



Adapting to Climate Change: FHWA Activities

National Hydraulic
Engineering Conference
Iowa City, IA

Brian Beucler
August 21, 2014



Three breaches in NC12 after Hurricane Irene. Credit: Tom MacKenzie, FWS



Google: FHWA Climate Adaptation

www.fhwa.dot.gov/environment/climate_change/adaptation/

Climate Change & Sustainability Adaptation

Mitigation Adaptation Sustainability Energy



Ongoing & Current Research

FHWA Publications & Tools

Policy & Guidance

Case Studies

Webinars

Workshops & Peer Exchanges

Newsletter

Contacts

FHWA → Environment → Climate Change

Adaptation

Climate change adaptation refers to planning, designing, constructing, operating, or maintaining transportation infrastructure while incorporating consideration of climate changes. Adaptation to global climate change (GCC) is critical to protecting the nation's transportation system. Current efforts to reduce greenhouse gas (GHG) emissions in the atmosphere, while important for reducing the long-term effects of global climate change, will likely have little effect on expected GCC impacts over the next twenty or thirty years. Policymakers, transportation planners, and system managers, therefore, must proactively and cooperatively adapt to GCC in order to continue to deliver the public a safe, reliable, effective, and sustainable transportation system.

"Adaptation" is not a new term for transportation decision makers. Legislation encouraging action agencies to develop and apply a portfolio of adaptation and mitigation responses to reduce the loss of life and property to weather-related natural hazards have existed since flood management laws were enacted in the late 1930s. The fact that the rate of climate change is now accelerating necessitates a new strategy for action.

FHWA believes that the impacts of climate change need to be taken into account as transportation systems are planned and as transportation projects are developed. There are several initiatives underway designed to develop information, tools, and procedures necessary to support the consideration of the impacts of climate change.

[Summary of FHWA Climate Adaptation Initiatives](#)

Recent Updates

- [Transportation and Climate Change Newsletter \(6/27/14\)](#)
- [Transportation and Climate Change Newsletter \(3/13/14\)](#)
- [Summary of FHWA Climate Adaptation Initiatives \(2/21/14\)](#)

 Sign up for Climate Change & Sustainability updates.

Feedback

For more information, please contact:

- Robert Kafalenos
- Robert Hyman
- Rebecca Lupes
- Heather Holsinger
- Tina Hodges

Climate Change Adaptation at FHWA



Climate Change Adaptation at FHWA

Systems vs. Project Level Focus

Procedures vs. Technical Guidance

National Scope...Big Country...Many ?'s

International Outreach

Policy Development



Climate Change Adaptation at FHWA

Goal: Regular/Systematic consideration of climate change vulnerability/risk in transportation decision making at:

Systems Level: Transportation Planning, Asset Management

Project Level: Environmental process, Preliminary Engineering, Design, Construction, Operations, Maintenance



Current Ongoing Activities

Procedural/Descriptive

- Vulnerability Framework
- Climate Pilots
- Gulf Coast 2
- Post Sandy Project
- TEACR
- Central NM Project
- Culvert Mgt Case Studies

Technical Guidance

- Gulf Coast 2
- Climate Pilots
- TEACR
- HEC-25 Vol. 2
- HEC-17 2nd Edition
- NWS Precip. Trends
- HIBS Strategic Initiatives



Vulnerability Assessment Framework (2012)

