

# Transportation and Climate Change



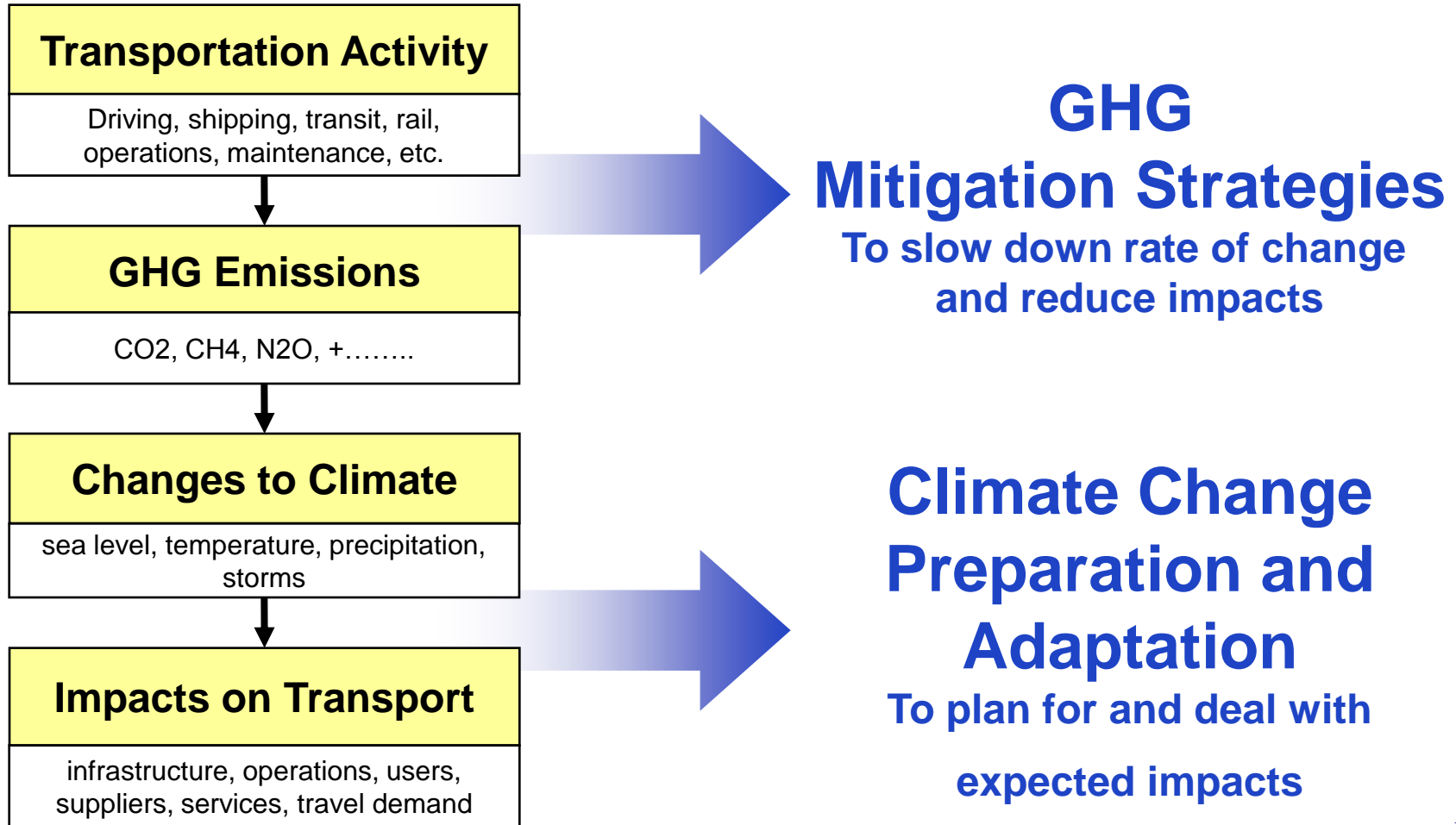
**Robert Kafalenos, FHWA  
MTAQS  
October 28, 2009**

# Topics



- **GHG Mitigation**
  - And...Livability and Sustainability
- **Adaptation to the impacts of climate change**

