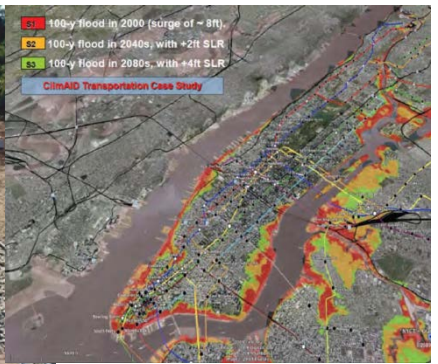




U.S. Department of Transportation  
Climate Adaptation Plan



*Ensuring Transportation Infrastructure and System Resilience*

Cover graphics courtesy of Nashville MTA, Volpe National Transportation Systems Center, and Jacob Klaus.

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## 1. Introduction

Under Executive Order No. 13514 and Council on Environmental Quality (CEQ) Implementing Instructions, the U.S. Department of Transportation (DOT) is required to submit a Climate Adaptation Plan for implementation in 2013. DOT's work on climate adaptation began a number of years before this requirement because potential climate impacts influence DOT's strategic goals of safety, state of good repair and environmental sustainability. This plan reflects FY12 and FY13 commitments as well as other DOT accomplishments. It incorporates DOT's earlier report on vulnerabilities to climate variability and change. DOT's Policy Statement on Climate Adaptation is attached.

The Department's mission is to serve the United States by ensuring a safe, efficient, accessible and convenient transportation system that meets vital national interests and enhances the quality of life of the American people, today and into the future. The Department and its modal agencies oversee the safe operation of the United States transportation system including more than 3.9 million miles of public roads, 120,000 miles of major railroads, 25,000 miles of commercially navigable waterways, 5,000 public-use airports, 500 major urban public transit operators and more than 300 coastal, Great Lakes, and inland waterways ports.<sup>1</sup>

Scientists have concluded that some level of climate change has already occurred, weather patterns are changing, and these changes are expected to continue or accelerate in the future.<sup>2</sup> Additionally, past weather and climate patterns appear to be much less reliable indicators of future weather and climate than in recent decades, which necessitates greater flexibility in planning and decision-making processes.

DOT shall integrate consideration of climate impacts and adaptation into the planning, operations, policies, and programs of DOT in order to ensure that taxpayer resources are invested wisely and that transportation infrastructure, services and operations remain effective in current and future climate conditions.

**Excerpt from DOT Policy Statement on Climate Adaptation**

Transportation both contributes to and will be impacted by climate change. While mitigating transportation contributions to greenhouse gas emissions and adapting to climate impacts on the transportation system are equally important for the transportation sector to address, this plan addresses adaptation work only.

<sup>1</sup> Source: <http://www.nationalatlas.gov/transportation.html>

<sup>2</sup> See USGCRP, Global Climate Change impacts in the United States, particularly pp.27-40. <http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/full-report>

DOT recognizes that climate variability and change pose potential threats to U.S. transportation systems. The range of impacts from these threats may include roadway deterioration, flooding, limited waterway access, and weakened structures. Severe conditions may reduce the life of capital assets and increase operational disruptions. Some consequences may require changes in the design, construction, and maintenance of infrastructure. For example, incorporation of certain materials and building techniques will enable infrastructure to better withstand extreme temperatures.

Building resilience to climate and weather-related risk is common sense management to protect current and future investments and to maintain safe operational capabilities. Adaptation to climate change can include adjusting how transportation infrastructure is planned, designed, built and operated. Making climate adaptation a standard part of agency planning can ensure that resources are invested wisely and that services and operations remain effective.

Transportation infrastructure is inherently long-lived. Bridges, tunnels, ports and runways may remain in service for decades, while rights-of-way and specific facilities continue to be used for transportation purposes for much longer. In addition to normal deterioration, transportation infrastructure is subject to a range of environmental risks over long time spans, including wildfire, flood, landslide, geologic subsidence, rock falls, snow, ice, extreme temperatures, earthquakes, storms, hurricanes and tornados. Infrastructure designers and operators must decide the magnitude of environmental stress that any particular project will be able to withstand over its lifetime.

### **Notable Potential Impacts**

- More frequent/severe flooding of underground tunnels and low-lying infrastructure, requiring drainage and pumping, due to more intense precipitation, sea level rise, and storm surge.
- Increased numbers and magnitude of storm surges and/or relative sea level rise potentially shorten infrastructure life.
- Increased thermal expansion of bridge joints and paved surfaces, potentially causing possible degradation, due to higher temperatures and increased duration of heat waves.
- Higher maintenance/construction costs for roads and bridges, due to increased temperatures, or exposure to storm surge.
- Asphalt degradation and shorter replacement cycles; leading to limited access, congestion, and higher costs, due to higher temperatures.
- Culvert and drainage infrastructure damage, due to changes in precipitation intensity, or snow melt timing.
- Decreased driver/operator performance and decision-making skills, due to adverse weather.
- Increased risk of vehicle crashes from improperly maintained vehicles, due to severe weather.
- System downtime, derailments, and slower travel times, due to rail buckling during extremely hot days.
- Reduced aircraft performance leading to limited range capabilities and reduced payloads.
- Air traffic disruptions, due to severe weather and precipitation events that impact arrival and departure rates.
- Reduced shipping access to docks and shore equipment and navigational aid damage.
- Restricted access to local economies.