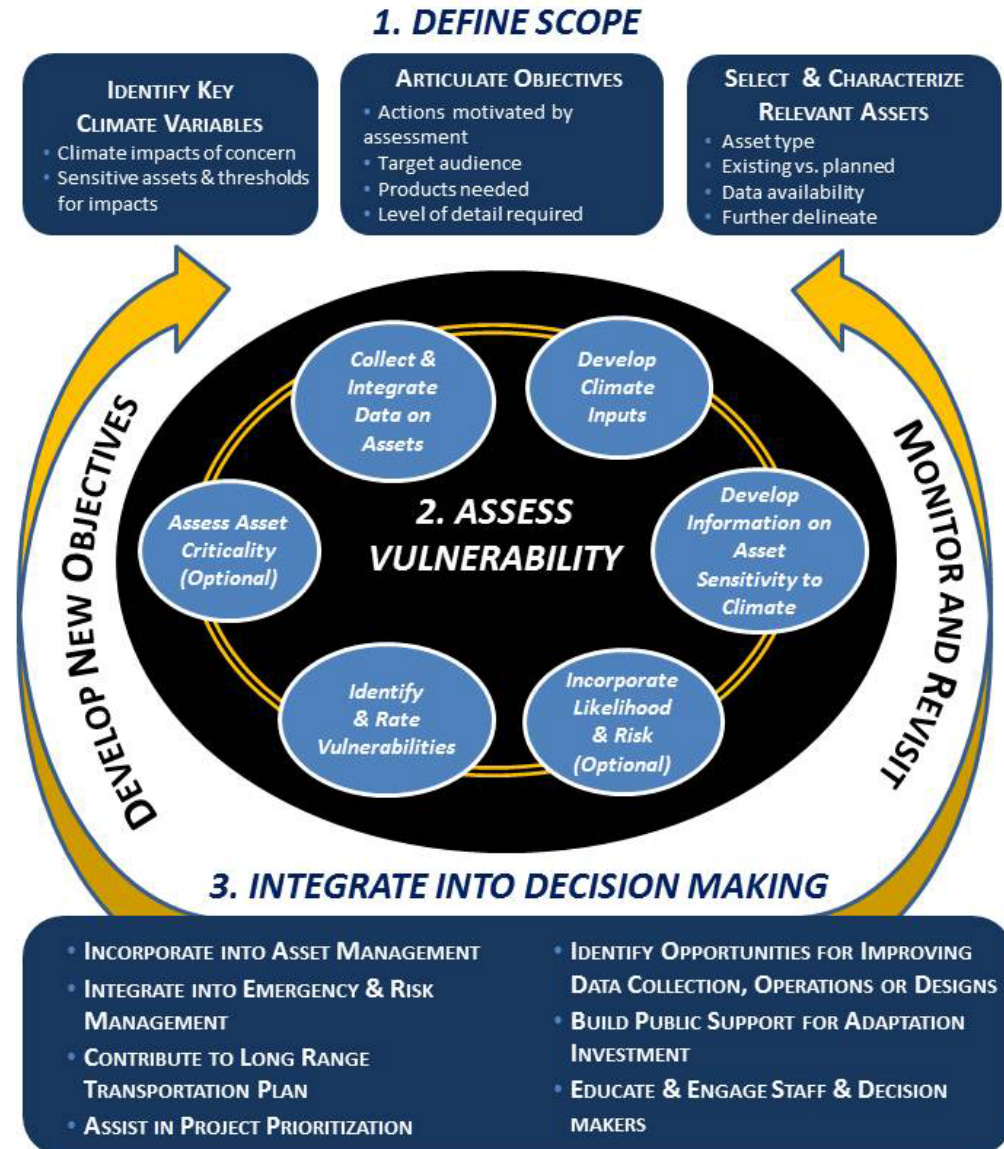
Define Project Scope

- Objectives
- Relevant Assets
- Climate Variables

Assess Vulnerability

- Climate Inputs
- Asset data, criticality, sensitivity
- Vulnerabilities, risk

Integrate Vulnerability Into Decision Making



2013-2014 Climate Resilience Pilot Program

Pilots using and building on FHWA's Climate Change & Extreme Weather Vulnerability Assessment Framework