# What is the Difference between Mitigation & Adaptation?

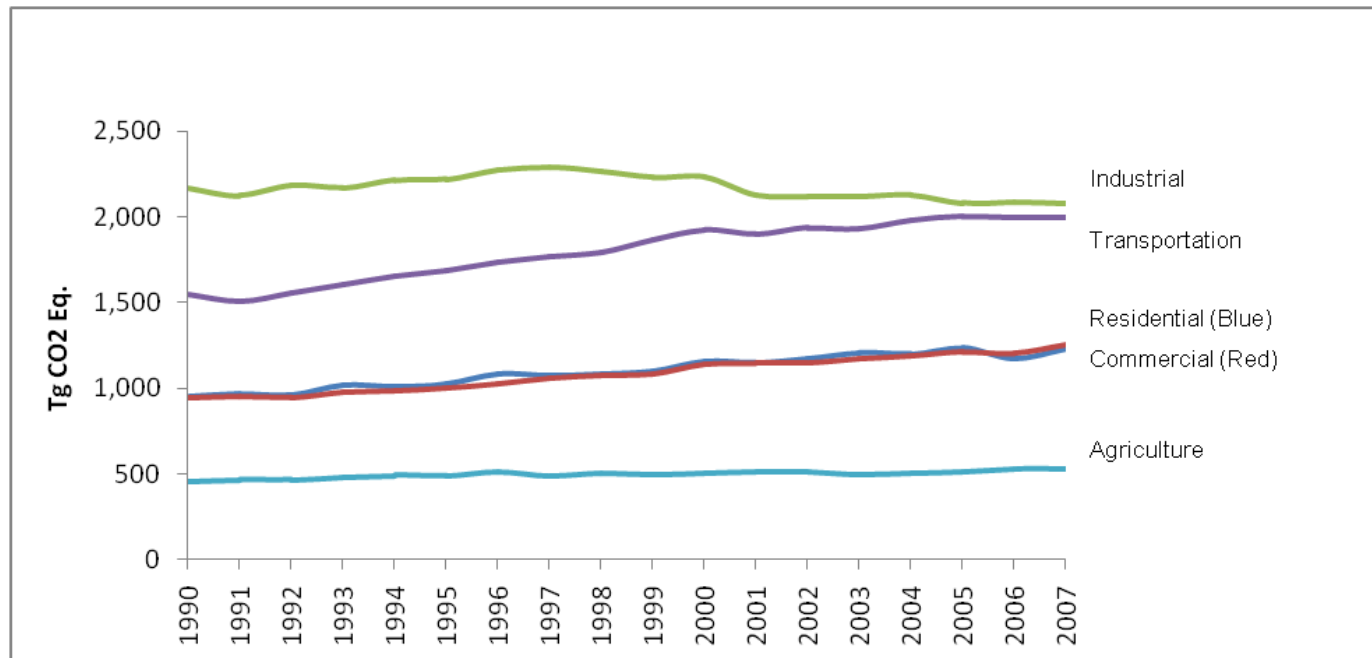


# GHGs and Transportation



- **Transportation sector accounts for 28% of GHGs nationally – much more in some states**
- **Transportation is among the fastest growing sources of GHGs**
- **More than 80% = onroad**

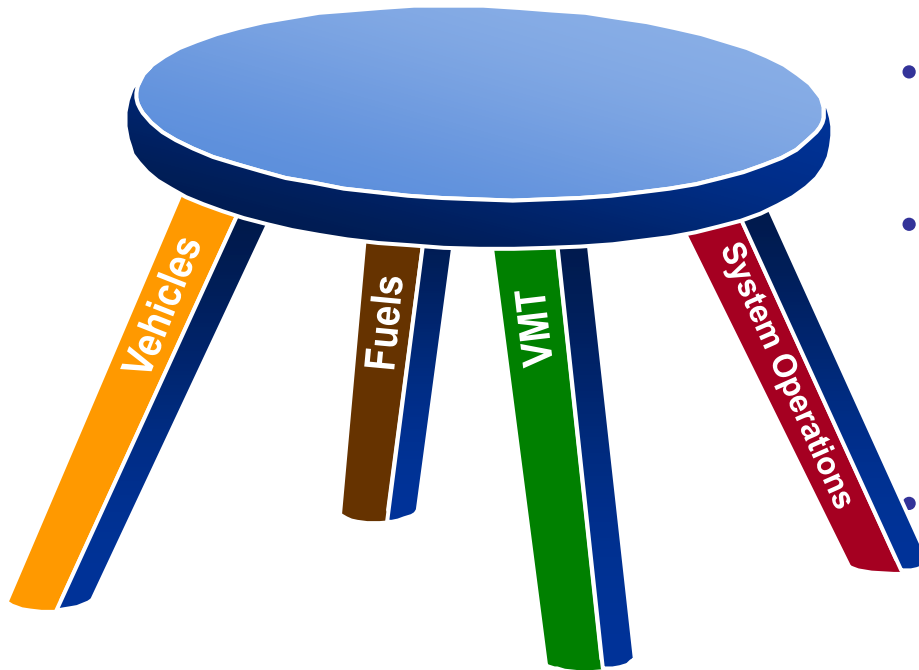
**U.S. GHG Emissions by Economic Sector, 1990-2007  
(with Electricity distributed to End-Use Sectors)**