Good project design balances both costs and benefits. It is important that infrastructure designers use the best possible information to assess all future environmental risks, including longer-term risks from climate variability and change, because many of the structures being built today will still be in use fifty or, in some cases, one hundred years in the future. If a project is overbuilt, it may cost too much and prevent other, more useful investments. If it is underbuilt, it is subject to risks of premature damage or destruction that require premature repair or replacement and impose an additional cost of being out of service on the public.

Climate variability and change present new challenges as DOT develops and advocates solutions to national transportation needs. DOT recognizes that particular changes in global climate and domestic weather patterns may require different adaptation strategies than in the past. DOT began to explore integrating climate change considerations into its planning and programs several years ago. While DOT has made progress, the process to more fully integrate climate considerations into planning and programs, and to build a more resilient transportation system, is expected to take place over time. Early consideration and development of proactive adaptation strategies can help achieve a more efficient and cost-effective approach to preserve transportation infrastructure and enhance public safety.

DOT's operating administrations are taking steps to address the impacts of climate variability and change on their respective missions, which, in turn, address the Department's overarching vulnerabilities. These steps vary among modes, but collectively substantial effort is focused on adapting to climate variability and change implications.

As required by EO 13514 and CEQ Implementing Instructions, DOT identified three high-level priority actions for implementation in both Fiscal Years 2012 and 2013. Each of these actions will support DOT's mission and improve the transportation sector's ability to assess and build resilience to risks posed by climate variability and change. DOT operating administrations committed to implementing the following priority actions:



**DOT Priority Actions for Implementation**

- **Planning.** DOT will take actions to ensure that Federal transportation investment decisions address potential climate impacts in statewide and metropolitan transportation planning and project development processes as appropriate in order to protect federal investments. Through such actions transportation systems will gradually become better prepared for future climate shifts.
- **Asset Management.** DOT will work to incorporate climate variability and change impact considerations in asset management. For example, modal administrations will work with grantees to assure that potential impacts are incorporated into existing grantee asset management systems. Agencies will assess the policy, guidance, practices, and performance measures of its asset management programs to incorporate such considerations.
- **Tools.** DOT will provide tools, case studies, best practices, and outreach for incorporating climate considerations into transportation decision-making.

This adaptation plan lays out steps DOT will take to move towards fully integrating considerations of climate change and variability in DOT policies, programs and operations. The Office of the Secretary and operating administrations are each playing a role, to varying degrees, in implementing this plan. The Office of Safety, Energy and Environment (OSEE) in the Office of the Secretary (OST) is coordinating DOT's actions with support from the Research and Innovative Technologies Administration and DOT's Climate Change Center. OSEE has participated on the Interagency Climate Change Adaptation Task Force, the related CEQ working group and the community of practice. DOT staff has presented work on regional impacts, pilots and best practices before Federal forums and with Federal agencies in order to share information and exchange best practices. As one example, DOT staff met with Department of the Interior staff to collaborate on transportation-related elements of the National Fish, Wildlife and Plants Climate Adaptation Strategy.

The DOT administrations listed below have committed to fulfilling specific actions related to DOT's high-level priority actions. Most DOT administrations report progress on adaption actions along with other regulatory and sustainability actions to the Deputy Secretary at regularly scheduled meetings.

- |   |   |
|---|---|
| • Federal Aviation Administration (FAA)                   | • Federal Highway Administration (FHWA)                 |
| • Federal Transit Administration (FTA)                    | • Federal Railroad Administration (FRA)                 |
| • Federal Motor Carrier Safety Administration (FMCSA)     | • Maritime Administration (MARAD)                       |
| • Pipeline and Hazardous Materials Administration (PHMSA) | • Saint Lawrence Seaway Development Corporation (SLSDC) |

## 2. Potential Vulnerability and Impacts

DOT identified three general vulnerabilities to climate change, which it will address through its climate adaptation actions. They focus on infrastructure and systems of infrastructure to foster a resilient transportation system.

1. **Existing Infrastructure Resilience:** Existing transportation infrastructure is owned and operated by various public agencies and private firms, and covers an enormous range of ages, service life and levels of sophistication. Existing infrastructure has been built to many different design standards, and its current and future environmental risk is similarly varied. As environmental risks change, the probability of unexpected failures may increase. Further, as existing infrastructure approaches the end of its service life, decisions about replacement or abandonment should, but may not currently take into account changing future risks.
2. **New Infrastructure Resilience:** Similarly, newly constructed infrastructure should be designed and built in recognition of the best current understanding of future environmental risks. In order for this to happen, understanding of projected climate changes would need to be incorporated into infrastructure planning and design processes, across the many public and private builders and operators of transportation infrastructure.
3. **System Resilience:** Transportation systems are more than just the sum of their individual parts. Some elements are of particular importance because of their vital economic role, absence of alternatives, heavy use, or critical function. The National Airspace System, for example, plays a critical economic role, while hurricane evacuation routes perform a critical function. Transportation systems are potentially vulnerable to the loss of key elements. Therefore selectively adding redundant infrastructure may be a more efficient strategy than hardening many individual facilities on the existing system. System resilience is best viewed across transportation modes and multiple system owners. While some key elements are obvious, other dependencies may be less well recognized. For example, some airports rely on petroleum pipelines, which may depend, in turn, on electric power for pumping. Transportation systems are also interdependent when passengers rely on multiple transportation modes to reach their destination.