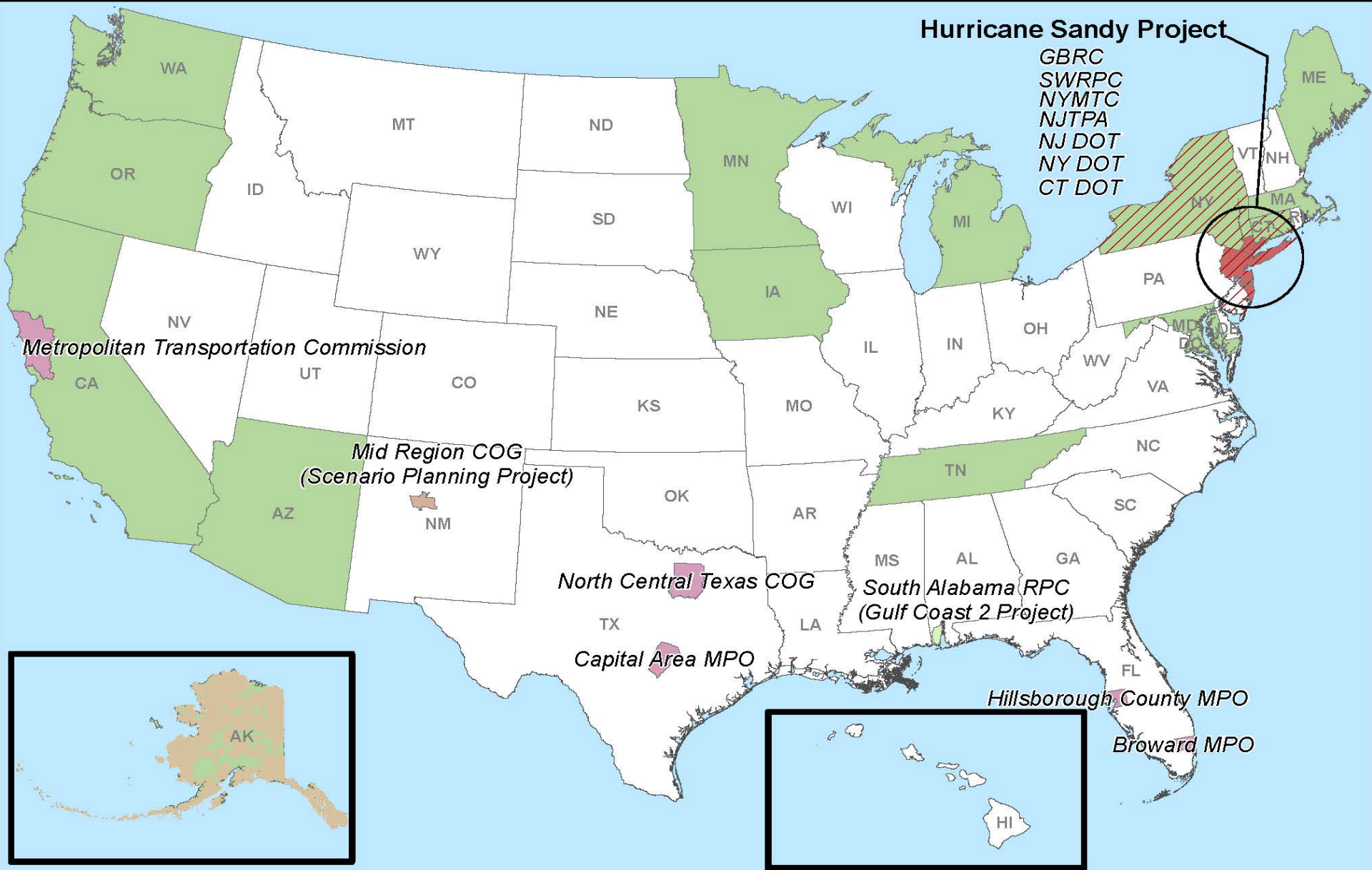
19 Pilots

Tennessee	Iowa
Maine	Minnesota
Michigan	California
Arizona	Washington
Alaska	NCTCOG
Oregon	CAMPO (Austin)
Connecticut	Hillsboro MPO
New York	South Florida
Maryland	MPOs
Massachusetts	MTC (San Francisco)

- Vulnerability and/or adaptation
- Broad geographic coverage and range of impacts
- Furthering the state of practice in resilience to climate change
- FHWA plans to update the framework in 2015 based on lessons from the pilots



Climate Pilots and Related Projects



Gulf Coast 2 Project: Mobile, Alabama

Phase 1 Study Area



Phase 2 Study Area



Primary Tasks

1. Identify critical transportation assets in Mobile (complete)
2. Identify climate effects, assess infrastructure sensitivity (complete)
3. Assess vulnerability of critical assets (Summer 2014)
4. Develop transferable risk management tools (Summer 2014)
5. **Roll out and webinars!** (Late Fall 2014)



Gulf Coast 2 Project (cont.)