# Multiple Transportation Strategies



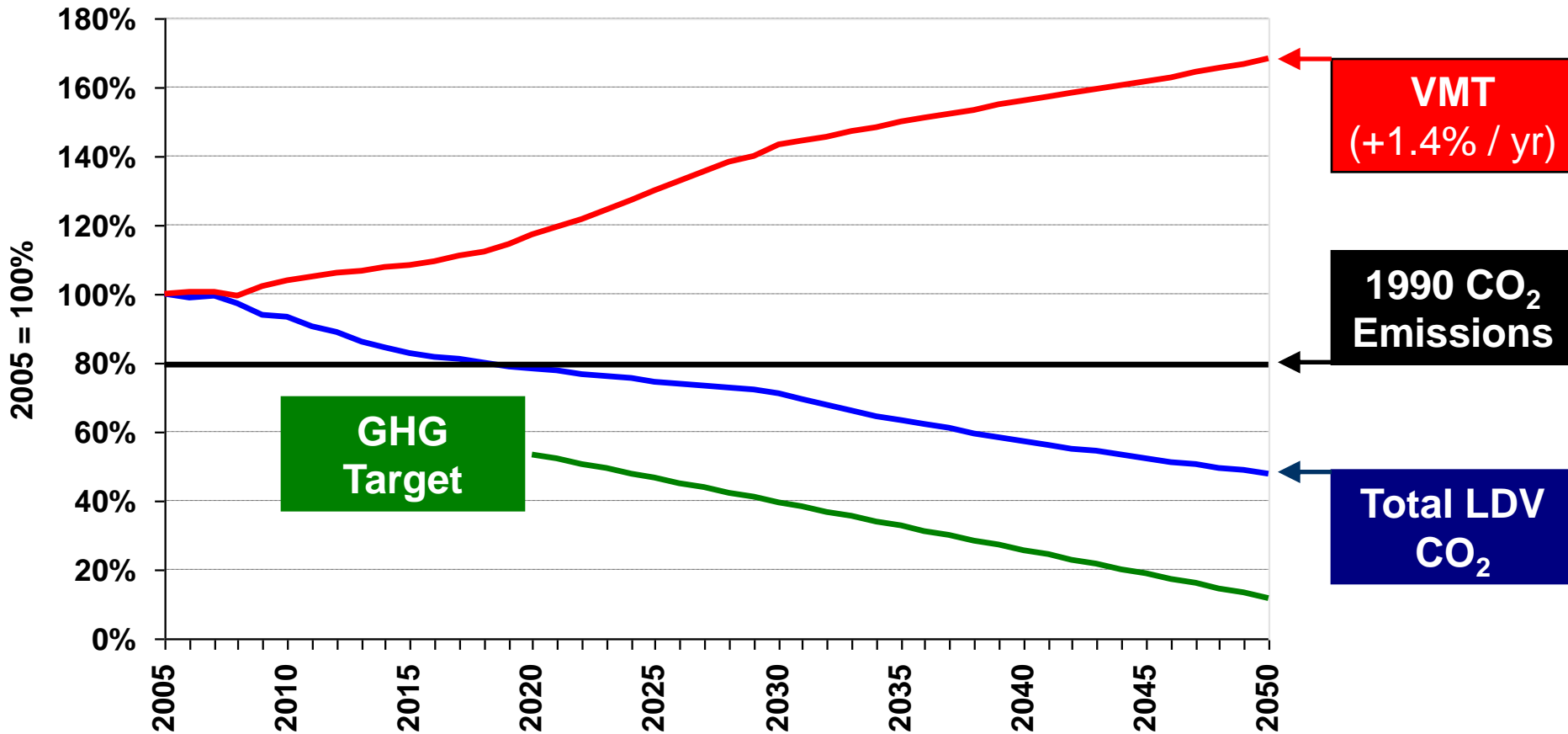
Transportation  
GHG Reductions



- Raise vehicle energy efficiency
  - CAFE Standards
  - Improved vehicle technology
- Reduce carbon content of fuels
  - Alternative and low-carbon fuels
- **Improve vehicle/system efficiency and operations**
  - Congestion/bottleneck relief
  - Idle-reduction
- **Reduce Growth in VMT**
  - Land use
  - Non-motorized