The vulnerabilities described above have some degree of opportunity to disrupt transportation operations and damage transportation assets. The greater the extent of the vulnerability, the greater the risk is for transportation systems and infrastructure. Transportation vulnerabilities to climate impacts must be evaluated alongside other risks to ensure better management of assets and, ultimately, ensure the long-term viability of American transportation systems.



DOT initially began adaptation efforts by identifying transportation related vulnerabilities to the potential impacts of climate variability, change and severe weather events. Understanding the range of potential impacts is essential for DOT to develop adaptation actions and options.

### *Higher Temperatures*

Fluctuating temperatures or longer periods of high temperature are expected to place additional stress on transportation infrastructure. For example, transit, highway, airport and other transportation systems across the country will face steadily increasing numbers of days in excess of 90 degrees Fahrenheit and less predictable weather patterns. Some transportation systems may also face more intense storms and changes in precipitation, though projections of precipitation are less clear than those of temperature. Some of the impacts may require changes in the design, construction, or maintenance of infrastructure such as incorporating materials and building techniques that allow infrastructure to better withstand temperature extremes.



**Rail Buckle from High Heat  
(Photo source DOT Volpe)**

More extreme conditions also may reduce the life of capital assets and increase operational disruptions. Higher temperatures can break down asphalt, buckle rail track or increase the demand for air conditioning potentially overloading the power grid. Any of these impacts can cause system downtime and/or derailments.

On the other hand, some climate change effects may positively affect transportation goals, as higher average temperatures in certain regions could reduce safety and maintenance concerns associated with snow and ice accumulation.

Warmer temperatures are expected to affect the volume and rates of water flow in rivers, lakes, reservoirs and marshes, ultimately affecting water depth and the cargo carrying capacity of marine vessels. Increasing temperatures may create greater demands from hydroelectric systems that depend on the water system of the Saint Lawrence Seaway, which may reduce the water available for commercial shipping.

### *Severe Weather and Precipitation*

Severe weather and precipitation already heavily affect transportation infrastructure, and potential changes in precipitation could increase future impacts. For example, four of the seven largest US public transit systems are located in the country's northeast, where climate change models forecast the largest increase in rain intensity in coming decades. In 2007, the New York City subway system was shut down by flooding during the morning rush hour, affecting 2 million commuters. Severe weather events also often impair or disable critical power lines and systems

Severe precipitation which increases the flooding of roadways, tunnels and evacuation routes can reduce the life of highway infrastructure. It can also increase road washout, landslides, and mudslides that damage roadways and overloaded drainage systems, causing traffic backups and street flooding. Ultimately, severe precipitation and wind speeds can damage bridges, signs, overhead cables and other tall structures. Storm surge can damage and destroy coastal roadways, bridges and airports.



**Hurricane Damage from Wave Action to Highway 90 in Bay St Louis, MS (Illinoisphoto.com)**

National airspace system efficiency and aviation system infrastructure can be adversely affected by severe weather and precipitation. Severe weather can cause delays in operations, impacting air traffic flow and reducing runway arrival and departure rates. More severe events may also increase airfield flooding and erosion, potentially requiring adjustments to infrastructure, drainage and erosion control measures.

Severe weather may impact road safety by heightening the risk of commercial motor vehicle or passenger vehicle crashes. Adverse weather conditions may increase weather-related delays and traffic disruptions. Traveling in severe weather can also contribute to operator fatigue which may affect driver/operator performance and decision-making skills.

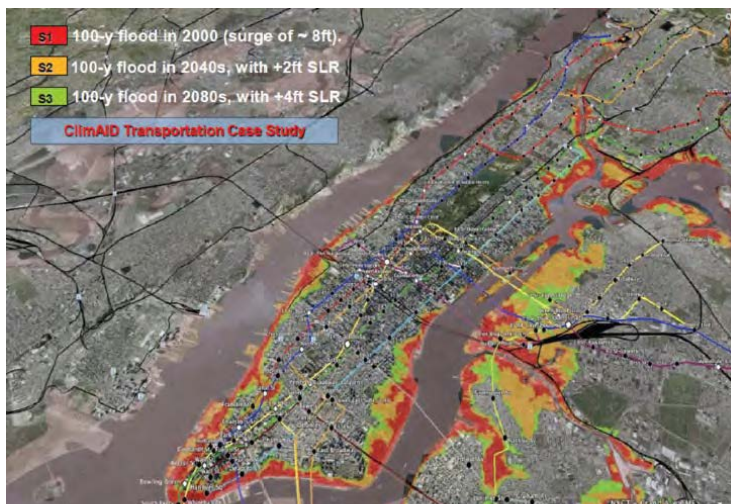
### *Sea level rise*

Sea level rise presents challenges to the transportation system and infrastructure. Rising sea level can present flooding risks to underground infrastructure such as subway and road tunnels,

allowing water to enter through portals and ventilation shafts. Where sea level rises, coastlines will change and infrastructure that was not previously at risk to storm surge and wave damage may be exposed.