Vulnerability Screen

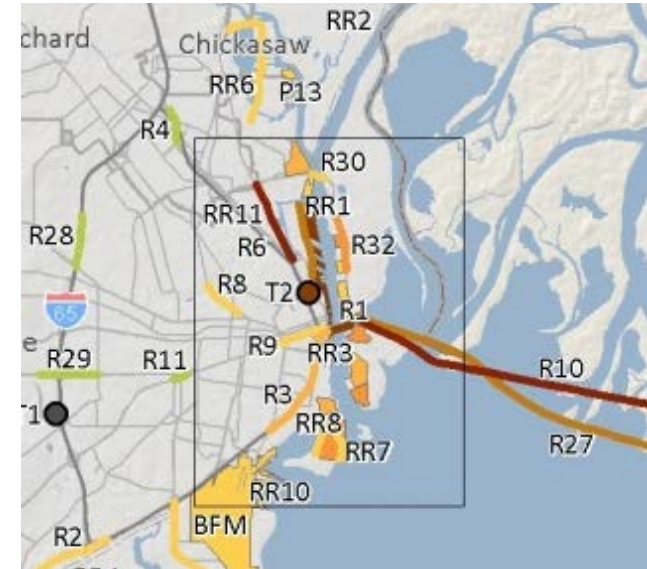
- High-level analysis to find assets most likely to be vulnerable to future changes (systems level)

Engineering Assessments

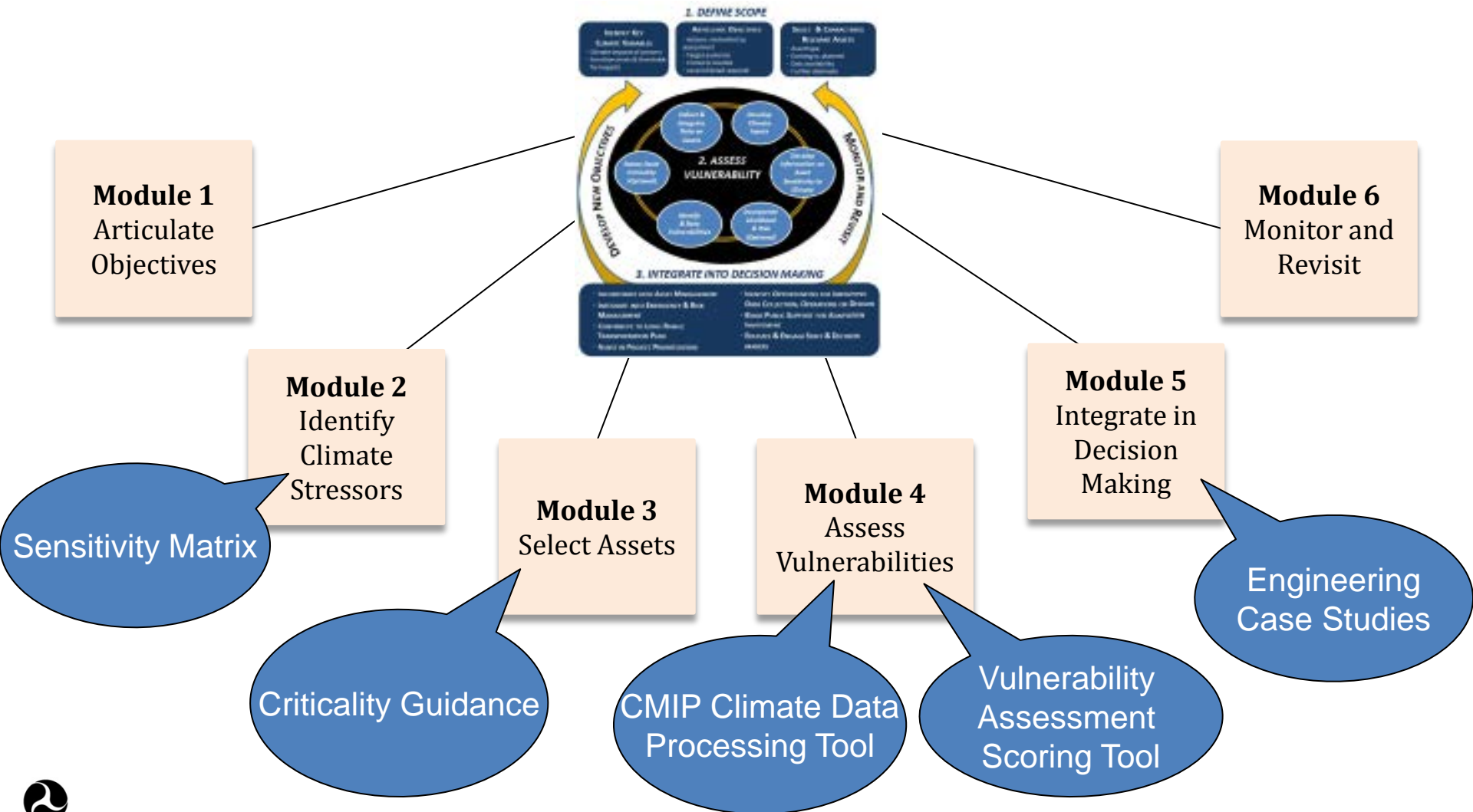
- Detailed assessments of specific assets in Mobile (project level)
- Eleven case studies