# Forecast of Light-Duty CO<sub>2</sub> Emissions

2030: 55 mpg CAFE; 15% Reduction in Fuel GHGs  
2050: 75 mpg CAFE; 40% Reduction in Fuel GHGs



# “Two Legs of the Stool”



- **System/vehicle Efficiency**
  - Traffic flow improvements
    - ITS, incident mgt, signal timing
    - Congestion pricing
    - Improved Intermodal connections
    - Reduced idling
- **Travel Activity Reduction**
  - Reducing VMT growth
    - Land Use (TOD, mixed use)
    - Bike/ped
    - Transit
    - Pricing strategies (congestion, parking, PAYD insurance, etc.)



# Improve Vehicle/System Efficiency and Operations



## Co-Benefits

- Time savings to travelers, reduced costs for shippers
- May represent important GHG reduction strategies on a local basis (e.g., highly congested areas)
- More livable communities

## Areas of Uncertainty

- Induced travel demand
- GHG reduction benefits will decrease over time as vehicle fuel efficiency increases and fuel carbon declines
- Operation of construction equipment

# Climate Change Why Address in Planning?



- **Broader regional scope is more consistent with scope of climate change impacts**
- **Consistent with current planning factors**
- **Can incorporate by reference in NEPA document**

# A Place to Start

**Federal Highway Administration**

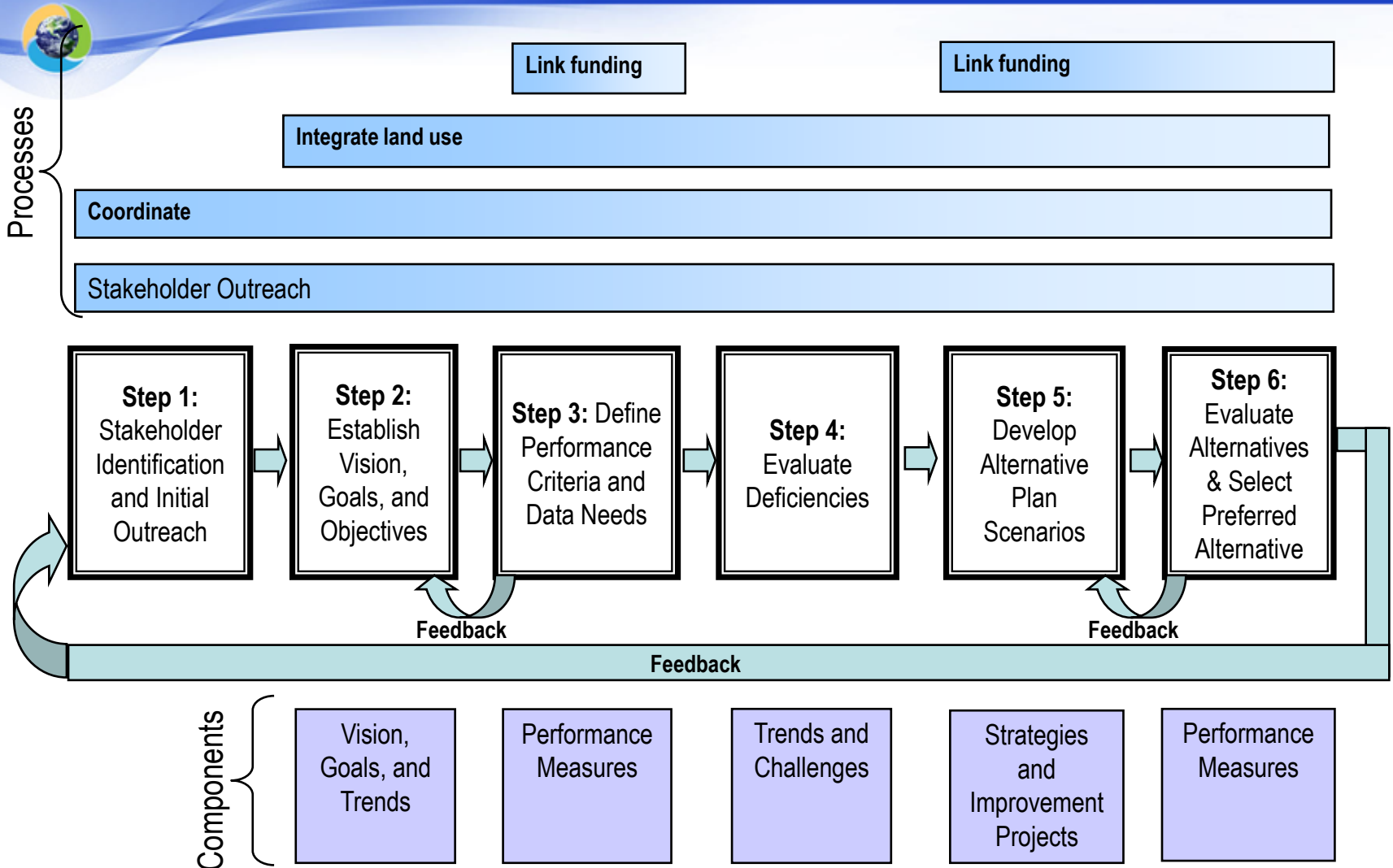
## **Integrating Climate Change into the Transportation Planning Process**