Rising sea level can affect transit agencies on the US coasts. These systems may experience more downtime due to flooding, requiring system users to be rerouted and possibly making obsolete earlier transportation investments in low-lying coastal areas. Some US airports located in coastal areas could be vulnerable to increased flooding with sea level rise.

Rising sea level may also take a toll on marine highway system infrastructure, including ports, terminals, shipyards, and the interfaces with other transportation modes. Sea level changes may add to the rate of infrastructure deterioration and damage shore side equipment and navigational aids. This damage could impact the ability of vessels to access docks and could potentially require rerouting of freight.



**New York City Vulnerability to 2 to 4 feet of Sea Level Rise with 100-year Storm Surge**  
(Source: Jacob Klaus)

### *Combined Effects*

Some of these effects, such as sea level rise and increased precipitation intensity, present greater challenges to the transportation system and infrastructure, when combined with subsidence of the land and vulnerable local geology, as well as storm surge and wave impacts associated with coastal storms. For example, storm surge can damage and destroy coastal roadways, bridges and airports, and sea level rise could exacerbate such effects.

### *Indirect Impacts*

In addition to direct impacts of climate change, transportation systems may also have to adapt to changes in the patterns of settlement or economic activity that may be induced by climate change. For example, changes in the location of agricultural production may demand changes in the transportation system to support moving products to markets. Better understanding of climate change impacts in other sectors will permit a better understanding of potential derivative impacts on transportation.

### 3. Priority Actions to Adapt to Climate Change

DOT is working to ensure that climate vulnerability is considered in all modes of American transportation. To this end, the Department has engaged in outreach and educational activities on climate adaptation for over a decade. The most recent actions are in the chart below.

**Selected DOT Climate Adaptation Outreach and Education**

**2012**

- FHWA: two webinars on pilot programs with San Francisco, New Jersey, Washington, Virginia, and Hawaii State DOTs, Metropolitan Planning Organizations (MPOs) and Universities; peer exchange with MPO representatives from Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont
- FTA: Workshop in Arlington, VA, on real-world approaches.

**2011**

- FHWA: peer exchange with Indiana MPOs and State DOT representatives from Indiana, Michigan, Kentucky, and Ohio.
- FTA: seminars with transit agencies in Los Angeles, CA, and New Orleans, LA; webinar on transit and climate adaptation and webinar on asset management lessons learned from Transport of London.
- DOT's Climate Center: two sessions for all DOT employees on the need for climate adaptation in transportation and on regional climate projections and why they matter to transportation.

**2010**

- FHWA: five workshops addressing climate variability and change in the State and MPO planning processes.

Highlights from USDOT modal administrations' accomplishments in FY 2012 as well as planned goals for FY 2013 are identified below.

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#### **Federal Aviation Administration (FAA)**

##### **1. Airport Sustainability Planning**

FAA is evaluating ways to make sustainability a core objective at every airport through the Sustainable Master Plan Pilot Program by funding long-range planning documents at ten airports around the country. These documents, called Sustainable Master Plans and Sustainable Management Plans, will include initiatives for reducing environmental impacts and achieving economic benefits while increasing integration with local communities. The ten airports were chosen earlier this year and several of the projects will be completed by the end of FY 2012 with the rest targeted for completion in FY 2013. The program will use lessons learned to develop national program guidance on airport sustainability.

## **2. Navigation Infrastructure Assessment**

In FY 2012, FAA is analyzing aviation facility, service, and equipment profile (FSEP) data for vulnerability to a combination of storm surge impacts that climate change might bring. The assessment process involves overlaying outputs of publically available climate models to FAA assets and operations to identify those most affected by storm surge under projected climate scenarios, evaluating mean high water mark in relation to the existing elevation. Based on the findings from the initial FY 2012 assessment, FAA will perform further analysis and take actions as appropriate in FY 2013. This assessment will provide FAA with an initial basis for understanding where vulnerabilities to climate change, and specifically storm surge in combination with sea level rise, exist within FAA navigation infrastructure. Based on the findings from this assessment, FAA will have a better understanding of how to determine adaptation priorities moving forward.

## **3. NextGen Network Enabled Weather (NNEW)**

NextGen Network Enabled Weather (NNEW) is part of an interagency effort to provide quick, easy, and cost effective access to weather information. NNEW will enable National Airspace System stakeholders to access weather information. In addition, the NNEW System will provide seamless interagency access to the National Oceanic and Atmospheric Administration's (NOAA) 4-Dimensional Weather Data Cube (4-D Wx Data Cube).