Tools and Website

- Stay tuned for Rollout



Tools and Website Deployment



Post-Hurricane Sandy Project

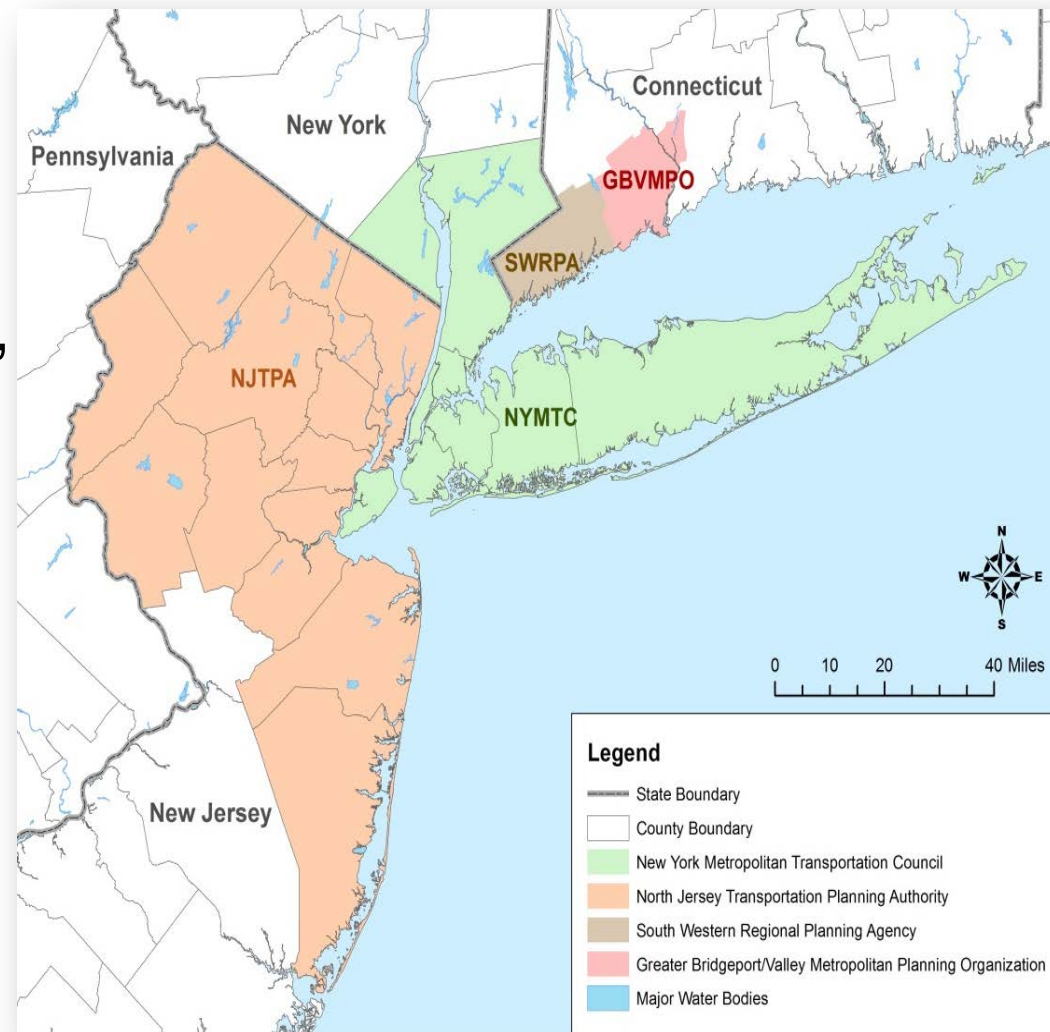
Partners:

FHWA; NY, NJ, and CT DOTs; Metro area MPOs; MTA; others

Primary tasks:

- Assessment of damages, lessons learned, gaps in climate analysis
- Analysis of adaptation options for 10 transportation assets (project level)
- Region-wide multimodal vulnerability assessment (systems level)

Sandy Project Study Area



TEACR

TEACR: *Transportation Engineering Approaches to Address Adaptation and Climate Resiliency*

Case Studies: Engr. analyses of specific asset/stressor pairs

National Scope: Inland and Coastal, Looking at more than hydrologic stressors (e.g. fire, dust, temperature)

Comprehensive Final Report: To combine with other studies from GC2, Sandy, Pilots, etc.



We need your help! Looking for case study projects...see me for more information



Culvert Management Case Studies

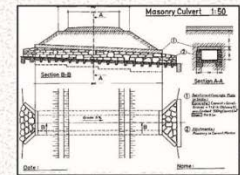
- Interviewed/documentated practices from VT, OR, OH, Los Angeles County
- Sections on:
 - Inventory and Inspection
 - Database and Management Systems
 - Prioritization and Risk Assessment
 - Planning and Funding
 - Summary of Best Practices
- Inquired to climate impacts on culvert systems

www.fhwa.dot.gov/asset/pubs/hif14008.pdf



Culvert Management Case Studies:

Vermont, Oregon, Ohio
and Los Angeles County



U.S. Department
of Transportation
Federal Highway
Administration

June 2014

HEC-25 Volume 2

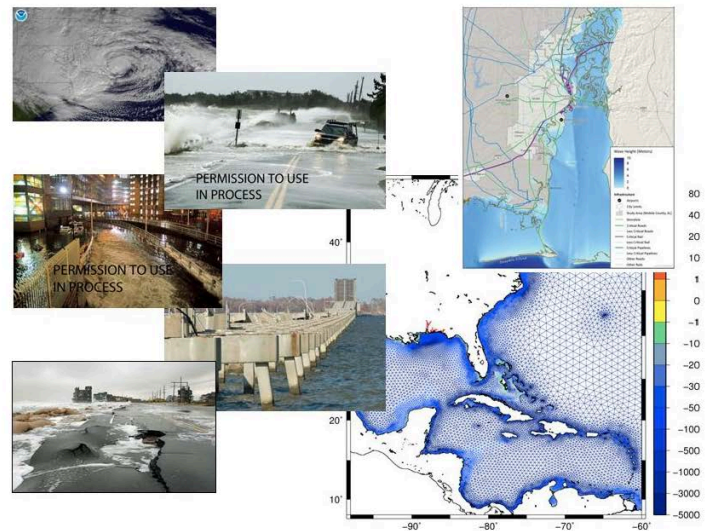
- ***Highways in the Coastal Environment: Assessing Extreme Events***
- How to incorporate extreme events and climate change into coastal highway designs
- Focus on sea level rise, storm surge, wave action
- 3 levels of effort approaches, case studies
- Fall 2014
- NHI module?



