

# The Surface Transportation Environment and Planning Cooperative Research Program

**STEP**

Presents

*“Air Quality and Climate Change”*

Webinar

September 28, 2010

12:00 p.m. to 1:30 p.m.



# Webinar Moderator

Lisa Colbert, Acting Team Leader  
Research and Financial Service Team  
FHWA Office of Human Environment



# Webinar Housekeeping Tips

- Asking Questions
  - Designated time at the end of presentation for questions and answers
    - Phone
      - Please state name and affiliation
    - Chat feature
      - If using the chat please send all questions to Lisa Colbert

# Welcome and Overview

- Welcome to the STEP Webinar on Air Quality and Climate Change
- Agenda
- STEP Overview and Stakeholder Feedback
- Air Quality and Climate Change Initiatives
- Polling Questions
- Question and Answers

# What is STEP?

- Surface Transportation Environment and Planning Cooperative Research Program
- Federally-administered nationally orientated research program
- Improve the understanding of the complex relationship between surface transportation, planning and the environment
- Identify, address and reassess national research priorities for environment, planning and realty
- A variety of procurement mechanisms are used to award STEP funds

# Who Gets STEP Money?

- State Governments
- Metropolitan Planning Organizations
- Local Governments
- Universities
- Federal Agencies
- Private Sector

# Stakeholder Involvement

*Outreach and stakeholder feedback are used to refine and implement national research agenda*

- Partnerships are formed to leverage funds
  - Federal, State and Local agencies
  - National Cooperative Highway Research Program
  - Future Strategic Highway Research Program
  - Pooled funds and foreign jurisdictions

# STEP Feedback and Submitting Lines of Research

- Requests Suggested Lines of Research for FY11
- Feedback Period Open Until September 30
- Review Proposed FY11 Implementation Strategy [www.fhwa.dot.gov/hep/step/strategy.htm](http://www.fhwa.dot.gov/hep/step/strategy.htm)
- Develop and submit feedback on suggested lines of research related to the proposed STEP research priorities at <http://knowledge.fhwa.dot/cops/step.nsf/home>



# STEP Emphasis Areas

## PLANNING

Congestion  
Safety Planning  
Freight Planning

Public Involvement, Environmental Justice,  
Visualization in Planning  
Other Activities That Support State/Local/Tribal  
Planning Capacity Building  
U.S./Canada & U.S./Mexico Border Planning  
National Security, Defense & Interstate Planning

## ENVIRONMENT

Air Quality & Climate Change  
Water/Wetlands/Vegetation/Wildlife/Habitat/Brownfields  
Environmental Streamlining/Stewardship  
Context Sensitive Solutions  
Bicycle/Pedestrian & Health  
Historic Preservation  
Noise

## REAL ESTATE SERVICES

Real Estate Program Stewardship  
Outdoor Advertising Control

## SUPPORT TOOLS

Travel Modeling  
Geographic Information Systems

# STEP Emphasis Areas for Today

- Air Quality
- Climate Change

# Air Quality and Climate Change Emphasis Area Overview

Cecilia Ho, Team Leader

Air Quality and Transportation Conformity Team  
FHWA Office of Natural Environment



# Transportation and Air Quality

- Transportation and Air Quality Emissions Analysis
  - Regional and project level hot-spot analysis
- Model implementation and tools development
  - MOVES implementation training and technical assistance
  - Air quality dispersion models
- Mobile Source Air Toxics near roadway Study
  - Near roadway air quality data collection
- Air Quality and health impacts

# Climate Change and Transportation

- Adaptation Research
  - Gulf Coast Study
  - Vulnerability assessment pilot
- Mitigation Research
  - Mitigation guidebook/carbon calculator tool
  - Operational strategies

# Sustainable Highways

- Sustainable Highways Criteria and Tools Project
  - Initiated to assist State and local transportation agencies understand and use sustainability criteria and tools in the planning, design, and construction of roads and highways
  - Development of criteria and tool

# Research Outreach & Communications

- Provide technical assistance
  - Webinar
  - Symposium
  - Training
- Outreach communications, publications

# STEP Funding for Air Quality and Climate Change Research

- Since 2006, STEP provided a total of \$7,606,900 and funded 26 Air Quality and Climate Change Research projects.
- Research ideas received from many different stakeholders:
  - Federal: EPA, USGS, USDA, NOAA, DOE
  - State/Local: State DOTs, State Environmental agencies; State Air agencies; MPOs; Cities
  - Others: stakeholder groups (AASHTO, AMPO etc); universities, research entities



# MOVES Implementation

Cecilia Ho

FHWA Office of Natural Environment



*and*

Kanok Boriboonsomsin, Ph.D., P.E.