NNEW System will provide common, universal access to aviation weather data. This will ensure that all categories of aviation weather users will have improved access to timely and accurate weather information to support improved decision making which will facilitate enhanced aviation safety. This tool will allow air traffic management (ATM) to more easily adapt to changing weather scenarios by distributing a single, comprehensive picture of current weather to a wide variety of users and systems. It will also be integrated into other NextGen-related systems in the future. FAA will award a contract for system implementation in CY 2013. The Initial Operating Capability (IOC) is set for CY 2016.

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## **Federal Highway Administration (FHWA)**

### **1. Vulnerability and Risk Assessments**

FHWA provided seed-funding to select grantees to support five infrastructure and/or system vulnerability and risk assessments. The vulnerability assessments were conducted on a regional scale and were completed in December 2011. State DOTs and MPOs will be able to apply the lessons learned from these pilots to their own vulnerability assessments and better determine potential climate impacts by providing case studies of vulnerability assessments in different locations.

FHWA will use the completed pilot projects to finalize the conceptual model framework for vulnerability and risk assessment, and disseminate/deploy to state and local partners by the end of FY 2012. In FY 2013, FHWA is planning to initiate additional pilots using the updated framework. This may include deploying the framework to additional locations, including inland locations; identifying resulting adaptation strategies; and examining the trade-offs and cost implications of implementing adaptation strategies.

## **2. Policy and Technical Guidance Information Documents**

FHWA Office of Infrastructure and the Office of Planning, Environment, and Realty will jointly issue an information document, by the end of FY 2012, clarifying that adaptation activities are generally eligible uses of Federal-aid funds. This document will describe which adaptation activities qualify.

This action will encourage grantees to conduct a range of activities that will help them analyze the risks and start adapting to climate change. Over time, State DOTs and MPOs will better factor climate change into their transportation decision-making processes by understanding that Federal-aid funds can be used for adaptation activities. The result will be improved safety, protected transportation investments, and promotion of economic growth.

In FY 2012 and FY 2013, FHWA will develop draft guidance documenting procedures and methodologies for incorporating climate change considerations into planning and design analyses for highway projects in the coastal environment. It will provide information on the state of the practice for addressing climate change in analyses related to sea level rise, storm surge, and wave action. The results will be used to support transportation decision making by demonstrating ways to determine potential climate impacts on coastal highway infrastructure.

## **3. Peer Exchange Workshops**

In FY 2012, FHWA held a Peer Exchange workshop series with MPOs and State DOTs focused on effective approaches to considering climate change adaptation in metropolitan and statewide transportation planning processes. FHWA is also developing an informational webinar series for stakeholder organizations and grantees focused on planning for climate change adaptation. Other information sharing opportunities such as presentations and conferences will be pursued.

These workshops and webinars are intended to raise awareness and understanding of the need to plan for the increased stresses caused by climate change. The series highlights activities that could be conducted in the planning process to identify vulnerabilities and strategies for alleviating them.

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## **Federal Transit Administration (FTA)**

### **1. Pilot Studies on Climate Change Assessments**

FTA is funding seven transit agency climate adaptation assessments pilots that are scheduled to be completed by spring 2013. These pilots will increase knowledge of climate adaptation within the transit industry, improve practices, and allow the transit industry to better prepare for current and future climate change impacts. The success of these assessments will encourage other transit agencies to begin adaptation assessments and benefit from lessons learned from the pilot program.

In FY 2013, FTA will develop and document lessons learned and best practices from the pilot projects. FTA will communicate and disseminate final results in various forums including webinars, conferences, and meetings with transit agencies by the end of FY 2013.

### **2. Roundtables**

FTA will include information on climate impacts and adaptation in state of good repair and construction roundtables. This action will be completed by September 30, 2012. FTA will also discuss climate change impacts at all of its state of good repair, asset management and construction roundtables and conferences in FY 2013.

### **3. Workshops and Webinars**

In FY 2013, FTA plans to continue outreach on climate impacts on public transportation, risk management tools, and adaptation responses through workshops, webinars, and conference sessions. This will build on the success of workshops and webinars held in 2011 and 2012.

### **4. Adaptation Research**

FTA will conduct additional research on climate adaptation. Key areas of research identified by stakeholders at workshops included costs related to extreme weather events and adaptation strategies and transit agency insurance against floods and other weather impacts. A better understanding of the range of costs will facilitate transit agency planning. Research products in this area are expected by the end of FY 2013.

### **5. Transportation Planning Capacity Building (TPCB) - Planning Process**

FTA will leverage its existing funding of TPCB to build staff and technical capacity for planning for climate change adaptation. FTA will build awareness of technical assistance resources at industry events and encourage stakeholders to take advantage of TPCB resources. FTA will work with FHWA on supporting identification of Planning for Climate Change Adaptation as a joint

Planning Emphasis Area in Metropolitan and Statewide Planning programs by the end of FY 2013.

