Climate Change Adaptation Strategies for Infrastructure Managers

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FHWA Adaptation

- Working Group
- Adaptation Strategy
- Effects and Impacts
- National and Regional Concerns
- Possible Responses
- Adaptation Objectives
- White House Approach
- Vulnerability Pilots
FHWA Adaptation Working Group

• Formed in 2008

• Office Representation
  ▪ Environment, Planning, and Realty
  ▪ Infrastructure (Asset Management, Bridge, Design, ER)
  ▪ Operations
  ▪ Safety
  ▪ Federal Lands Highway

• Primary activity to date: Adaptation Strategy
FHWA Adaptation Strategy

Purpose

• Establishes FHWA policy on adaptation
• Provides strategic foundation for future activities
• Identifies FHWA objectives in short, medium and long-term

Status

• Internal draft currently under review
 FHWA Adaptation Strategy

• Foundation and plan for addressing climate change adaptation at FHWA

• Purpose of strategy:
  ▪ identify issues of concern for FHWA
  ▪ focus attention on what FHWA needs to do to address the issue

• Will include multi-office adaptation activities

• Primary consideration: address adaptation across all steps of the delivery highway projects
Climate Change Effects, Impacts, and Adaptation

**Climate change effects**

- Outcomes of long-term variation in the climate.

**Climate change impacts**

- Consequences that climate change effects may have on infrastructure

**Adaptation**

- Changes in the way surface transportation infrastructure is planned, designed, constructed, operated, and maintained
Climate Change Effects Vary by Region

- Changes in sea levels due to sea level rise, subsidence
- Increased storm surge
- Changes in temperature
- Changes in precipitation
Impacts on U.S. Transportation

- Permanent and temporary flooding of coastal roads, tunnels, rails, and runways
- Pavement and track damage from extreme heat; reduced snow and ice removal costs
- Slope failures, wildfires, damaged infrastructure in Alaska from permafrost thaw
- Improved ocean transport from reduced sea ice
Why be Concerned about Climate Change Impacts?

• Design life of transportation infrastructure: decades or longer

• As climate changes, our infrastructure will need to evolve to handle new conditions

• Each region has unique transportation assets, and faces different vulnerabilities and risks

Flooded roadways in Houston
Hurricane Katrina: Wave-Induced Bridge Damage (2005)

Photo by S. Douglass
Extreme Rutting

Photo by www.asphaltwa.com
Logistics and Operations
What Are Possible Adaptation Responses?

• Maintain & Manage
  ▪ Continue maintenance after storms

• Protect, Strengthen
  ▪ Sea walls and buffers
  ▪ Design changes when rebuilding

• Relocate & Avoid
  ▪ Move key facilities, site new facilities in less vulnerable locations

• Abandon and Disinvest

• Enhance Redundancy

Sources: WSDOT and Caltrans
FHWA Adaptation Objectives

- Cross cutting issues (like climate data)
- Transportation Planning
- Asset Management
- Preliminary Engineering and Project Development
- Project Design and Construction
- Operations
- Safety
- Federal Lands
Strategy – examples of draft FHWA objectives

- **Cross-cutting**: Collect, Synthesize, Disseminate Climate Data Scaled for State & Local Transportation Agency Use

- **Transportation Planning**: Implementation of system-level vulnerability and risk assessment tools to support investment decisions

- **Asset Management**: Maximized performance and minimized life-cycle costs of existing system
Climate change Adaptation Task Force

- Co-chaired by CEQ, OSTP, and NOAA.

- 20 Federal Agencies
  - DOT / FHWA

- Executive Order to develop recommendations for adapting to climate change impacts.

- Adaptation requires thoughtful, preventative actions and investments to build resilience and reduce risk.

- Framework to move science into practice.
White House Climate Change Adaptation Task Force

- Make adaptation a standard part of Agency planning
- Ensure scientific information about the impacts is easily accessible
- Align Federal efforts to respond to climate impacts that cuts across jurisdictions
- Develop a U.S. strategy to support international adaptation to leverage resources.
- Build strong partnerships to support local, state and tribal decision makers
White House Climate Change Adaptation Task Force

• Guiding Principles

• Adopt Integrated Approaches
• Prioritize the Most Vulnerable
• Use Best-Available Science
• Apply Risk-Management Methods and Tools
• Apply Ecosystem-based Approaches
• **Department of Transportation Pilot**

• Recognizing that FHWA must include climate change in its risk and vulnerability assessments of transportation infrastructure,

• DOT/FHWA set out to help transportation decision makers, particularly transportation planners, asset managers, and system operators, identify which infrastructure assets

  • (a) are most exposed to the threats from climate change and/or
  
  • (b) could result in the most serious consequences as a result of those threats.

