Research on Infrastructure, Built Environment, and Public Policy

Institute for Science Technology and Public Policy
The Bush School of Government and Public Service
TEXAS A&M UNIVERSITY

Natural disasters, aging infrastructure, other events impact the quality of life throughout the world. The policy and political impacts are both immediate and long term. These projects seek to examine these complex social and natural issues and to inform policy and decision makers.

Current Projects

Climate Change/Variability Science and Adaptive Strategies for State and Regional Transportation Decision Making

Funder: Southwest Region University Transportation Center

According to the U.S. Department of Transportation's Center for Climate Change, projected climate-related changes in sea level, weather patterns, temperatures and precipitation, and an increase in extreme weather events (including tropical storms and hurricanes) will adversely affect transportation infrastructure and decision making. Much of the debate over climate change and transportation has previously been focused on mitigating the impact of automobile greenhouse gas emissions. However, the need to link climate change/variability science, (including modeling, risk analysis and assessments, regional impacts assessment, projections and probabilities) with adaptive strategies, regardless of the cause, has risen on the decision agenda within the USDOT and the Transportation Research Board. Much of the impact of climate change and variability will be felt at the state and regional levels, and there will be significant negative implications for not developing adaptation strategies at these decision and policy levels. The objective of this study is to generate a baseline understanding of current policy response to climate change/variability at the state and regional transportation planning and decision levels. Results will provide a "best practices" component which will not only include existing adaptation and recovery strategies, but potential new policy ideas for adaptation and recovery at the state and regional decision levels. The final UTC report can be used as a workbook for integrating climate science at the state and regional planning levels, and as a resource for state and regional policy and decision makers in the environmental and climate change policy arena. At this time, there is a significant lack of information of this kind available for decision makers. The research team includes: Principal Investigator, Dr. Eric Lindquist (ISTPP Associate Research Scientist/political science) and Co-Principal Investigator, Dr. Arnold Vedlitz (ISTPP Director/political science).

Graduate Course Development: Transportation Policy and Politics

Funder: Southwest Region University Transportation Center

At this time, there are no course offerings at Texas A&M University (TAMU) covering transportation policy and politics. Considering the focus on transportation in both research and education at TAMU, in particular through the activities of the Texas Transportation Institute (TTI), the Civil Engineering and Landscape Architecture and Urban Planning programs, the availability of such a course could significantly enhance these existing activities. It is increasingly important for transportation professionals to be familiar with and work in an interdisciplinary environment and to become familiar with policy and political issues and processes relevant to their fields. In addition, this work will provide an opportunity to engage relevant TAMU Colleges and Departments in dialogue regarding transportation policy in an educational context. This project will systematically assess the market for a graduate-level course in transportation policy and politics at TAMU, develop relevant material for such a course (syllabi and reading lists), and provide recommendations for implementing this course. The results from this project will be used to support the recommendation of a graduate-level transportation policy course at TAMU. The Master of Public Service and Administration (MPSA) in The Bush School of Government and Public Service is the tentative home for this course, although this may be revised pending project findings. The course is being developed by Principal Investigator Dr. Eric Lindquist (ISTPP Associate Research Scientist/political science).

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Current Projects *(cont.)*

Transportation Planning, Policy and Climate Change: Making the Long-Term Connection

Funder: University Transportation Center for Mobility (UTCM)

