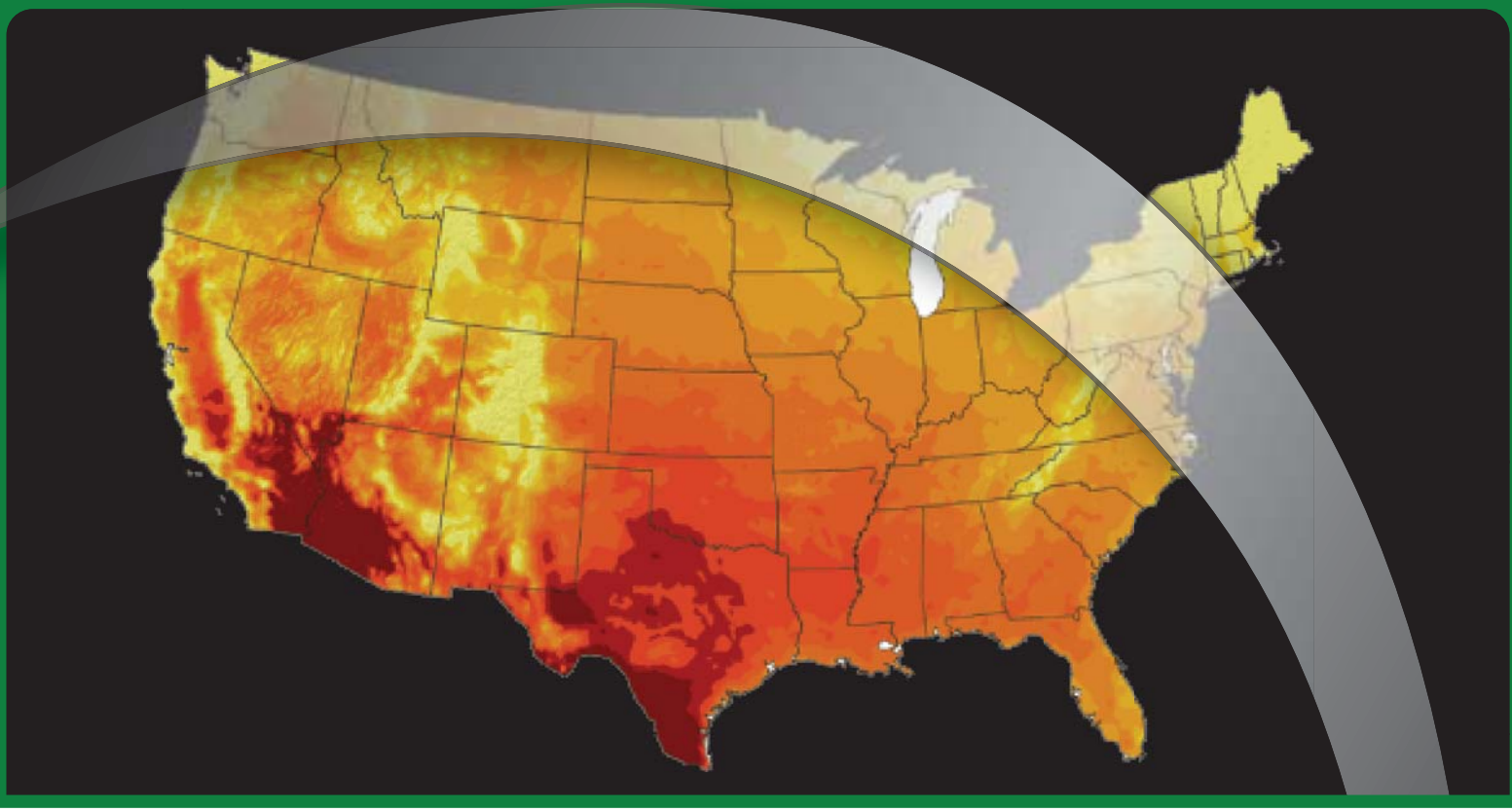


Federal Highway Administration
Surface Transportation Environment and Planning Cooperative Research Program