Center for Environmental Research and Technology,  
University of California



# MOVES Implementation

- Funded 3 projects through a Broad Agency Announcement
- A total of 20 proposals received
- More than half are MOVES related

# Advances in Project Level Analysis (Pechan)

- Demonstrate a methodology to use micro-simulation modeling output to create VSP profiles as inputs to MOVES model under two scenarios:
  - A series of congested conditions for different facility types (e.g., V/C ratio's 0.7 to 1.2)
  - Conditions typical of intermodal and port facilities.
- Work is expected to be completed in November 2010.

# Improving Vehicle Fleet, Activity, and Emissions Data for On-Road Mobile Sources Emissions Inventories (UC Riverside)

- The study will cover the following data issues related to MOVES:
  - Review of the current state of practice and identify limits of truck data;
  - Evaluate use of vehicle identification number (VIN) decoders in conjunction with license plate surveys and vehicle registration databases to derive vehicle fleet data;
  - Evaluate the use of electronic control modules data to derive truck activity data;
  - Develop data fusion methods to combine truck activity data from multiple sources;
  - Measure emissions from heavy-duty trucks with various loaded vehicle weights.
- Work is expected to be completed in May 2011.

# Modifying Link-Level Emissions Modeling Procedures for Applications within the MOVES Framework (Eastern Research Group (ERG))

- Recreated the emissions inventory used for the Houston SIP based on data provided by TTI from the travel demand model and MOVES
- Recreated the emissions inventory used for the Houston SIP based on HPMS activity data and MOVES
- Used the Kansas City data to produce real world drive cycles and recreated both the travel demand model and HPMS based inventories for Houston with the new drive cycles
- Compared the results of new inventories produced against the original inventories developed using MOBILE.
- Documented lessons learned from transitioning from MOBILE6 to MOVES for regional analyses.
- Work is expected to be completed in September, 2010

# MOVES and Its Implementation

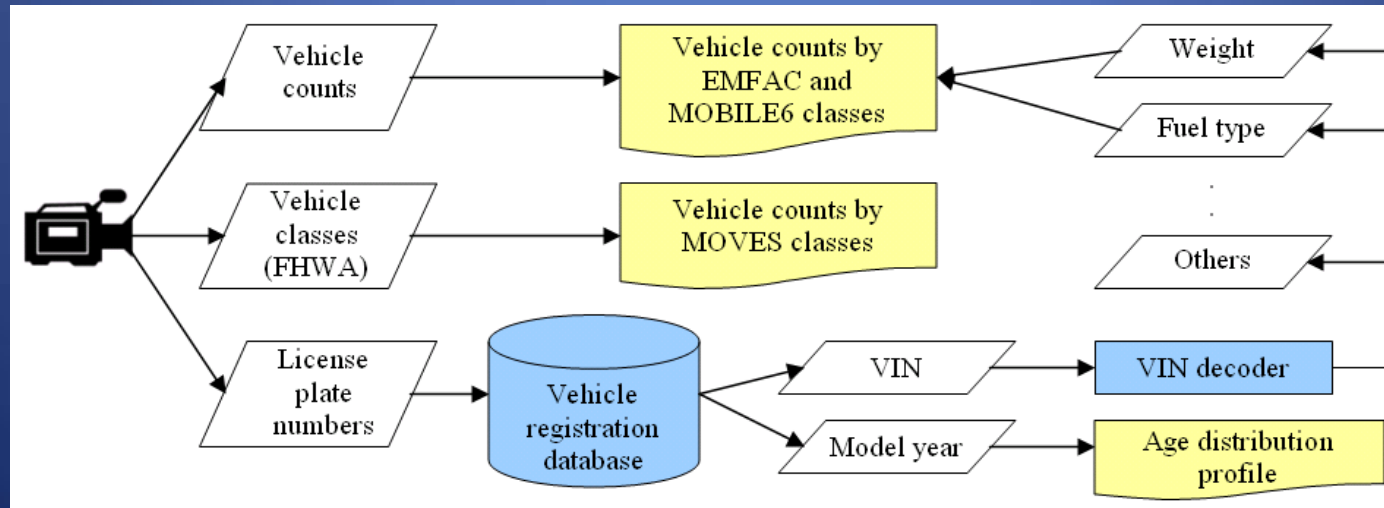
- MOVES is now the EPA's official regulatory model. MPOs are adopting this new model in place of MOBILE6.2.
- Challenges:
  - New modeling approach, i.e. VSP-speed bins
  - New software architecture & user interfaces
  - New input data format & requirements
- Support & assistance:
  - MOVES training (EPA & FHWA)
  - Converter tools (EPA)