Climate change and variability will have significant impacts on the future mobility of the population in this country. Previous research conducted by the Principal Investigators has found that the transportation sector is not considering adaptation as a solution to these potential impacts. Further, preliminary results from a current project funded by the Southwest Region University Transportation Center—*Climate Change/Variability Science and Adaptive Strategies for State and Regional Transportation Decision Making*—suggest that state and regional transportation planners are not integrating climate change science and impacts into their decision and planning processes. This runs counterintuitive to the traditional long range focus of these planning processes, however. Our findings suggest several reasons for this situation, including: uncertainty in regard to climate science, lack of resources, other problems that require more short term attention, a lack of understanding of the problem, and the desire to avoid the issue as too political. These findings raise significant questions we are exploring in more detail in this project. If transportation decision makers are not concerned with climate change, why not, and will this situation continue even as climate change is recognized as a significant threat to the health and mobility needs of society, and its infrastructure? Can the question of uncertainty in regard to climate science be resolved as an issue as far as policy makers are concerned? What other long range issues are considered more significant to planners and policy makers? Coastal areas in particular are seen as vulnerable to climate change and variability, and will comprise the regional focus of this study. From a temporal perspective we are interested in adaptation to abrupt climate change (discrete climate events such a hurricane or storms) as well as longer term incremental changes traditionally associated with global warming. This project will be structured around two general themes: 1) continued research on the climate change and adaptation nexus and its impact on future mobility needs, and 2) interactions with transportation planners and policymakers. The research team includes: Principal Investigator, Dr. Eric Lindquist (ISTPP Associate Research Scientist/political science) and Co-Principal Investigator, Dr. Arnold Vedlitz (ISTPP Director/political science).

Mileage-Based User-Fee Pilot Project: Rural/Small Urban Area Application in Northeast Texas

Funder: University Transportation Center for Mobility (UTCM)

Over the past few years, transportation practitioners have identified the growing gap between transportation infrastructure investments, particularly new capacity to meet growing travel needs and rehabilitation of aging infrastructure and the generation of revenue necessary to achieve these investments. Inflation, rising construction costs, and increased vehicle fuel efficiency has caused a decline in the purchasing power of the fuel tax. The shift to more fuel efficient vehicles, and the incremental use of alternative fuels, will result in fewer gallons consumed over time. There is an urgent need to begin addressing the challenges of moving toward a user-fee approach as a more equitable substitute for the fuel tax, and the most logical way to address both technological and public acceptance concerns is through pilot implementation programs that demonstrate the application, evaluate the benefits and drawbacks, and communicate the findings to policymakers at local, state, and national levels. Since the early 1990s, a variety of states and regions have studied the application of use-based fees. By contrast to previous efforts, this proposed effort is focused upon determining the appropriateness of mileage-based user fees for accomplishing regional goals and objectives for mobility and long term financial sustainability. It involves correlating fees collected with roadway maintenance, operations, and expansion expenditures; determining .actual. value of roadway miles traveled (reducing the need for formula estimates), and building the case for a citizen-validated ballot measure for transitioning to a new finance framework.

This project will conduct a strategic assessment of the fuel tax collection framework in Northeast Texas. This assessment will help researchers identify: 1) What players. and interests are involved in fuel taxation in the area; 2) What barriers and constraints might develop in response to a proposed fuel taxation collection framework; 3) How regional fuel taxes are collected; 4) What the detailed connection is between taxes raised and revenues distributed; 5) What the magnitude of funds is that a mileage based system must collect; 6) How fuel taxes collected and revenue distributed have been measured over time; and 7) How trip valuation should occur. The research team includes: Principal Investigator, Dr. Ginger Goodin (Research Engineer, Texas Transportation Institute, Austin, Texas) and Co-Principal Investigator, Dr. Eric Lindquist (ISTPP Associate Research Scientist/political science).

Research on Infrastructure, Built Environment, and Public Policy

Completed Projects

Impacts of Climate Variability and Change on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I

Funder: U.S. Department of Transportation (USDOT)

The changing climate raises critical questions for the transportation sector in the United States. As global temperatures increase, sea levels rise, and weather patterns change, the stewards of our Nation's infrastructure are challenged to consider how these changes may affect the country's roads, airports, rail, transit systems, and ports. The U.S. transportation network – built and maintained through substantial public and private investment – is vital to the Nation's economy and the quality of our communities. Yet little research has been conducted to identify what risks this system faces from climate change, or what steps managers and policy makers can take today to ensure the safety and resilience of our vital transportation system.

