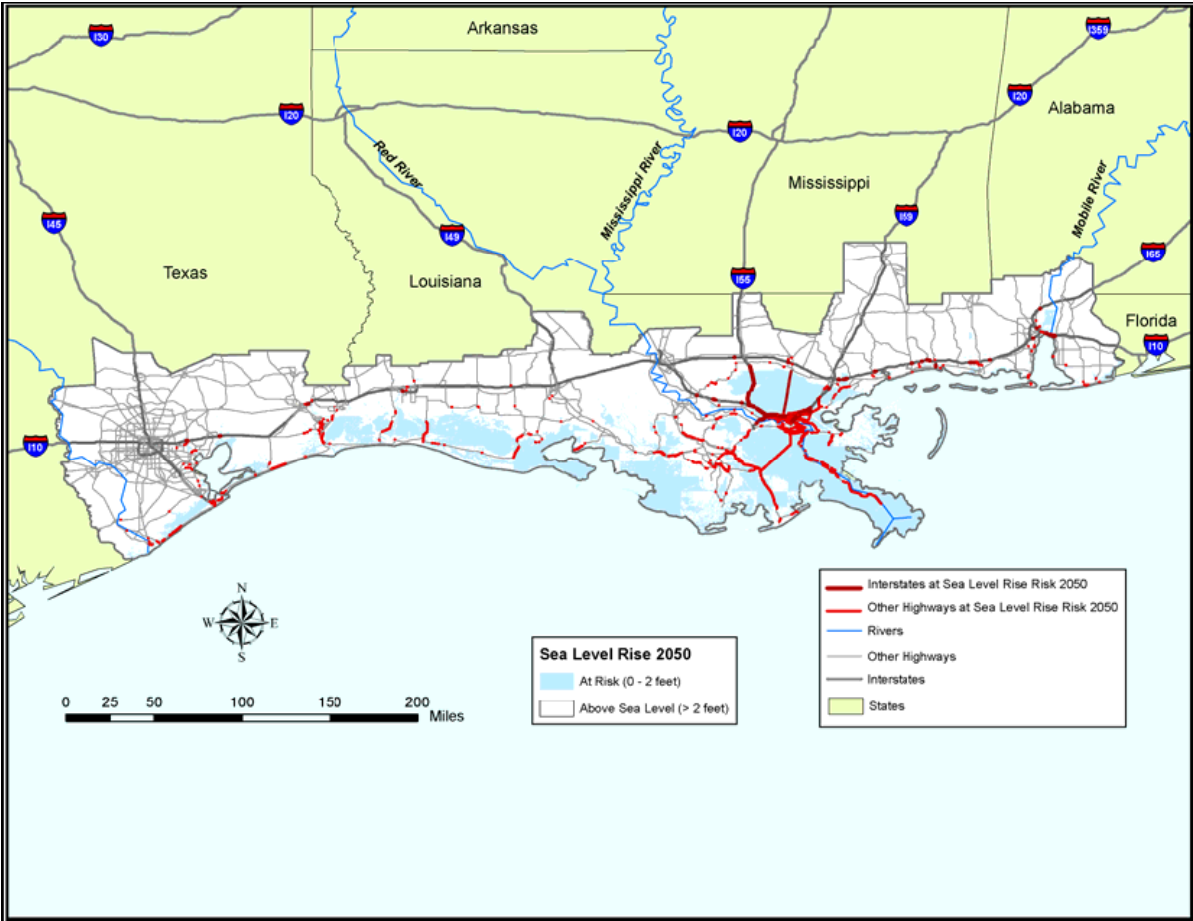
Why adaptation and transportation?

- ❑ Despite the potential for billions of dollars of damage, the potential for climate change impact on transportation infrastructure has received little attention.
- ❑ Major stressors include sea level rise, changes in precipitation and temperature and an increase in magnitude and frequency of severe storms.
- ❑ Potential impact on relevant planning, policy and governance institutions and systems.
- ❑ Adaptation is particularly important in areas vulnerable to sea level rise, storm surge, and flooding.