# Ongoing Research at UC Riverside

- Tools for developing local input data
  - New data sources that are potentially useful
  - New methodologies to utilize existing data sources effectively
- Validation of selected MOVES emission factors
  - Those based on “hole filling” methods
- Modeling issues that affect emission inventories
  - Effect of out-of-domain vehicles
  - Effect of heavy-duty trucks’ container weight

# Vehicle Fleet Distribution Data

- Needs: Current practice relies heavily on state vehicle registration databases.
  - Not accounting for out-of-domain vehicles
  - Not able to capture temporal variation well
- Solutions: Vehicle license plate survey



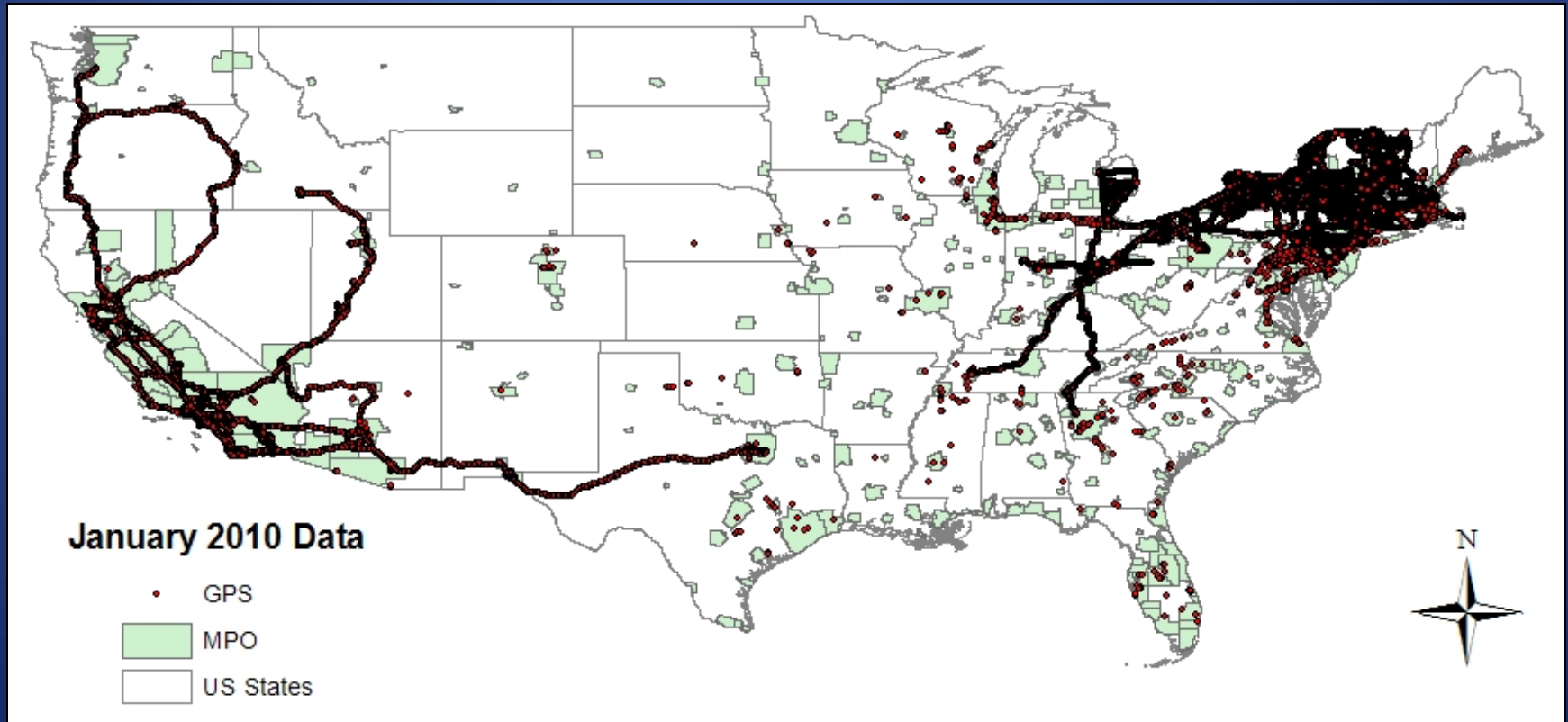


# Heavy-Duty Truck Activity Data

- Needs: Heavy-duty truck activity data is more limited compared to that of light-duty vehicles.
  - HPMS → no speed information
  - GPS data loggers → only a few studies
  - Freight flow models → not well validated yet
- Solutions:
  - Other existing data sources (e.g. weigh-in-motion (WIM) stations)
  - New data sources (e.g. Electronic Control Units (ECU), fleet monitoring systems)

# Nationwide Truck Telemetry Data

- A collective fleet of more than 2000 class 8 trucks



# Heavy-Duty Truck Emission Factors

- Needs: Some emission factors in MOVES are based on “hole filling” methods.
  - Future vehicle model years
  - Alternative vehicle fuels and technologies
  - Vehicles with no existing emission test data available
- Solutions: Limited emission testing program
  - The new state-of-the-art heavy-duty chassis dynamometer
  - 2 trucks → 2007-2009 standard & 2010 standard
  - Effect of container weight (i.e. empty, half-full, full)

# Expected Products of Research

- Summary of current state of the practice
- Guidance document on conducting vehicle license plate survey to supplement on-road mobile source emissions modeling and analysis
- A set of tools & methodologies:
  - Accounting for out-of-domain vehicles in vehicle fleet distribution inputs