This study: *The Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* has investigated these questions through a case study of a segment of the U.S. central Gulf Coast. The Gulf Coast study area includes 48 contiguous coastal counties in four States, running from Houston/Galveston, TX, to Mobile, AL. The research, sponsored by the U.S. Department of Transportation (DOT) in partnership with the U.S. Geological Survey (USGS), has been conducted under the auspices of the U.S. Climate Change Science Program (CCSP). The study is 1 of 21 "synthesis and assessment" products planned and sponsored by CCSP. The interdisciplinary research team included experts in climate and meteorology; hydrology and natural systems; transportation; and decision support.

A case study approach was selected for this research as an approach that would generate useful information for local and regional decision makers, while helping to develop research methodologies for application in other locations. In defining the study area, the DOT sought to design a project that would increase the knowledge base regarding the risks and sensitivities of all modes of transportation infrastructure to climate variability and change, the significance of these risks, and the range of adaptation strategies that can be considered to ensure a robust and reliable transportation network. The availability of reliable data, interest of local agencies and stakeholders, and transferability of findings were also important criteria in selecting the study area. This study focuses on those climate factors which are relevant to the Gulf Coast; in other areas different aspects of climate change may be significant. The modeled climate projections and the specific implications of these scenarios for transportation facilities are specific to the Gulf Coast study area However, the methods presented in this report can be applied to any region.

This report presents the findings of the first phase of a three phase research effort. The ultimate goal of this research is to provide knowledge and tools that will enable transportation planners and managers to better understand the risks, adaptation strategies, and tradeoffs involved in planning, investment, design, and operational decisions vulnerabilities of transportation in the region, after collecting and integrating the range of data needed to characterize the region—its physiography and hydrology, land use and land cover, past and projected climate, current population and trends, and transportation infrastructure. Subsequent phases will conduct more detailed analyses. Phase II will conduct an in-depth assessment of risks to transportation in a selected location, reporting on implications for long-range plans and impacts on safety, operations, and maintenance. This phase will also develop a risk assessment methodology and identify techniques to incorporate environmental and climate data in transportation decisions. Phase III will identify and analyze adaptation and response strategies and develop tools to assess these strategies, while enumerating future research needs.

The project's large, interdisciplinary research team was led by Michael J. Savonis, Federal Highway Administration; Virginia Burkett, U.S. Geological Survey; and Joanne R. Potter, Cambridge Systematics. ISTPP team members included Co-Principal Investigator, Dr. Eric Lindquist (ISTPP Associate Research Scientist/political science), Co-Principal Investigator, Dr. Ronald R. Hagelman III (Assistant Professor, Department of Geography, Texas State University-San Marcos), Dr. Wesley Dean (ISTPP Assistant Research Scientist/sociology) and ISTPP Director, Dr. Arnold Vedlitz (political science). Drs. Lindquist and Dean co-authored Chapter 5 and Dr. Hagelman co-authered Chapters 2 and 6. A list of the full project team can be found online at: www.climatescience.gov/Library/sap/sap4-7/.

Full Report Citation:

CCSP, 2008: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Savonis, M. J., V.R. Burkett, and J.R. Potter (eds.)]. Department of Transportation, Washington, DC, USA, 445 pp.

For additional information, visit the Climate Change Science Program (CCSP) website: www.climatescience.gov/. This research is part of Project No. 4.7. The final project report, public review comments, peer review comments, along with responses to these comments, can be found onlin at: www.climatescience.gov/Library/sap/sap4-7/.

Completed Projects *(cont.)*

SGER: An Integrated Study of Post-Flood Hydrology, Ecology, Politics and Policy Change: A Cross-National, Urban Perspective

Funder: National Science Foundation (NSF), Small Grants for Exploratory Research (SGER)

Natural disasters such as floods, earthquakes, and hurricanes have impacts far beyond the physical damage related to the actual event. The policy and political impacts of natural disasters can be immediate, in the form of federal disaster relief aid, or long-term, as in changes to long-standing land use regulations. As a result of Tropical Storm Allison, Houston suffered over $5 billion in damages, the loss of 22 lives and an estimated 73,000 homes. Recently, as a result of major flooding in Central Europe, the German city of Dresden, and Prague, in the Czech Republic, experienced similar disasters, the impacts of which are being estimated in the billions of dollars. The similarity of these events provides a unique research opportunity to contribute a broader understanding of the role of focusing events on policy development, politics, and the general health and well being of society. From a research perspective, we are interested in understanding how focusing events, such as urban flooding, develop and propagate across scales and influence decision processes in regard to physical infrastructure and subsequent changes in policy.