**Final Report**

July 2008

<http://www.fhwa.dot.gov/hep/climatechange/index.htm>

# Climate Change in RTPs



# Actions from One MPO Plan



## **Genesee Transportation Council**

- **Develop expanded bicycle and pedestrian networks**
- **Increase funding for public transportation**
- **Improve management and operation of existing system**
- **Support cleaner vehicle technologies and fuels**
- **Strengthen connection between land use and transportation**
- **Expand outreach to involved, interested stakeholders**



# Recent Legislation with National Impact



- **June 26, 2009: U.S. House of Representatives passed the American Clean Energy and Security Act of 2009 (ACES Act)**
  - Legislation would establish an economy-wide, GHG cap-and-trade system and critical measures to help address climate change and build a clean energy economy.
- **September 30, 2009: U.S. Senate released the Clean Energy Jobs and American Power Act**



# FHWA Activities - *Mitigation*



- **Working with stakeholders on approaches for reducing growth in VMT**
- **Analyzing the most cost-effective mitigation strategies, reductions associated with “bundling” those strategies**
- **Playing key roles in the Secretary’s Livability Initiative, HUD-DOT-EPA Sustainable Communities Partnership**
- **Offering technical assistance to State DOTs and MPOs in an effort to update existing models and provide training on MOVES**
- **Carbon sequestration pilot program**
  - **New Mexico, Minnesota**
- **Operations Strategies to Reduce Greenhouse Gas Emissions**
- **Mitigation Guidebook**
- **Scenario Planning**



# Livability



- **The Livable Communities Initiative (*DOT*)**
  - Provides transportation choices that promote place-based transportation policies that are centered on people
- **Livable Communities defined**
  - Encourage mixed-use, multi modal neighborhoods with highly-connected streets promoting mobility, access and quality of life for all users



# DOT/HUD/EPA Sustainable Communities Partnership



## Principles

- **Provide more transportation choices**
- **Promote equitable, affordable housing**
- **Enhance economic competitiveness for urban and rural communities**
- **Support existing communities, both urban and rural**
- **Coordinate policies and leverage investments**
- **Value communities and neighborhoods**



# Partnership for Sustainable Communities



Action's tied to DOT's Livability Initiative:

- **TIGER Discretionary Grant Program**
- **Transportation/HUD Budget Request**



# FHWA Livability Initiatives



- **FHWA/FTA Livability Initiative Training**
- **A Livability in Transportation Guidebook**
- **Strategies for Livable Communities Research Project includes:**
  - White Paper on Livability
  - Livability Workshops
  - Toolbox of Training Materials
  - Develop a Regional Comprehensive Livability Plan
  - Develop a Livability Marketing Plan



# Sustainability – How It Will Shape the Future Highway Program



- **Increase use of recycled materials**
- **Stormwater runoff techniques that mimic natural hydrology**
- **Construction equipment that reduces pollution and ion practices that minimize ecosystems impacts**
- **Designs to minimize environmental impacts**
- **Operational equipment that uses renewable fuels**
- **Maintenance that minimizes environmental impacts**
- **Conversion of brownfields**
- **Designs that accommodate multiple modes and promote connectivity**
- **Facilitation of affordable choices for jobs and schools**