  - Developing truck activity inputs from WIM data, ECU data, truck telemetry data, etc.

# National Near Road MSAT Study

Victoria Martinez

Air Quality and Transportation Conformity Team  
FHWA Office of Natural Environment



Sue Kimbrough

Environmental Protection Agency (EPA)



# Program Background

- NDOT Agreed to do monitor and filtration study at near-by schools
- FHWA Agreed to monitor concentrations of NAAQS and MSAT in the near road environment

# Monitoring Protocol

- Pollutants (CO, NO, Black Carbon, PM<sub>2.5</sub>, Acetaldehyde, Acrolein, Benzene, 1,3-Butadiene, Formaldehyde)
- Methodologies & Measurements
- Distances (10 m, 100 m, 300 m and background/upwind)
- Schedule: Both Continuous and Canister Samples -  
Las Vegas = nine 1 hour samples every 12 days.  
Detroit = peak commute times. Samples will be collected on a quarterly basis with 5 samples collected during the quarter and 2 samples being collected on sample days.

# EPA Interagency Agreement & Pooled Fund

- EPA & FHWA Interagency Agreement
  - Monitoring in Las Vegas Complete. Detroit monitoring underway. Together we have over \$6 m invested or planned over the next 12 months
- Pooled Fund
  - 6 states contributing funds (AZ, CA, MI, NV, NY and WI)



# More Information

Website:

[www.fhwa.dot.gov/environment/airtoxicmsat/index.htm](http://www.fhwa.dot.gov/environment/airtoxicmsat/index.htm)

# EPA/FHWA Near Road Collaboration Project



# EPA/FHWA Near Road Team Members

## Project Team:

- Strategic Project/Science Management
  - Dan Costa
  - Carlos Nunez
  - Doug Mckinney
  - Richard Baldauf
  - David Kryak
  - Alan Vette
- NRMRL – Project Management
  - Sue Kimbrough
  - Richard Shores
- EPA/FHWA Technical Working Group (including above)
  - Victoria Martinez (FHWA) -- IAG Project Officer)
  - Dan Vallero (EPA IAG Project Officer)
  - Bill Mitchell
  - Donald Whitaker
  - Richard Baldauf
  - Gayle Hagler
  - James Hirtz
  - Jason Herrington
  - Paul Solomon
  - Other EPA technical staff as needed.....