## **6. Scenario Planning Program**

FTA funds technical assistance to MPOs on scenario planning, which helps communities consider the broad range impacts of investment options in long term planning for transportation infrastructure. FTA will discuss planning for climate change adaptation as part of at least two scenario planning events by the end of FY 2013. Typical annual program efforts include two on-demand workshops and two national webinars.

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## **Saint Lawrence Seaway Development Cooperation (SLSDC)**

### **1. Work Plan**

The SLSDC is completing a Climate Change Adaptation (CCA) Plan for actions it will pursue in FY 2013 to integrate climate adaptation considerations into its operations and services. This will include coordinating adaptation plans with partnering agencies as appropriate. The success of the CCA Plan is highly dependent on a complete buy-in from the Canadian Seaway. All departments have begun the process of reviewing all standard operating procedures and emergency response plans in FY 2012. Recommendations and assessments of modifications stemming from the CCA Plan are anticipated to be completed by late summer 2012. The formal roll out of a work plan is scheduled for FY 2013.

### **2. Engineering Assessment**

Engineering has completed its review of internal mechanical, electrical and hydraulic systems of lock operations. Modifications will be required to safeguard all of these systems from the extreme consequences of high and low water levels that could result from climate variability and change. SLSDC is currently entering the fourth year of its Asset Renewal Program (ARP). The Corporation will be renewing all components that are essential to safe and efficient lock operations. Several areas will incorporate modifications that will safeguard the system in extreme conditions, including:

- New ice flushing systems for Snell lock - 2013
- Hydraulic lock operating equipment - ongoing
- Heating systems to safeguard against extreme cold conditions - 2014
- Drainage systems to safeguard against flooding - 2014
- Funding requirements to any non-ARP programed areas.

### **3. Outreach**

The SLSDC's workforce has received a briefing on the SLSDC's draft CCA Plan. SLSDC has encouraged feedback from employees to ensure that all areas that may be prone to



malfunctioning in extreme conditions be brought to the attention of operations and engineering. Periodic briefings are planned during 2012. In March of 2013, prior to the commencement of the 2013 Navigation Season, the CCA Plan will be formally launched.

SLSDC will discuss the CCA Plan with partnering agencies beginning June 2012. The Saint Lawrence Seaway Management Corporation (SLSMC), SLSDC's Canadian counterpart, will receive an in-depth briefing in June 2012 at the biannual Strategic Planning Meeting.

The time frame for reviewing the CCA plan with other agencies will span a period from June 2012 to December 2012. Key agencies that will be contacted include:

- International Joint Commission- Canadian / US
- US Coast Guard/ Canadian Coast Guard
- New York State Department of Conservation
- Canadian Fish and Wildlife
- Environmental Protection Agency
- National Oceanic and Atmospheric Association
- US / Canadian Pilots
- New York Power Authority
- Ontario Hydro
- Canadian Ship owners
- Canadian Shipping Federation
- US Ship Owners

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## **Federal Railroad Administration (FRA)**

### **1. Rail Planning**

FRA will consider potential climate impacts and adaptation during rail planning and corridor program development. This effort includes developing language for future FRA grants regarding infrastructure planning and development that requires the requestors to consider the impacts of climate variability and change in project planning and design. This action will be completed by the end of FY2012.

In FY 2013, FRA will incorporate language in future programs regarding infrastructure planning and development that requires the requestors to consider the impacts of climate variability and change in project planning and design.

### **2. Risk and Vulnerability Assessments**

FRA and Amtrak will collaboratively initiate a pilot climate risk and vulnerability assessment to determine the potential impacts - both positive and negative - that climate change will have on Amtrak assets. It is economically beneficial to incorporate a comprehensive climate change

analysis in funding decisions to improve and maintain Amtrak assets. Anticipating and preparing for the challenges of the future will yield responsible investments in Amtrak-owned facilities and can provide an example for broader consideration of climate change impacts and adaptation. This action will begin by the end of FY 2012. FRA and Amtrak will complete a climate change vulnerability assessment document by the end of FY 2013.

### **3. Stakeholder Outreach**

FRA will conduct outreach focused on incorporating climate change consideration into rail planning and operation through meetings with states and railroads. Promoting the incorporation of climate change impact adaptation efforts into rail transportation decisions prepares railroad owners and operators for the demands of future weather related adversities. The desired outcome would be for states and railroads to incorporate climate adaptation planning into planning projects and operations. This action will begin by the end of FY2012.

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## **Federal Motor Carrier Safety Administration (FMCSA)**

### **1. Grant language**

FMCSA grant application requirements will contain language that requires the requestor to consider the impacts of climate variability and change in their project if the grant is to be used to place equipment or temporary facilities, modify structures, or alter existing infrastructure. Grant language will be finalized by FY 2013 and incorporated into FMCSA's Financial Assistance Agreement General Provisions and Assurances. FMCSA will also continue to pursue links between adverse weather conditions and commercial motor vehicle safety.

### **2. Asset Management**

All infrastructure projects funded with FMCSA funds or grants will consider the impacts of climate variability and change by the end of FY 2012. FMCSA may identify a Pilot Project to highlight how to consider and mitigate these impacts in a project in FY 2013 if an appropriate grant project can be identified. This effort would demonstrate to other applicants how this particular provision would be considered and, potentially, how it can produce a better, more effective project.