U.S. Department of
Transportation
Federal Highway
Administration

Publication No. FHWA-NHI-14-006
May 2014

Hydraulic Engineering Circular No. 25 – Volume 2

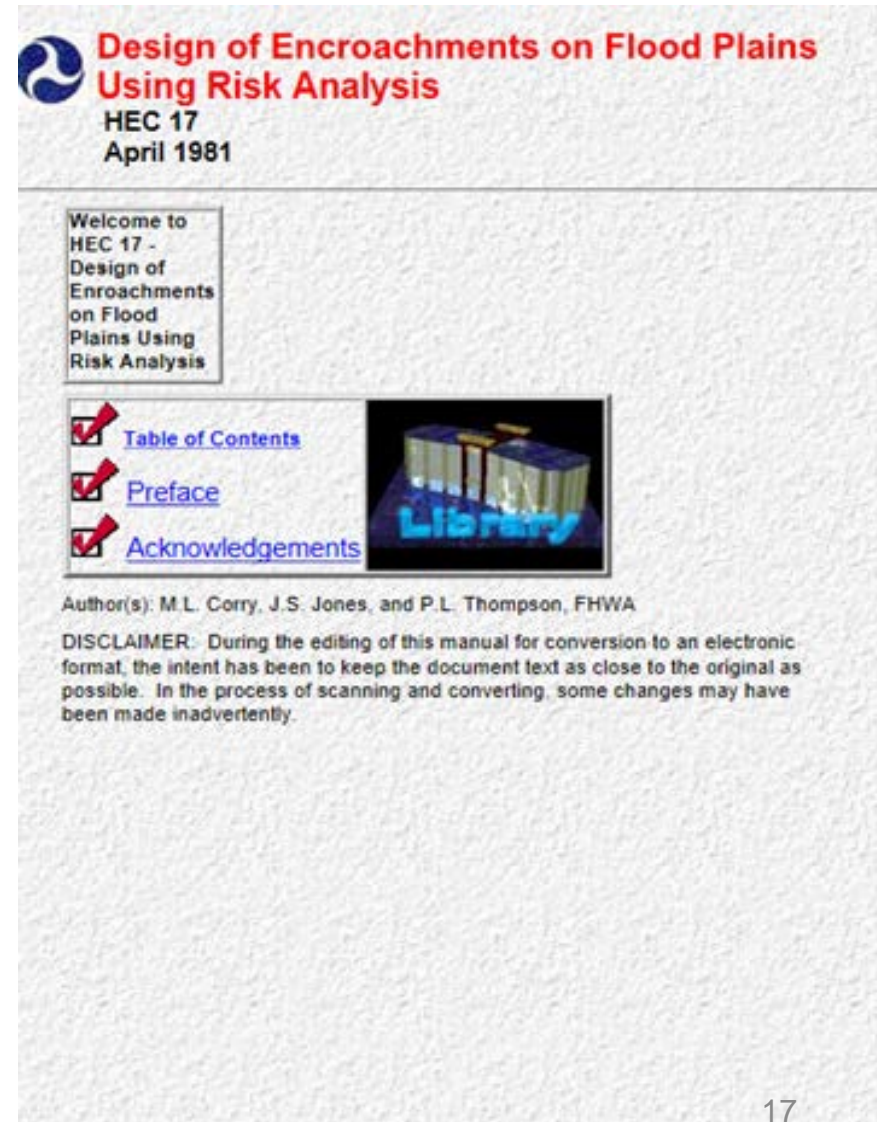


**Highways in the Coastal Environment:
Assessing Extreme Events**



HEC-17 2nd Edition

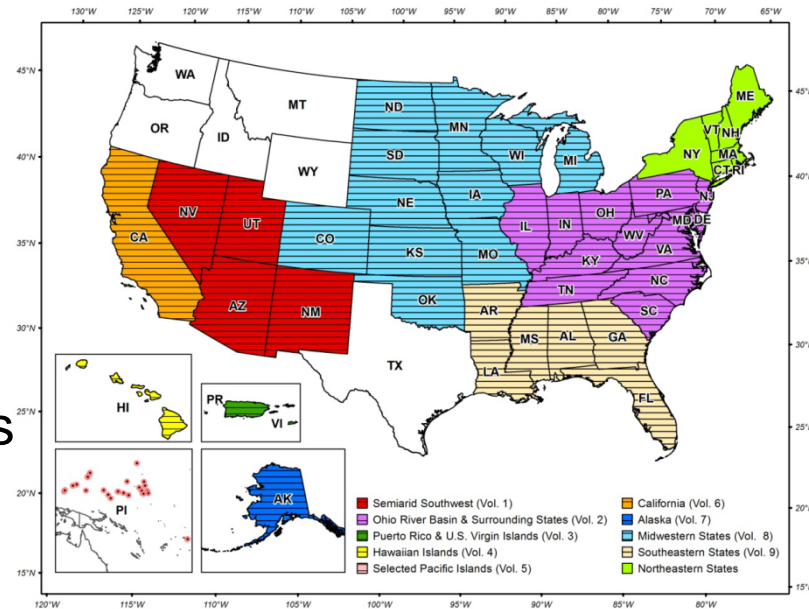
- ***Highways in the River Environment – Floodplains, Extreme Events, Risk and Resilience***
- Replaces/enhances 1981 edition which dealt with Least Total Effective Cost (LTEC)
- How to incorporate floodplain management, risk, extreme events, resilience, and adaptation for highways in the riverine environment
- Focus on hydrology (w/climate change), statistics, risk assessments and regulatory issues (NEPA/FEMA/FHWA) associated with precipitation and stream flow



NWS Precipitation Trend Analysis

NWS Precipitation Trends

- NOAA Atlas 14 updates based on stationary assumptions, annual maximum series using L-moment statistics
- Studying non-stationary GEV analysis using maximum likelihood (MLE) approach is used instead of current NOAA Atlas 14 L-moment
- Currently comparing IDF's generated from non-stationary models to IDF's from current NOAA Atlas 14 stationary model
- Considering looking at partial durations series to aid in detecting trends in smaller storms
- Dec 2014 projected completion (?)
- http://www.nws.noaa.gov/oh/hdsc/current-projects/progress/201407_HDSC_PR.pdf