The objectives of this SGER proposal were two-fold. The first objective was to initiate contact with social and physical scientists in Europe and develop a collaborative research team capable of focusing on the broad topic of public policy change as a result of urban flooding. Researchers expanded upon personal contacts in their respective areas and sought additional collaborators in substantive research areas within the physical and social sciences, as well as geographical areas impacted by both recurring and nonrecurring urban flooding events. In so doing, we will also identify sources of relevant and reliable data, and to the extent possible, collect baseline hydrologic, ecologic, and social field data on the impact of the recent flooding incidents such as those in Germany, the Czech Republic, and Houston. The end point of this phase of the SGER project will be a well-defined, and committed interdisciplinary and cross-national research team. The second objective is to integrate the disciplines of political science/public administration, hydrology and the geosciences into a strategically sound large scale, multi-year cross-national, collaborative, interdisciplinary research proposal for submission to either multiple NSF programs, or one major cross-cutting NSF initiative. The context for this proposal is cross-national. The integration of the physical and social sciences also reflects the current interest from NSF in approaching complex social and natural problems through multiple perspectives.

The research team includes Principal Investigator, Dr. Binayak Mohanty (biological and agricultural engineering) and Co-Principal Investigator, Dr. Eric Lindquist (ISTPP/political science)

Completed Projects *(cont.)*

Exploring the Interface of Urban Decision Dynamic and Infrastructure Knowledge

Funder: National Science Foundation (NSF), Urban Research Initiative (URI)

In countless cities across the U.S., infrastructure—streets, bridges, sewers and other public utilities—is aging and falling into an increasingly critical state of disrepair. And just as these elements of our infrastructure have passed their prime, so too have the computer information systems we use to manage and maintain them. This growing problem is about much more than simply fixing what's broken; it's about fixing the *way* that we fix what's broken. That was the focus of this interdisciplinary research effort. A team of researchers at the Institute for Science, Technology and Public Policy worked to design a "decision support systems" or DSS to help cities maintain their support systems in a way that's more efficient and less expensive. If adapted, the resulting advancements could produce nationwide savings worth tens of billions of dollars.

The city of Houston served as the case study site and partner for this research. The Houston case included a large set of stakeholders and problem elements that were related in complex ways and often changed dynamically during the decision process. Data were gathered from three units: the Department of Public Works and Engineering, the Mayor's Office, and the City Council.

After analysis, the researchers defined nine key requirements for a good decision support system. Among other things, the researchers determined that infrastructure decision making could be greatly enhanced by consolidation of information, communication and decision making; that there is a need for significant investment in infrastructure information that is understandable by non engineers; that the decision support system will have important educational community building functions; and as stakeholders use the decision support system, they will learn about the decision process, suggesting process improvements.

Researchers believe that the basic decision support suggestions they have made can be a starting point for future research-based refinements. By integrating information from engineering, human and environmental issues, the decision support system will enable users to utilize a more comprehensive body of information. It can encourage stakeholders to broaden their decision criteria and also serve as an educational vehicle for non-technical personnel. If users take advantage of the full range of information provided, it should result in a better-rounded decision process. For the citizens, this could result in improved streets, dependable public utility systems, and overall, a better to community in which to live.

The research team reflected the multiple perspectives that influence infrastructure decisions in all cities—social sciences (political science, business, and communication), engineering sciences and ecological sciences. The research team was led by Principal Investigator and civil engineer, Dr. Timothy J. Lomax, Texas Transportation Institute and Dr. Arnold Vedlitz, ISTPP Director and political scientist. Other project team members included Dr. Scott Poole (communication), Dr. Marty D. Matlock (biological and agricultural engineering), and Dr. Robert Lytton (civil engineering).