### **3. Stakeholder outreach**

FMCSA will develop guidelines for considering the impacts of climate variability and change for grant projects in FY 2012 to support the new requirement for grants that will be used to place equipment or temporary facilities, modify structures, or alter existing infrastructure. FMCSA will conduct webinars to present and explain the guidelines in FY 2013 as appropriate. FMCSA

communicates regularly with its State partners through the Commercial Vehicle Safety Association meetings which may be the venue at which to present this new requirement. FMCSA will also reach out to stakeholders at partnership meetings on the issue for education purposes.

#### **4. NEPA**

In FY 2013, FMCSA will formally incorporate guidance into FMCSA NEPA Order 5610.1 for considering the impacts of climate change to environmental issues in its NEPA process. While FMCSA currently calculates greenhouse gas emissions as part of its NEPA analysis, consideration of impacts to the Agency's mission from climate change will be incorporated.

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### **Maritime Administration (MARAD)**

#### **1. Work Plan**

MARAD will incorporate climate change adaptation considerations into internal reviews, especially with regard to port infrastructure projects, shipyard grant application evaluations, and Agency facility modifications. This activity will be implemented by the end of FY2013.

#### **2. Stakeholder Outreach**

MARAD has begun stakeholder outreach efforts to aid adoption of climate change considerations, and will complete these initial activities by the end of FY 2013.

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### **Pipelines and Hazardous Materials Safety Administration (PHMSA)**

#### **1. Stakeholder Outreach**

PHMSA will increase awareness among its industry stakeholders regarding the potential impacts of climate change in FY 2012. PHMSA will conduct outreach via the web and in meetings to assist stakeholders in understanding the implications of climate change. While PHMSA's pipeline safety mission is not directly impacted by climate change factors, the potential impact on related systems could affect PHMSA's mission area. The outreach program began in September 2011 and continues today.

PHMSA will continue to increase awareness among its industry stakeholders regarding the potential impacts of climate change in FY 2013. PHMSA will continue to conduct outreach via the web and in meetings to assist stakeholders in understanding the implications of climate change through FY 2013.

#### **2. Design Reviews**

PHMSA conducts design reviews of pipeline projects. During these reviews, PHMSA will raise the issue of whether adaptation to climate change was incorporated in the design considerations. While PHMSA's pipeline safety mission is not directly impacted by climate change factors, the potential impact on related systems could affect PHMSA's mission area. The program began in September 2011 and continues today.

The pipeline safety program has implemented integrity management requirements for gas and liquid pipelines, requiring pipeline operators to assess and mitigate the most serious risks to their pipelines. The operator must implement an integrity plan that prevents/mitigates those risks. FHWA will begin advising operators to consider adaptation in these plans by the end of FY 2013.

#### **4. Recent Accomplishments in Climate Adaptation**

Many of the documents listed below can be found at the DOT Transportation and Climate Change Clearinghouse website at [www.climate.dot.gov](http://www.climate.dot.gov).

##### *Flooded Bus Barns and Buckled Rails: Public Transportation and Climate Change Adaptation* (2011)

This FTA report examines climate impacts on U.S. public transportation, adaptation strategies, risk management tools, and incorporation into organizational structures and processes. It includes case studies on New York NY; Los Angeles, CA; Mobile, AL; and London, England.

##### *FTA Policy Statement and Dear Colleague Letter* (2011)

These documents explain the impact of climate change on the key Federal Transit Administration (FTA) goals of state of good repair and safety and commit FTA to taking action by integrating adaptation considerations into FTA programs.

##### *Transit Climate Change Adaptation Workshops and Webinars*

FTA held three workshops in 2011 through 2012 (Los Angeles, CA, on August 3, 2011, New Orleans, LA, on October 5, 2011, and Arlington, VA, on March 21-22, 2012) with participation from public transportation agencies, MPOs, academics, government agencies, and consulting firms. For more information see <http://www.fta.dot.gov/adaptation>.

##### *Interim Framework on Conducting Assessments of Transportation Infrastructure Vulnerable to Global Climate Change Effects*

This FHWA project's first phase addressed what should reasonably be assumed by practitioners with regard to climate change impacts, its effects differentiated by geographic area, and data to be used in conducting assessments, including data gaps. The Framework itself includes criteria to be considered; recommended categories for existing and planned infrastructure; and methods to assess importance, redundancy and scale. Office of Planning, Environment and Reality and Office of Infrastructure provided research funds to pilot the Framework in five States. This research put together the best thinking currently available in a quick timeframe, and the framework will be updated with lessons learned from the results of the pilot test process. The five pilots were completed in December 2011 and the reports are available on FHWA's website. [http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/ongoing\\_and\\_current\\_research/vulnerability\\_assessment\\_pilots/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/vulnerability_assessment_pilots/index.cfm)

##### *Gulf Coast Study, Phase I* (2008)

Phase 1 of the Gulf Coast Study studied how changes in climate over the next 50 to 100 years could affect transportation systems in the U.S. central Gulf Coast region and discussed how to

account for potential impacts in transportation planning. A case study approach was selected that generated useful research methodologies for application in other locations.

