GreenGov Symposium

Climate Change: An Adaptation Challenge for US Transportation

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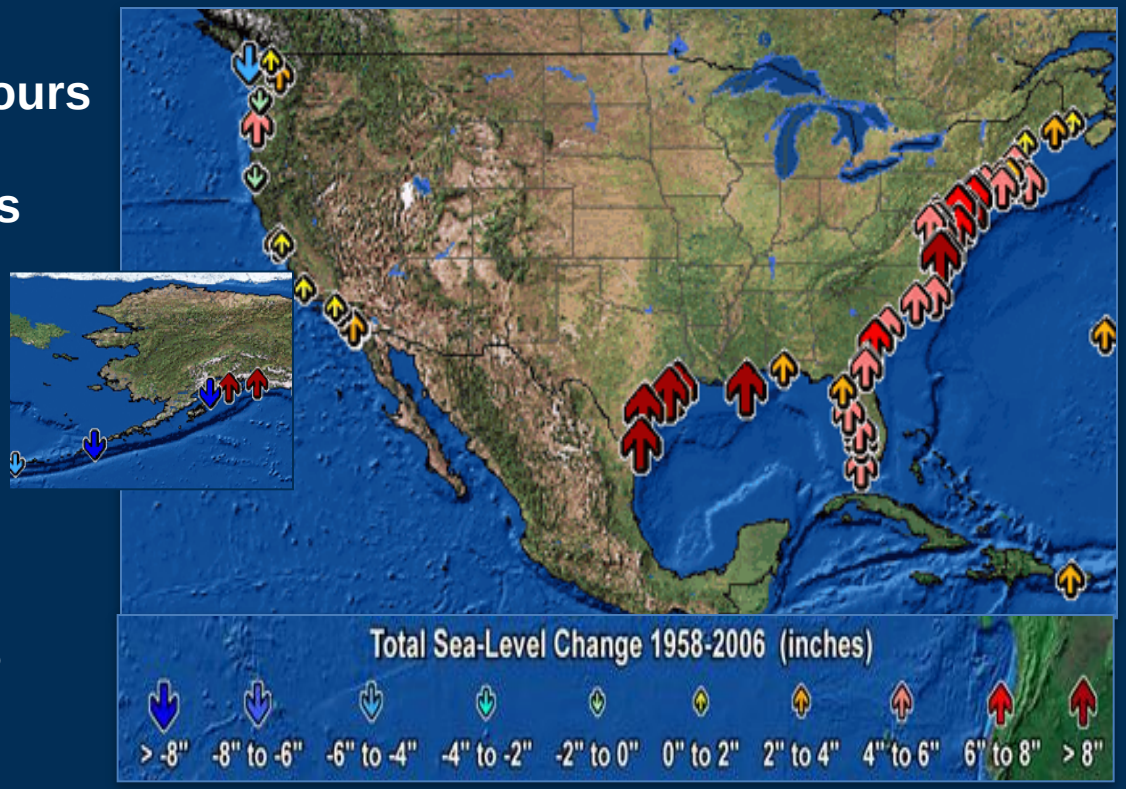
Climate changes are underway in the U.S. and are projected to grow

- Temperature rise
- Sea-level rise
- Increase in heavy downpours
- Rapidly retreating glaciers
- Thawing permafrost
- Longer growing season
- Longer ice-free season in the ocean and on lakes and rivers
- Earlier snowmelt
- Changes in river flows