# Why are we involved in this project?

## --- Key Science Questions ---

- What is the spatial and temporal variability of traffic-related pollutants near roadways?
- How do traffic (volumes, speeds, fleet mix, etc.) and environmental (meteorology, topography, etc.) conditions affect vehicle emissions and near road air quality?
- What marker(s)/metric(s) can be used to identify exposures to traffic-related emissions?
- What tools are available, or can be produced, to identify the relationship from traffic emissions to population exposures to adverse health effects for use in regulatory decision making and transportation planning?
- What are the concentration gradients at a fine(er) scale resolutions?
- How does urban topography and barriers impact these gradients?
- Are there mitigation techniques that can reduce exposures to susceptible populations?

# What do we hope to get out of this effort?

Outcomes	Stakeholders
Provide FHWA with data necessary to comply with Settlement Agreement.	FHWA
Understanding the relationship between traffic, meteorology and near road air quality	FHWA, NRMRL/NERL
Identify metrics used to relate traffic emission impacts on air quality and adverse health effects for inclusion in risk and health assessments	FHWA, OTAQ, OAQPS, NHEERL, HEI, states
Provide improved air quality dispersion algorithms for near-road assessments and upgrade EPA's regulatory dispersion model AERMOD	OTAQ, OAQPS, NOAA, FHWA, DOE, states

# Site Selection Criteria

Selection Considerations	Monitoring Protocol Criteria
AADT (> 150,000)	Only sites with more than 150,000 annual average daily traffic (AADT) are considered as candidates.
Geometric Design	The geometric design of the facility, including the layout of ramps, interchanges and similar facilities, will be taken into account. Where geometric design impedes effective data collection on MSATs and PM <sub>2.5</sub> , those sites will be excluded from further co
Topology (i.e., Sound Barriers, Road Elevation)	Sites located in terrain making measurement of MSAT concentrations difficult or that raise questions of interpretation of any results will not be considered. For example, sharply sloping terrain away from a roadway could result in under representation of
Geographic Location	Criteria applicable to representing geographic diversity within the U.S. as opposed to within any given city.
Availability of Data (Traffic Volume Data)	Any location where data, including automated traffic monitoring data, meteorological or MSAT concentration data, is not readily available or instrumentation cannot be brought in to collect such data will not be considered for inclusion in the study.
Meteorology	Sites will be selected based on their local climates to assess the impact of climate on dispersion of emissions and atmospheric processes that affect chemical reactions and phase changes in the ambient air.
While not explicitly included in the Monitoring Protocol, the following selection criteria were deemed important to the selection process and were included.	
Downwind Sampling	Any location where proper siting of downwind sampling sites is restricted due to topology, existing structures, meteorology, etc., may exclude otherwise suitable sites for consideration and inclusion in this study.
Potentially confounding air pollutant sources	The presence of confounding emission sources may exclude otherwise suitable sites for consideration and inclusion in this study.
Site Access (Admin/Physical)	Any location where site access, is restricted or prohibited either due to administrative or physical issues, will not be considered for inclusion in the study.