Success Story: The Gulf Coast Study

January 2010

U.S. Department of Transportation
Federal Highway Administration

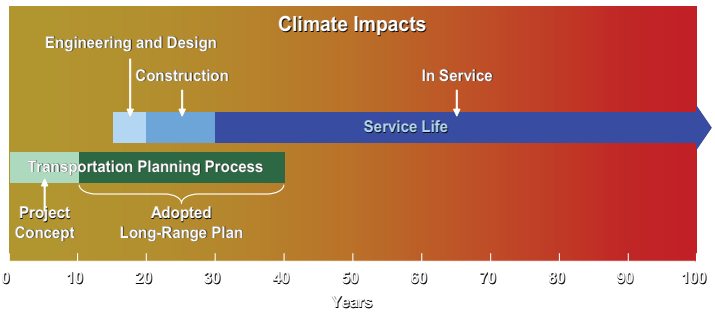
Surface Transportation Environment and Planning Cooperative Research Program (STEP) Bulletin

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

Under the STEP cooperative research program, FHWA supports environment and planning activities and initiatives of interest to the transportation community and the public at large, including facilitating partnerships, developing strategies, and conducting cutting-edge research on national priorities such as climate change. This STEP Bulletin highlights *Gulf Coast Study, Phase I*—research that addresses the impacts of climate change on transportation systems and infrastructure.

www.fhwa.dot.gov/HEP/STEP

Answering Critical Questions about Climate Change and Transportation



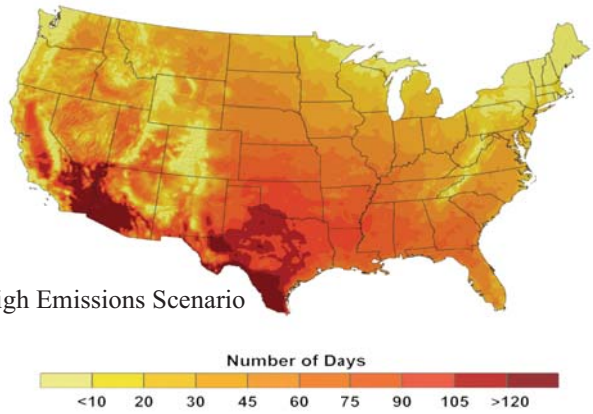
How will climate change affect transportation? The FHWA has been interested in this question since the late 1990s.

Roads, bridges, ports and rail lines are in service for very long periods, usually 50 to 100 years. And, the best current science tells us that the future climate in the U.S. will be very different from what we know today.

How will our climate be different? Can we determine future climate conditions in ways that might improve the transportation decisions we make today? How we design and build roads today, and where we locate them, will be vital to the kind of service we provide in the future.

STEP Success Story: *The Gulf Coast Study*

With STEP funding, FHWA set out to answer these questions in 2003 and initiated, *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I.*



High Emissions Scenario

Source: *Global Climate Change Impacts in the United States,* USGCRP (June 2009)

Since transportation systems, like politics, are local, FHWA decided that a case study was the best way to research these important questions. The central Gulf Coast was selected for examination because this area is densely populated and has a complex, multi-modal transportation network that is vital to America's oil and gas interests.

The FHWA collaborated with top scientists from the U.S. Geological Survey, assembled a broad 27-member team of authors (for the full list, follow the link to the Gulf Coast Study under "Additional Information"), and established a Federal Advisory Committee of climate, transportation and decision support experts to oversee the research. The study was conducted under the auspices of the United States (U.S.) Department of Transportation's (DOT) Center for Climate Change and the U.S. interagency Climate Change Science Program. The *Gulf Coast Study* was one of their highest priority research projects.

Phase I, an overview of the climate effects and resulting transportation impacts of the changing climate, was completed in March 2008.

Science magazine called it, "the most rigorous effort thus far to quantify how climate change could impact vulnerable U.S. infrastructure.…"

Then-DOT Secretary Mary Peters said it, "provides… valuable information [to] better assess the sustainability of our transportation system…" The author team was commended by the President's Science Advisor and the Secretaries of Commerce and Energy, who submitted the report to Congress.

Research Overview

The primary objectives of *Phase I* were to assemble the data needed for an analysis of the potential impacts of climate chage on transportation; determine whether climate and ecological data could be usefully employed in such an assessment in the Central Gulf Coast; identify and implement an assessment approach; and provide an overview of the potential impacts.

Conducting the *Gulf Coast Study* required the collection of more than 250 gigabytes of data in a Geographical Information System format that described the region's physical environment and hydrology, land use and land cover, past and projected climate, current population and trends, and transportation infrastructure.