• DOT/FHWA has developed a vulnerability tool for state and municipal planners that takes a deeper look at steps in the flexible framework for understanding climate risk and applying that risk to mission and activities.
Vulnerability/Risk Assessment
Conceptual Model and Pilots

Becky Lupes
FHWA Office of Natural Environment
Peer Exchanges and Survey

- Peer Exchanges conducted in 2008 and 2009
- Preceded by survey
- Survey results indicated that while some States were actively addressing adaptation, many States were just beginning to consider adaptation, or were not planning to in the near future
Vulnerability Assessment and Risk Management

RISK ASSESSMENT
• Exposure
• Vulnerability
• Resilience

ADAPTATION RESPONSE
• Protect
• Accommodate
• Retreat

GREATER RESILIENCE
• Goal: help transportation decision makers identify assets:
  ▪ most exposed to the threats from climate change; and/or
  ▪ could result in the most serious consequences as a result of those threats

• Draft Conceptual Model Completed

• Pilots - Use by State DOTs and MPOs

• Finalize
Vulnerability/Risk Assessment Conceptual Model

- Develop inventory of infrastructure assets
- Gather climate data
- Assess risk and vulnerability of assets to projected climate change
- Analyze, prioritize adaptation options
- Monitor and revisit

www.fhwa.dot.gov/hep/climate/conceptual_model62410.htm
Pilots Selected

- MTC (San Francisco)
- Virginia DOT
- Washington State DOT
- New Jersey DOT
- Oahu MPO
Climate Change Vulnerability and Risk Assessment Pilot Locations

- Oahu, Hawaii
- San Francisco, California
- Hampton Roads, Virginia
- Central New Jersey, New Jersey Coastal
- New Jersey Coastal
- Hampton Roads
- New Jersey Coastal
Metropolitan Transportation Commission

- Focus on San Francisco Bay
- Complements a NOAA funded sub-regional project
- Partners:
  - MTC,
  - CalTrans District 4,
  - San Francisco Bay Conservation and Development Commission,
  - NOAA,
  - Association of Bay Area Governments,
  - Bay Area Air Quality Management District
Virginia DOT

• Focus on Hampton Roads
• Asset Management, Security Perspective
• Partners:
  ▪ Virginia Transportation Research Council (VDOT)
  ▪ Hampton Roads Planning District Commission,
  ▪ UVA Center for Transportation Studies,
  ▪ UVA Center for Risk Management of Engineering Systems,
  ▪ Hampton Roads Transportation Planning Organization
New Jersey DOT

- Study Areas:
  - New Jersey Coastal
  - Central New Jersey

- Partners:
  - New Jersey DOT
  - North Jersey Transportation Planning Authority,
  - South Jersey Transportation Planning Organization,
  - Delaware Valley Regional Planning Commission,
  - New Jersey Department of Environmental Protection
• Statewide geographic scope
• Studying WSDOT owned and managed facilities potentially at risk to a range of impacts:
  - Sea-level rise inundation areas
  - Rivers and stream channel migration, melt effects
  - Extreme temperature effects
  - Drought threats to wetland creation, mitigation sites, roadside vegetation, soil moisture/flux, invasive species, worker health, wildfire
  - Precipitation changes- threats to slope stabilization, stormwater management, erosion control, landslides, “road survivability”
  - Wildfire – safety, emergency response
• Scope: Island of Oahu, HI
• Consultant will perform risk assessment of identified transportation assets
• Public input meetings
• Partners:
  ▪ Oahu MPO
  ▪ HI DOT
  ▪ HI Dept. of Business, Economic Development, and Tourism
  ▪ HI State Civil Defense
  ▪ City and County of Honolulu
  ▪ U. of HI Center for Island Climate Adaptation and Policy
  ▪ The Pacific Disaster Center
  ▪ People’s Advocacy for Trails Hawaii
Next Steps

• Conduct pilots over the next year
• Work to improve model, given info from pilot testing
Thank you