Observed U.S. Sea-Level Changes



United States Global Change Research Program

Arctic warming will thaw permafrost damaging infrastructure

- The USACE has identified over 180 communities that are threatened in Alaska

Loss of shore-fast sea ice will cause greater erosion

These photos were taken 2 hours apart

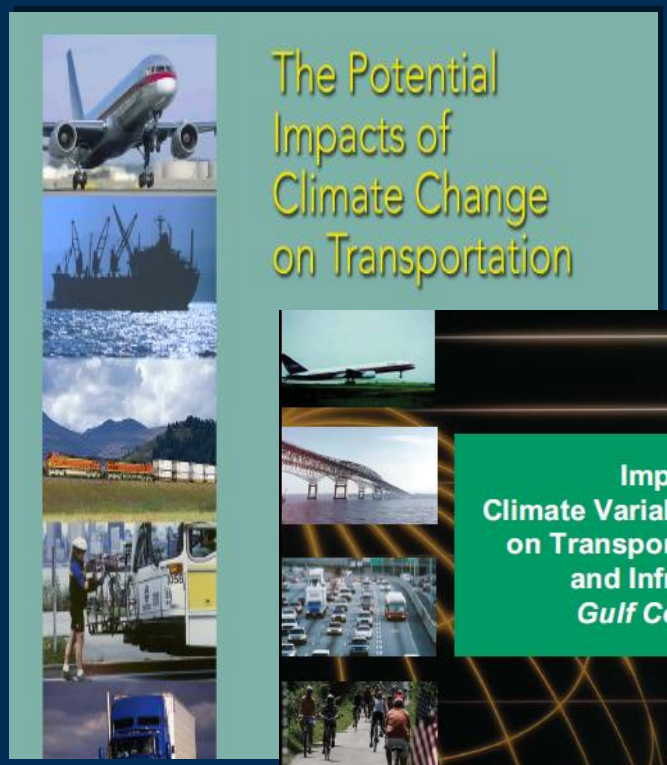
This road no longer exists

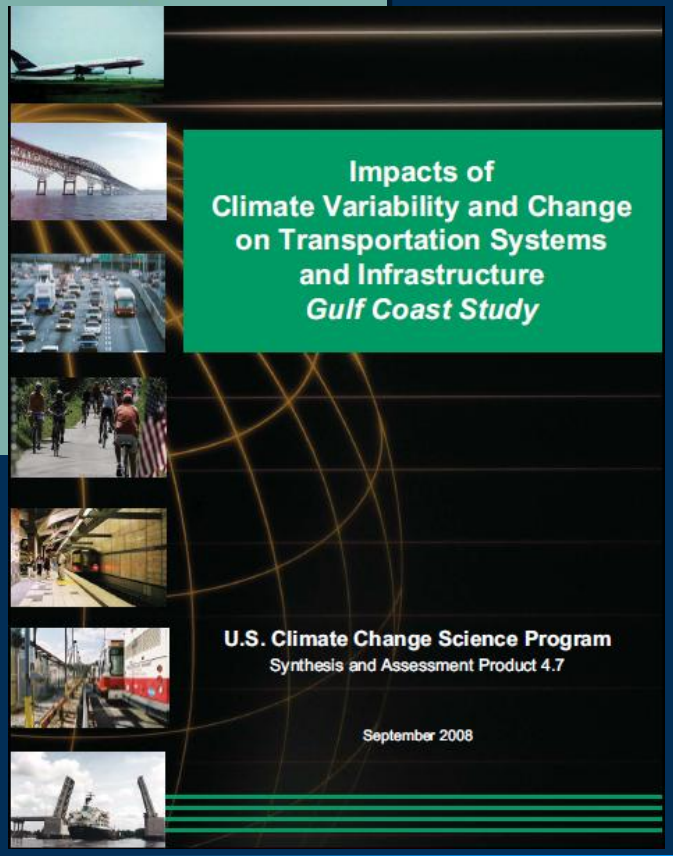
Storm intensity will increase damaging infrastructure

Source: NASA Remote Sensing Tutorial.