U.S. Gulf of Mexico Coastal Highways at Risk from a Sea Level Rise of Two Feet - 2050

Source:
Cambridge
Systematics
analysis of
U.S. DOT
Data



U.S. Gulf of Mexico Coastal Highways at Risk from a Sea Level Rise of Four Feet - 2100

Source:
Cambridge
Systematics
analysis of
U.S. DOT
Data



Current thinking in the U.S. regarding adaptation to climate change impacts on transportation

1998 - U. S. Department of Transportation report suggests adaptation as a potential response to sea level rise with a focus on technical solutions:

- ❑ Seawalls for protecting roads and causeways in coastal areas
- ❑ Seawalls for airports
- ❑ Port facility improvements for higher tides
- ❑ Land use planning is suggested as an adaptability mechanism in coastal areas

2002 - U.S. DOT Center for Climate Change & Environmental Forecasting workshop suggests:

- ❑ More research is needed to on weather patterns and impacts on infrastructure
- ❑ Nearly all infrastructure could be considered vulnerable
- ❑ Need to disseminate information to transportation decision makers

2008 - Transportation Research Board's (TRB) Committee on Climate Change and U.S. Transportation: Potential Impacts of Climate Change on U.S. Transportation.

Current thinking in the U.S. regarding adaptation to climate impacts on transportation

A review of documents from the American Association of State Highway and Transportation Officials (AASHTO), National Association of Regional Councils (NARC), and the American Planning Association (APA) show that these institutions are not addressing the climate change issue.

Overall, the picture in the United States in regard to adaptation of transportation infrastructure to potential impacts from climate change suggests:

- ❑ Incremental movement in the United States toward recognition of the significance of climate change impacts on transportation
- ❑ Currently this issue is not on the agenda for many of the relevant stakeholders

Research question

Are state DOTs and MPOs in the United States addressing the issue of climate change in general, and more specifically, the issue of adaptation to potential climate change and variability impacts?



Project assumptions

Adaptive strategies to large scale climate changes in the United States will primarily be addressed at the sub-national level.

For transportation infrastructure, this adaptation will need to occur in

- ❑ the departments of transportation (DOT) in each of the 50 states
- ❑ the Metropolitan Planning Organizations (MPOs), regional transportation planning and support agencies



Project methodology

- ❑ Content analysis of state DOT and MPO plans
- ❑ Surveys of state DOT and MPO planners (50 states and 70 MPOs: 53 total responses)
- ❑ In depth interviews with 11 agencies (5 MPOs and 6 state DOTs)



Findings: Content analysis

- ❑ Reviewed plans from 50 state DOTs and 70 MPOs
- ❑ Only 4 states (CA,CT,OR,WA) explicitly mention “climate change”
- ❑ Connecticut DOT includes adaptation action item:
 - “Encourage efforts that focus on risk and response assessment, including prediction tools, products and strategies for potential maintenance, system planning, safety management and emergency preparedness issues arising from global climate change.”
- ❑ Similar results with the MPOs plans: very few even mention climate change as an issue

Findings: Survey

Q16: Is your agency currently considering climate change as a factor in its decision making or planning processes?
(yes = 20; no = 32)

YES

“Because it is one of the most serious issues our generation faces!”

“Major focus of transportation plan update.”

“Just beginning to look at climate change in next years work program.”

“Considering it in relation to long range planning activities.”

“Recent awareness/interest on the part of some constituents”

“State is undertaking a comprehensive climate change planning process. Executive and legislative branches are very supportive.”

Findings: Survey

Q16: Is your agency currently considering climate change as a factor in its decision making or planning processes?

NO

“Staff follows the direction of Policy Board members and various state and federal guidance – it is not a priority of any of these levels at this time.”

“No documented reason.”

“Global warming has not yet become a local issue.”

“More urgent issues to address with limited resources.”

“Uncertainty as to the magnitude of the problem and specifically how to take the issue into consideration.”