# Instrument Deployment - Overview

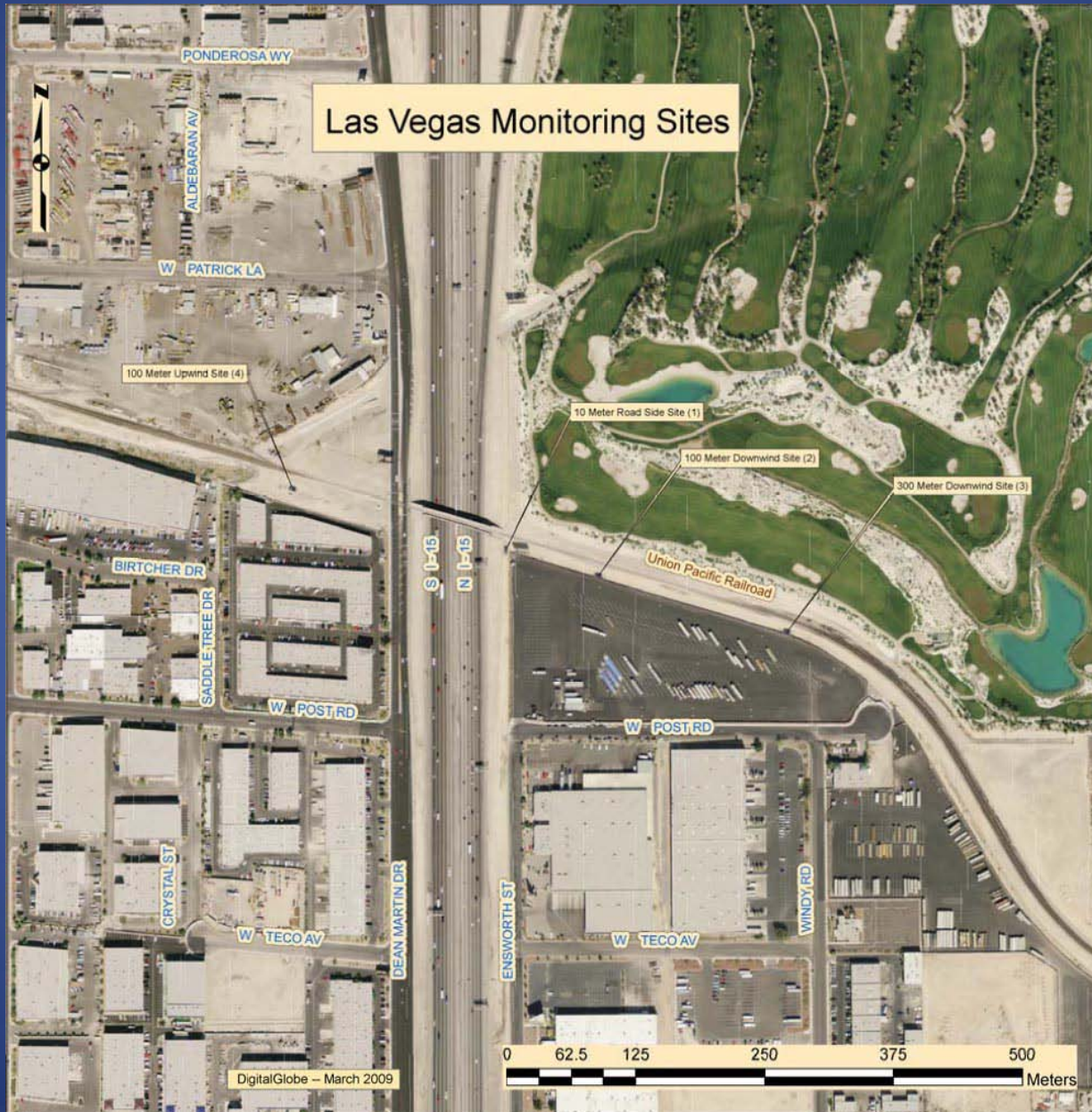
Core Instruments	10 Meters @ I-96 Roadside	100 Meter Downwind	300 Meter Downwind	100 Meter Upwind
TO-11A Cartridge sampling	X	X	X	X
TO-15 Canister sampling	X	X	X	X
Continuous GC	X	X	X	X
Continuous gas monitoring (CO, NOx )	X	X	X	X
Continuous black carbon monitoring (Aethalometer)	X	X	X	X
Continuous fine particle (TEOM)	X	X	X	X
Integrated PM2.5 (FRM)	X	X	X	X
Wind speed/wind direction (sonic anemometer)	X	X	X	X
Meteorological monitoring (temp, RH, solar, etc.)		X		
Study Enhancements				
Continuous Particle Counts (TSI, 6nm – 3mm)	X		X	
Ultrafine Particles (20-100 nm)	X		X	
Continuous gas monitoring (CO2)	X	X	X	X
Michigan DOT -- Traffic Data				
Vehicle Count, Vehicle Speed, Vehicle Class				