<http://www.climatescience.gov/Library/sap/sap4-7/final-report/>

*Regional Climate Change Effects: Useful Information for Transportation Agencies (May 2010)*

This FHWA report provides basic information on projected climate change effects (changes in temperature, precipitation, storm activity and sea level rise) over the near term, mid-century and end-of-century by geographic area. The report includes two appendices: maps for some of the climate change effects, and "typology" of projected climate change information gleaned from recent reports.

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/resources\\_and\\_publications/](http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/)

*The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure—Atlantic Coast Study (2008)*

The study uses multiple data sources to identify the potential impact of sea level rise on land and transportation infrastructure along the Atlantic coast, from Florida to New York. The study (1) creates maps of land and transportation infrastructure that, without protection, could be inundated regularly by the ocean or be at risk of periodic inundation due to storm surge under a range of sea level rise scenarios; and, (2) provides statistics to demonstrate the potential extent of land areas and transportation infrastructure affected.

*Integrating Climate Change into the Transportation Planning Process (June 2008)*

The final report summarizes an FHWA review of the state-of-the-practice in State DOTs and MPOs, including statutes and regulations, and interviews with several planning agencies. Report includes both mitigation and adaptation. <http://www.fhwa.dot.gov/hep/climatechange/index.htm>

*Peer Workshop on Adaptation to Climate Change Impacts (December 2008)*

FHWA conducted a peer exchange (with support from the American Association of State Highway Transportation Officials (AASHTO)) on adaptation of transportation infrastructure to climate change impacts. Participants in the workshop included leaders from FHWA and 11 State DOTs. <http://www.fhwa.dot.gov/planning/statewide/pwsacci.htm>

*Peer Workshops on Integrating Climate Change into the Transportation Planning Process (2008)*

Three peer exchanges were conducted (two in Seattle WA, and the other in Albany, NY) in 2008. The goal of the workshops was to allow senior staff from a variety of MPOs and State DOTs from across the country to come together to share information, experiences, and challenges regarding how both climate change mitigation and adaptation issues can be integrated into the transportation planning process. <http://www.fhwa.dot.gov/hep/climate/resources.htm>

WASHTO Facilitated Session on Asset Management and Adaptation (July 2009)

FHWA facilitated a session at a Regional AASHTO meeting in Seattle on managing transportation assets in a changing environment. <http://www.washto2009.com/>

Additional Initiated or Ongoing Activities include:

FHWA Adaptation Working Group

FHWA has formed a multi-disciplinary internal working group to coordinate policy and program activities to address climate change impacts to transportation infrastructure. This group operates across all of FHWA, including planning and construction officials. This group first met November 30, 2011 to develop a federal highway action plan. All actions are coordinated throughout FHWA.

Gulf Coast Study – Phase 2

Phase 1, completed in 2008, studied how changes in climate over the next 50 to 100 years could affect transportation systems in the U.S. central Gulf Coast region and discussed how to account for potential impacts in transportation planning. Phase 2 is building on the information developed in Phase 1 to develop more definitive information about impacts at the local level in a particular MPO or smaller region. The study is developing more precise tools and guides for State DOT and MPO planners to use in deciding how to adapt to potential climate impacts and determine vulnerability for key links for each mode. Phase 2 will also develop a risk assessment tool to allow decision makers to understand vulnerability to climate change and develop a process to implement transportation facility improvements in a systematic manner.

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/ongoing\\_and\\_current\\_research/gulf\\_coast\\_study/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/gulf_coast_study/index.cfm)

NCHRP 20-83(05): Climate Change and Highway Infrastructure: Impacts and Adaptation Approaches

This \$1 million project was identified by the Transportation Research Board (TRB) executive committee as priority research. FHWA is providing technical assistance to the panel and coordination with other FHWA and DOT activities to prevent duplicative effort. The anticipated product will be guidebooks for transportation practitioners and outreach materials. This study is meant to further results of the interim study listed above, with a larger budget and a goal of addressing more issues. This effort is broader than the Gulf Coast Study since it will create guidebooks for planners, NEPA practitioners, designers, asset managers, and operators. NCHRP has a panel overseeing the research that is broad and diverse. Recently, a literature review and study of climate impacts on transportation was completed to better inform the process. For example, work began on the final deliverables, which are guides on how to incorporate adaptation into the different stages of transportation decision making (planning, construction, operations, etc.) The project is expected to be completed by the summer of 2013.

*Guidelines for Consideration of GCC Impacts and Adaptation in Project Development and Environmental Review*

These guidelines will include discussions of how to consider climate change impacts as part of the project development, preliminary engineering, and NEPA analysis (including scoping, environmental context, and alternatives screening and analysis). The Guidelines are meant to provide information to FHWA Division offices on how to handle discussion on impacts in the project development process. Case studies were compiled on adaptation planning and considerations within the NEPA process. Draft guidance is presently under review.