Findings: Survey

Q19: Are you aware of any policies or projects in your agency aimed at adapting transportation infrastructure or services to the impacts of climate change? (yes = 10; no = 39)

“Hurricane evacuation and preparedness planning”

“Bus shelter redesign”

“Discussions are beginning”

“Promote smart growth”



Findings: Interviews

Problems defined

- ❑ Sea level rise and increased temperatures were the major stressors of concern
- ❑ Storms and flooding also of concern
- ❑ Mismatch between timeframes: planning (25 years) and climate change (50-100 years)
- ❑ Lack of good information, metrics, and measures for planning and decision making
- ❑ Lack of good measures and indicators of regional climate change
- ❑ Not incorporating climate change into planning process yet

Findings: Interviews

Solutions defined

- ❑ Develop metrics to measure climate change impacts
- ❑ Identify areas at risk
- ❑ Integrate climate change as a factor in planning
- ❑ Structural solutions – consider repairs to vulnerable infrastructure as the solution
- ❑ Regulatory solutions – prevent new infrastructure in at risk areas or special land use permits
- ❑ Better planning and longer term perspective

Project conclusions

Few agencies in this study are:

- ❑ considering climate change in their decision processes
- ❑ considering adaptation as a policy alternative

Survey and interview responses suggest:

- ❑ Incremental movement - several agencies are in the process of including climate change in plan and policy revisions.
- ❑ Need for public involvement and interaction with agencies – some are responding to public sentiment on this issue.

Project conclusions

Survey and interview responses suggest:

- ❑ State DOTs and MPOs are “in the middle” of the governance structure – they have to respond to the top down (federal) and bottom up (public) agendas.
- ❑ Uncertainty and lack of trust in climate science are issues to overcome.
- ❑ Lack of resources and political will are a common constraint.
- ❑ There is a willingness to integrate climate change adaptation in the planning process under certain circumstances.

MPSA Capstone Project 2008-2009

- ❑ Capstone Course: Real world problem and client
- ❑ Client: Houston Galveston Area Council
- ❑ Project question: What can an MPO do in regard to adaptation to climate change?
- ❑ Objective: Provide an assessment of resiliency planning as an effective means for addressing potential impacts of climate change on public infrastructure
- ❑ Research team: 8 Master's of Public Service and Administration students and 1 faculty advisor
- ❑ Approach: Content analysis (underway), field research and interviews
- ❑ Deliverables: Preliminary and final reports and presentation to HGAC Board of Directors, Spring 2009

Impact of Hurricane Ike on study area

- ❑ Increased awareness of vulnerability of study area and Texas Gulf Coast in general
- ❑ Support for a regional approach to adaptation
- ❑ Need for issue “education” (extreme events and climate change)
- ❑ Difficulty in defining the role of HGAC
 - Lack of regulatory authority
 - Climate change as an issue without well defined boundaries
 - Cyclical nature of the problem (agenda setting)
 - General acceptance of hurricanes and floods as the “cost of doing business” along the Texas Gulf Coast

Hurricane Ike

Debris, boats and trailers line the southbound lanes of Interstate Highway 45. (Eric Kayne, Houston Chronicle)



Hurricane Ike

The surge before the storm swamps Galveston Island, Texas, and a fire destroys homes along the beach as Hurricane Ike approaches the Texas coast. (David J. Phillip, AP)



Hurricane Ike

Flooding over access road 523 to Surfside beach, caused by the approach of Hurricane Ike. (Carlos Barria, Reuters)



Hurricane Ike

The JP Morgan Chase Tower in downtown Houston was heavily damaged by Hurricane Ike. (James Nielsen, Houston Chronicle)



Hurricane Ike

A single house is left standing amidst the devastation left by Hurricane Ike in Gilchrest, Texas. (Smiley N. Pool, Houston Chronicle)



Hurricane Ike

Traffic backs up on Interstate 45 northbound as residents evacuate the greater Houston area in anticipation of Hurricane Ike. (Smiley N. Pool, Houston Chronicle)



Conclusions and outlook for the future

- ❑ Incremental movement in the planning community toward adaptation as a solution to climate change impacts
- ❑ Some effort in developing regional metrics for decision making
- ❑ Still focusing on uncertainty and inability to “measure” climate change
- ❑ Primary focus is still on mitigation
- ❑ 2009 TRB Annual Meeting: *Transportation, Energy, and Climate Change*