Even More Activities (Tally Ho!)

FLH Drainage Sensitivity Project

- Conducted by 3 FHWA Federal Lands Highway Divisions
- Examines sensitivity of assorted types of drainage infrastructure to increased flows (ditches, storm drains, culverts, bridges)
- Looking at rural National Park sites
- Targeting Jan 2016 completion

HIBS Strategic Climate Initiatives

- Meeting of the minds (engineers, hydrologists, climate scientists) to close knowledge gaps
- Climate and geohazards



Questions Yet to be Answered

- Can we get by extrapolating historical data alone?
- How can I appropriately use climate model information in the design process?
- Do we change our acceptable level of risk or just compute our current level better?
- What are the real damage mechanisms and threshold points from climate stressors?
- How do we integrate climate into a risk-based asset management strategy?
- How do we do an honest benefit/cost analysis to justify adaptations?
- What about secondary impacts, travel/supply chain interruptions?
- When do you decide retreat is the best option?
- Why am I seeing the 100 year storm every year 😊?



Thank you.

Office of Environment & Planning

- Mike Culp
- Tina Hodges
- Heather Holsinger
- Rob Hyman
- Rob Kafalenos
- Rebecca Lupes

Office of Infrastructure

- Joe Krolak
- Brian Beucler
- Steve Gaj
- (Cynthia Nurmi and Eric Brown from Resource Center)

www.fhwa.dot.gov/environment/climate_change/adaptation/