# I-15 Monitoring Site:



I-15 Site

North View



West View

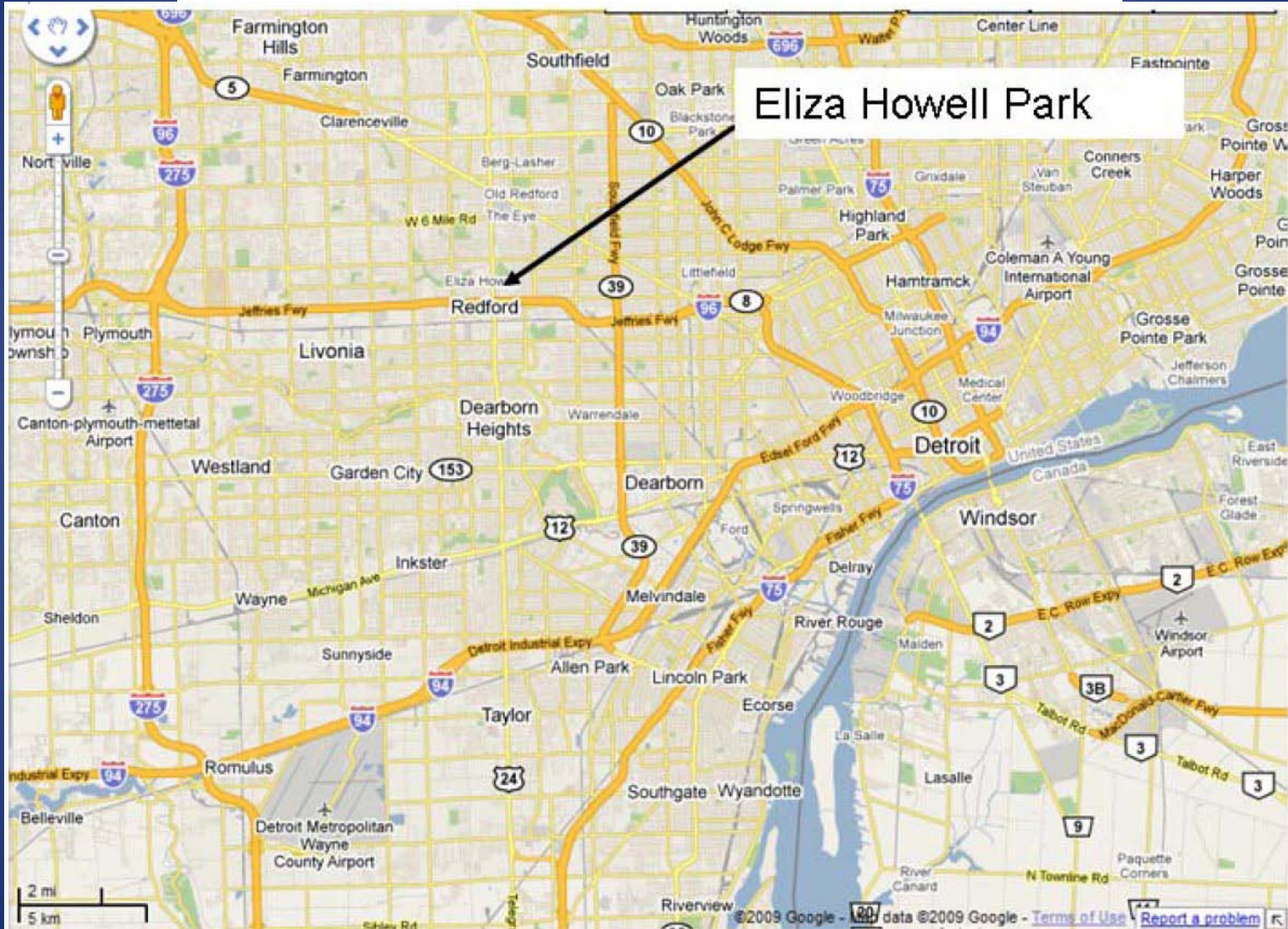


East View





# Overview Map of Detroit



# Where do we go from here?

- Shelters In Place
- Quality Assurance Project Plan
- Detroit Data Collection – Imminent

# Vulnerability/Risk Assessment Conceptual Model and Pilots


Becky Lupes

Sustainable Transport and Climate Change Team  
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