Historical trends and future climate scenarios were used to establish a context for examining the potential effects of climate change on all major transportation modes within the region. Rather than relying on a single set of models or projections, the Study employed a range of future greenhouse gas scenarios and the output of an ensemble of climate models to bracket future conditions. The latest and most sophisticated statistical techniques were used to "downscale" climate projections from the national to the regional level.

Existing planning practices and time horizons were also examined to determine if climate change was considered in planning and project development, and if current techniques are able to address these considerations.

What We Found

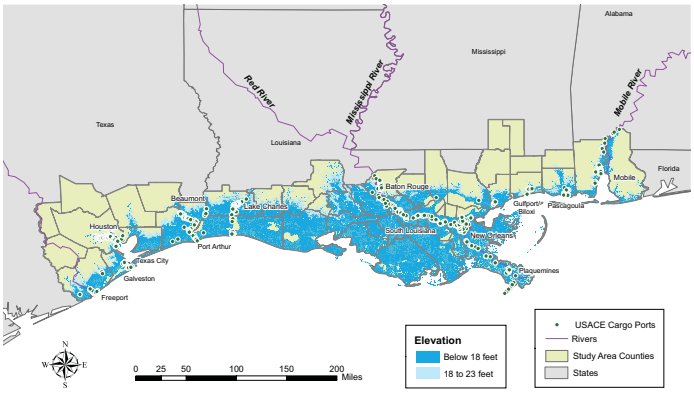
The climate is changing. Sea levels in the Gulf of Mexico are likely to rise by two to four feet over the next 50 to 100 years from the combination of climate-induced warming and land subsidence. Tropical storms are anticipated to increase in intensity and the number of heavy precipitation events is expected to increase, raising prospects of flooding and structural damage. And the number of very hot days (i.e., >90°F) could rise by 50%.

The expected impacts of these climate effects on transportation are striking. An untenable portion of the region's road, rail, and port network is at risk of **permanent** flooding if sea levels rise by four feet. This includes more than 2,400 miles (27%) of the major roads, 9 % of the rail lines, and 72 % of the ports.

More than half (64% of interstates; 57% of arterials) of the area's major highways, almost half of the rail miles, 29 airports, and virtually all of the ports are subject to temporary flooding and damage due to increased storm intensity.

The increase in daily high temperatures could increase wear on asphalt and the potential for rail buckling. Construction costs are likely to increase because of restrictions on workers on days above 90 degrees Fahrenheit.

Transportation planners can employ climate data to draw meaningful conclusions about the future. In fact, the *Gulf Coast Study* recommends that transportation decision makers in the Gulf Coast should begin immediately to assess climate impacts in the development of transportation investment strategies. The study also found, however, that transportation planners need new methodological tools to address the longer time frames, complexities and uncertainties that are inherent in projections of climate phenomena. Such methods are likely to be based on probability and statistics (i.e., risk assessment techniques) as much as on engineering and material science.



Next Steps

STEP played a critical role in the successful accomplishment of *Phase I*. While *Phase I* strongly demonstrated the need to consider climate impacts in current planning, it stopped short of advising how to conduct vulnerability or risk assessments or how to decide what adaptations are most likely to be effective in the long term. The FHWA is continuing its examination of transportation in the Gulf Coast. *Phase II,* currently underway with STEP funds, will shed further light on how we can make our transportation networks as robust and resilient as possible.

Additional Information

The reference for the report is:

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 [M.J. Savonis, V.R. Burkett, and J. R. Potter (eds.)] Department of Transportation, Washington, DC, USA, 445 pp., which can be downloaded for free from: http://www.globalchange.gov (search: Product 4.7)

We also recommend:

Global Climate Change Impacts in the United States, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson (eds.), A Report by the U.S. Global Change Research Program. Cambridge University Press (June 2009) which can be downloaded for free from: http://www.globalchange.gov (search: Publications --> Reports and Assessments --> USGCRP Scientific Assessments)

Useful transportation and climate change information can also be found at the:

U.S. DOT Transportation and Climate Change Clearinghouse website http://www.climate.dot.gov/

FHWA Highways and & Climate Change website http://www.fhwa.dot.gov/hep/climate/index.htm

"STEP: A Federal Research Program - Conducting Research that Links to Practice."

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