More Focus/Better Information
US DOT Efforts

- Potential Impacts Workshop, 2002
- Gulf Coast Study, Ph. I, 2008
- Current US DOT Efforts
  - Adaptation Strategy
  - Regional Typology
  - Vulnerability and Risk Pilots
  - Gulf Coast, Ph. II
  - Peer Exchanges





Why this matters: Transportation Impacts

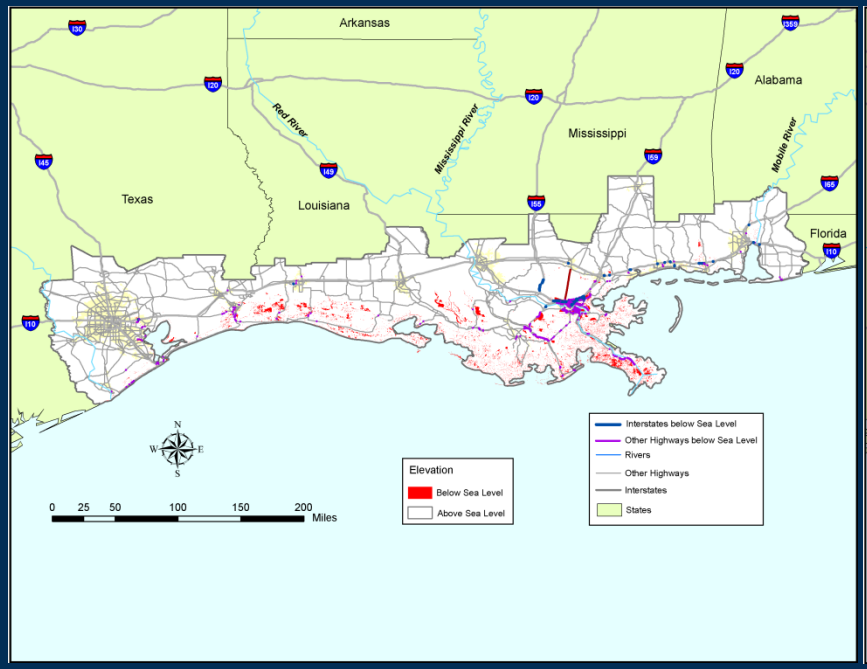
CLIMATE EFFECT	IMPACTS
Higher high temperatures, more hot days	• Asphalt deterioration • Thermal expansion of bridge joints, paved surfaces • Changes to biodiversity (impacting pest management, wetlands commitments) • More night time work, longer construction season • Pavement & structural design changes
Wind speeds	• More frequent sign damage, truck rollovers • Changes to testing of and design factors for wind speed • Need for stronger materials
More frequent, intense precipitation	• Loss of visibility, lane obstruction • Increase in weather-related delays, traffic disruption • Increased flooding of roads, evacuation routes • Increased peak stream flow could affect scour rates, influence size requirements for culverts • Standing water could affect road base adversely

Why this matters: Transportation Impacts

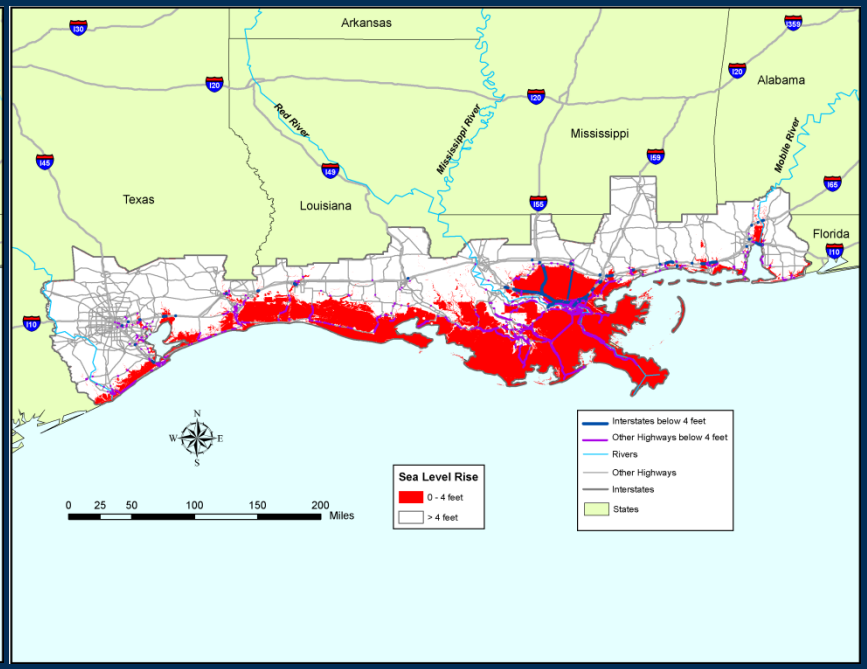
CLIMATE EFFECT	IMPACTS
Increased coastal storm intensity	• Increased storm surge and wave impacts on roads, bridge structures , signs, etc. • Decreased expected lifetime of highways exposed to surge • Damage to infrastructure caused by the loss of coastal wetlands and barrier islands • Erosion of land supporting coastal infrastructure
Sea level rise	• Permanent inundation of some roads and areas, reduced route options/redundancy • Erosion of road base • Reduced clearance under bridges • Exposes new areas to effects of surge/wave action, potentially causing interruptions to coastal roads • May amplify storm surges in some cases, requiring greater evacuations