# Adaptation



## **Climate change effects**

- Outcomes of long-term variation in the climate

## **Climate change impacts**

- Consequences that climate change effects may have on infrastructure

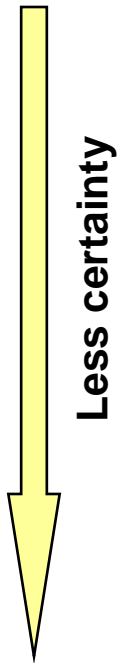
## **Adaptation**

- Changes in the way surface transportation infrastructure is planned, designed, constructed, operated, and maintained

# Climate Change Effects?



	Level of Uncertainty	Probability of Occurrence
<b>Sea level rise</b>	Virtually certain	≥99 %
<b>Temperature changes</b>		
Decreases in very cold days	Virtually certain	≥99 %
Increases in Arctic temperatures	Virtually certain	≥99 %
Later onset of seasonal freeze, earlier onset of seasonal thaw	Virtually certain	≥99 %
Increases in very hot days and heat waves	Very likely	≥90 %
<b>Precipitation</b>		
Increases in intense precipitation events	Very likely	≥90 %
Increases in drought conditions for some regions	Likely	≥66 %
Changes in seasonal precipitation and flooding patterns	Likely	≥66 %
<b>Storms</b>		
Increases in hurricane intensity	Likely	≥66 %
Increased intensity of cold-season storms, with increases in winds, waves and storm surges	Likely	≥66 %



IPCC. 2007. Summary for Policymakers. In Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

***Local impacts more important than global averages***

# Why be Concerned about Climate Change Impacts?



- **Design life of transportation infrastructure: decades or longer**
- **As climate changes, our infrastructure will need to be able to handle new conditions**
- **Each region has unique transportation assets, and faces different vulnerabilities and risks**



Flooded roadways in Houston



# Impacts



CLIMATE CHANGE EFFECT	SOME POTENTIAL IMPACTS (& ADAPTATION RESPONSES)
Sea level rise	<ul style="list-style-type: none"><li>• Greater inundation and erosion of coastal highways</li><li>• Greater infrastructure damage when higher sea levels combine with storm surges</li><li>• Need for more stringent design standards for flooding and building in saturated soils</li></ul>
Higher storm surges and wave heights	<ul style="list-style-type: none"><li>• Road infrastructure damage</li><li>• Road closures/major disruptions</li><li>• Increased VMT, VHT, &amp; route delays/accidents during evacuations</li><li>• Changes to bridge design in vulnerable areas</li><li>• Changes in materials specs &amp; more protective strategies for critical components</li></ul>

# NC 12 Washout Hatteras Village, NC, 2003



# Hurricane Katrina: Wave-Induced Bridge Damage (2005)



Photo by S. Douglass

# Impacts



## CLIMATE CHANGE EFFECT

## SOME POTENTIAL IMPACTS (& ADAPTATION RESPONSES)

**More frequent intense precipitation**

- **Design impacts**
- **Concrete deterioration**
- **Bridge scour**
- **Loss of visibility, lane obstruction**
- **Travel & schedule delays**

**Wind speeds**

- **More frequent truck rollovers, sign damage**
- **Changes to testing of and design factors for wind speed**
- **Need for stronger materials**

**Higher high temperatures, more hot days**

- **Asphalt deterioration**
- **Thermal expansion of bridges**
- **Changes to biodiversity (impacting pest management, wetlands commitments)**
- **Longer construction seasons, night time construction**
- **Failing road embankments & settling of shallow pile foundations**
- **Pavement & structural design changes**



# What Are Possible Adaptation Responses?



- **Maintain & Manage**
  - Higher maintenance costs
- **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**



# FHWA Activities - *Adaptation* (1)



- **Developing FHWA Strategy to Address Adaptation to Climate Change Effects**
- **Climate Effects Typology, Regional estimates of effects**
- **Interim Framework for conducting vulnerability assessments (& pilots)**
- **Coordination with NOAA/USGS, others**
- **Gulf Coast study, Phase 2 (DOT)**
- **Climate Change and Highway Infrastructure: Impacts and Adaptation Approaches (NCHRP)**



# FHWA Activities - *Adaptation* (2)



- **Peer Exchanges (Dec 2008, upcoming)**
- **Technical assistance on projects and adaptation issues**
- **Considering guidance on adaptation in project development and environmental review**





# For More Information



Federal Highway Administration Climate Change Website:

<http://www.fhwa.dot.gov/hep/climate/index.htm>

US DOT Transportation and Climate Change Clearinghouse:

<http://climate.dot.gov/index.html>

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Sustainable Transport & Climate Change Team