Results – Gulf Coast Study
Highways Vulnerable to Relative Sea Level Rise

Baseline (Present Day)



4 Feet of Sea Level Rise



Study ('08) results based on IPCC4: 7 – 23" SLR

Global Climate Change Impacts in US ('09): 36 – 48"

Results - Gulf Coast Study

Vulnerability Due to…Relative Sea-Level Rise

- **Relative sea level rise (due to climate change and subsidence) of 4 feet could permanently flood:**

- ✓ **24% of interstate miles, 28% of arterial miles, New Orleans Transit**
  - ✓ ***More than 2,400 miles of roadway are at risk of permanent flooding***

- ✓ **72% of freight / 73% of non-freight facilities at ports**

- ✓ **9% of the rail miles operated, 20% of the freight facilities, no passenger stations**

- ✓ **3 airports**

- ✓ **Temporary flooding in low-lying areas due to increased heavy downpours will broaden affected areas**

Results – Gulf Coast Study
Vulnerability Due to…Storm Surge

- Transportation in the central Gulf Coast is already vulnerable to large hurricanes
- That vulnerability will be exacerbated if hurricane intensity increases

Results – Gulf Coast Study

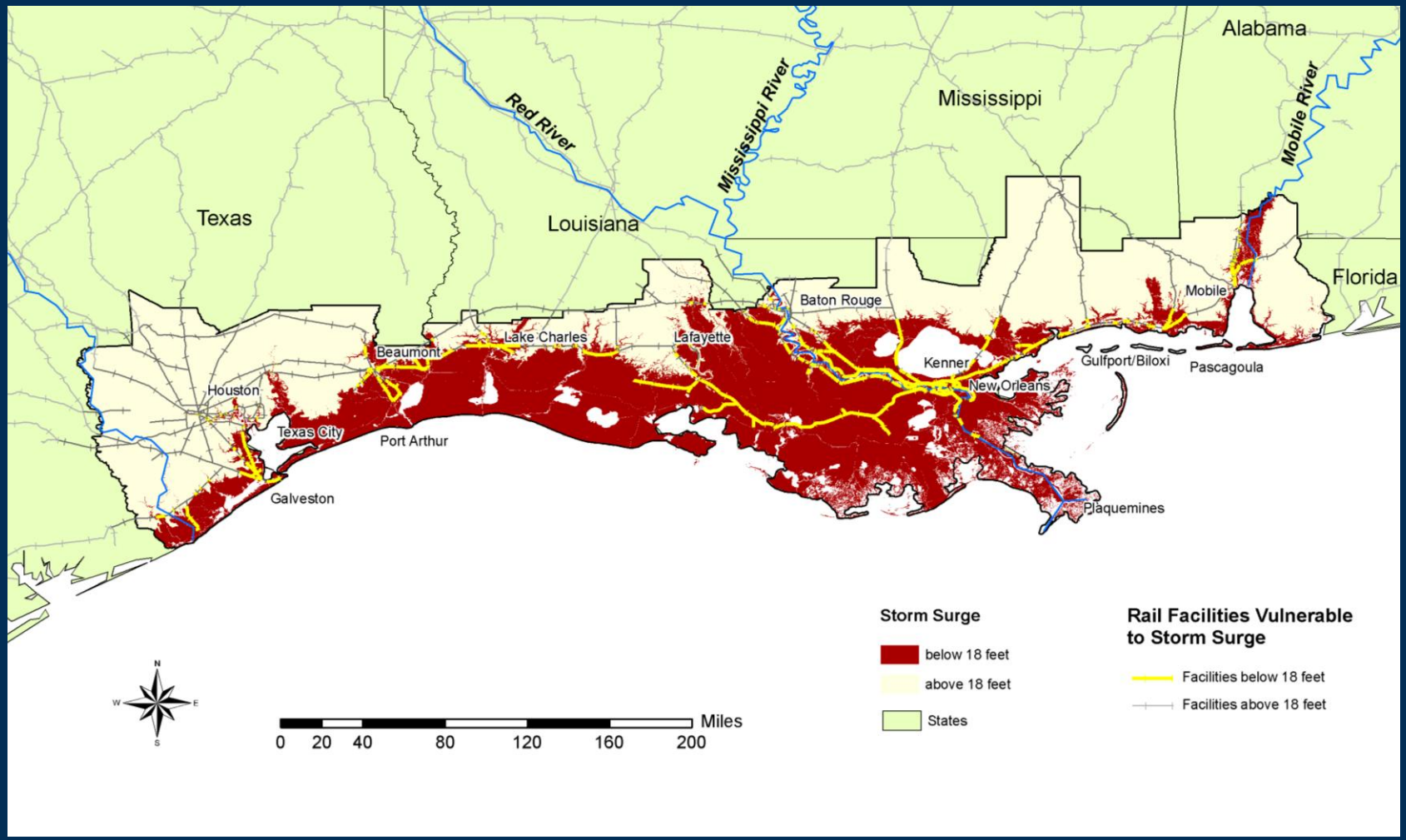
Vulnerability Due to…Storm Surge

- Transportation infrastructure that is vulnerable to 18 feet of storm surge includes:

- ✓ 51% of interstate miles, 56% of arterial miles, and most transit authorities
- ✓ 98% of port facilities vulnerable to surge and 100% to wind
- ✓ 33% of rail miles operated, 43% of freight facilities
- ✓ 22 airports in the study area at or below 18 feet MSL
- ✓ Potentially significant damage to offshore facilities

Results – Gulf Coast Study

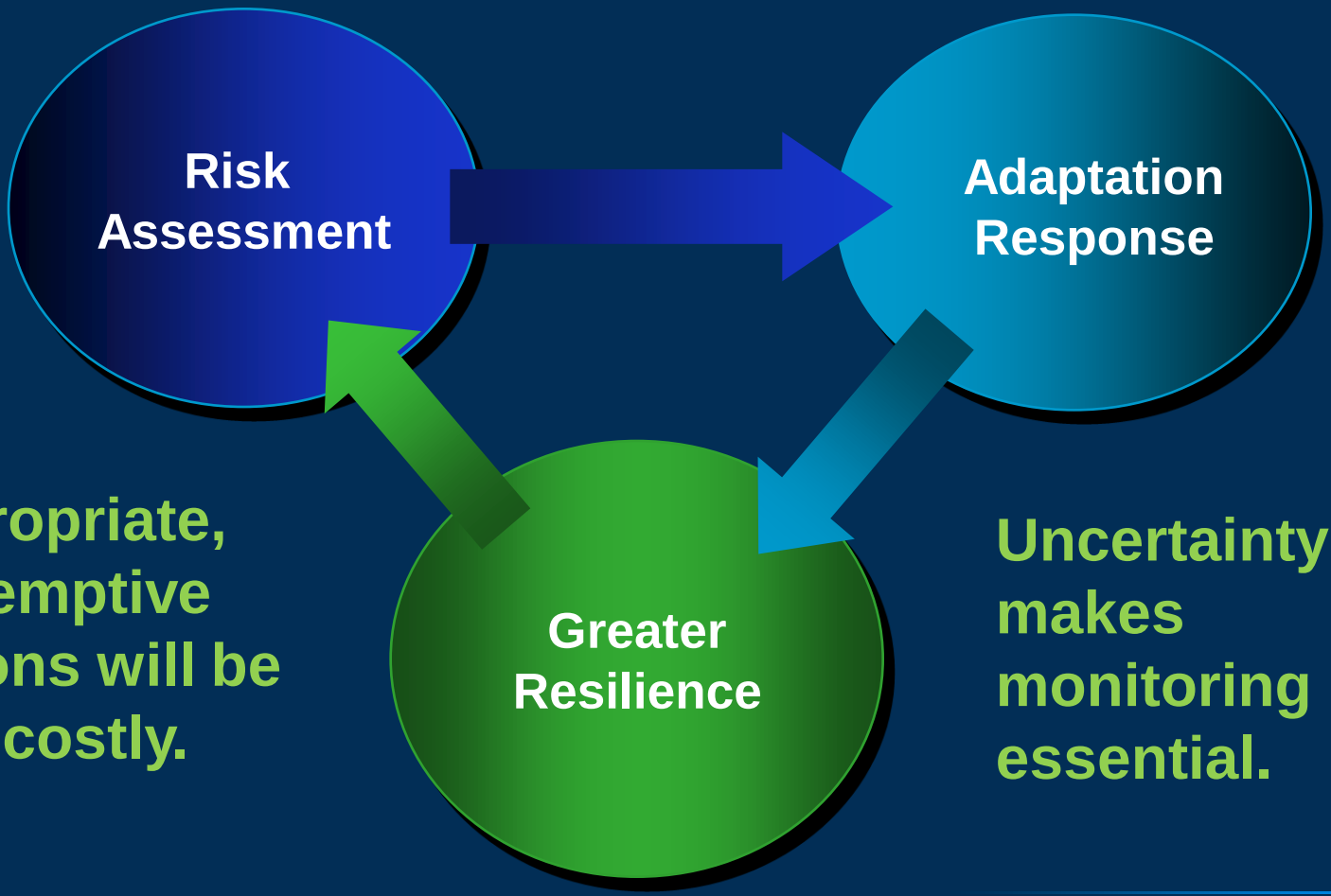
Freight Rail Lines Vulnerable to Storm Surge of 18 feet



Source: Cambridge Systematics analysis of climate projections and Federal Railroad Administration data.

Thoughts on Effective Adaptation: Reliability under a range of conditions

New approaches to decision-making: scenario planning and risk assessment



Appropriate, pre-emptive actions will be less costly.

Uncertainty makes monitoring essential.

Thoughts on Effective Adaptation
Levels of Implementation

- **Planning or Strategic Level**
  - Regional scale
  - Land uses
  - Critical services
- **Transportation Facility Level**
  - Local scale
  - Public and Private sectors
- **Research and Development**

Gulf Coast Study: Phase II Goals

- Comprehensive assessment of how climate change will affect transportation in the Gulf Coast area
- Multimodal impacts on specific facilities in 1 metro area
- New vulnerability/risk assessment tools and adaptation guides
- Timeframe: 2010-2012
- FHWA Contact: Rob Kafalenos
  - Robert.kafalenos@dot.gov

Gulf Coast Study, Phase 2

- Focus on the Mobile, AL
  - Identify "critical assets"
  - Evaluate climate change effects & stressors
  - Determine vulnerability of key links and assets
    - Develop detailed engineering analyses for selected assets
  - Develop risk assessment & risk management tools
  - Work with stakeholders
    - Share lessons learned
    - Make new tools/methods accessible to other MPOs

Vulnerability/Risk Assessment Pilots

- **Goal: to identify assets most exposed to the climate stressors and/or would result in the most serious consequences**
  - **Develop inventory of infrastructure assets**
  - **Gather climate data**
  - **Assess risk and vulnerability**
  - **Analyze, prioritize adaptation options**
- **FHWA Contact: Becky Lupes**
  - **Rebecca.lupes@dot.gov**

Vulnerability/Risk Assessment Pilots Selected

Thank you!

Questions?