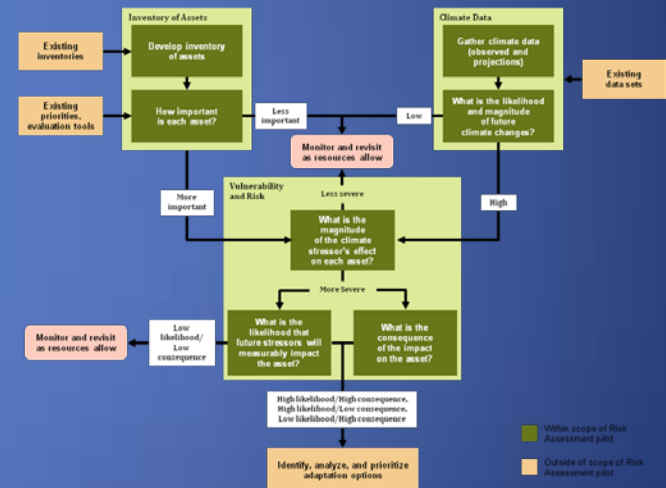


# Vulnerability/Risk Assessment Conceptual Model

- 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





# Pilots Selected

- MTC (San Francisco)
- Virginia DOT
- Washington State DOT
- New Jersey DOT
- Oahu MPO



# 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

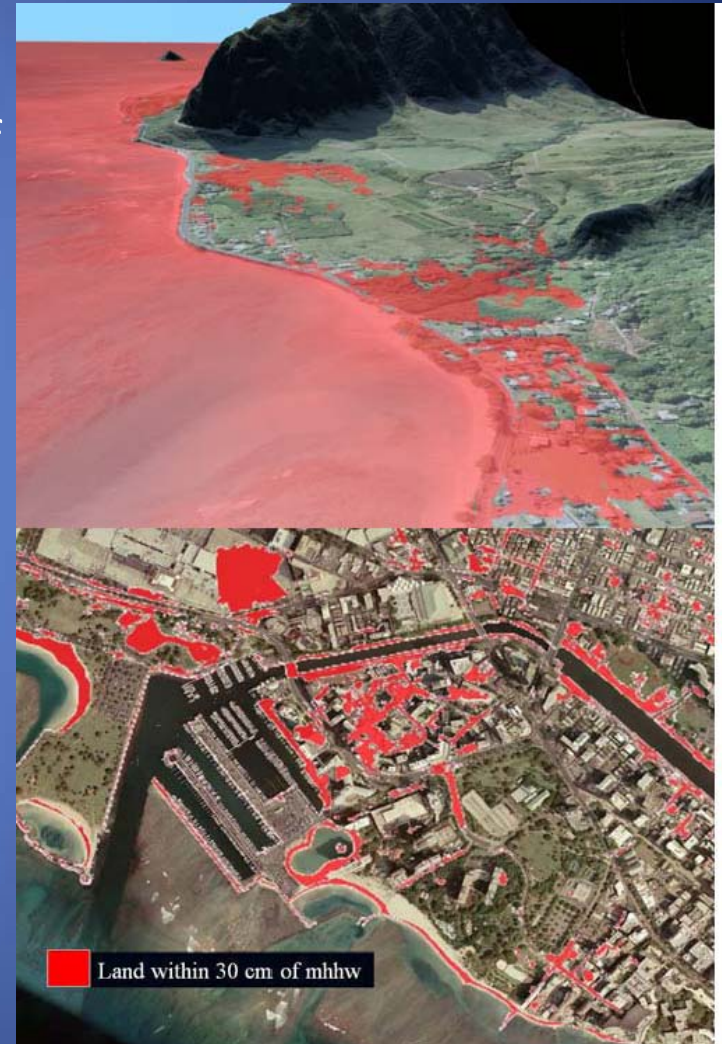
- Study Areas:
  - New Jersey Coastal
  - Central New Jersey
- Partners:
  - New Jersey DOT
  - North Jersey Transportation Planning Authority,
  - South Jersey Transportation Planning Organization,
  - Delaware Valley Regional Planning Commission,
  - New Jersey Department of Environmental Protection

# Washington State DOT

- 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

# Oahu MPO

- Scope: Island of Oahu, HI
- Consultant will perform risk assessment of identified transportation assets
- Public input meetings
- Partners:
  - OahuMPO
  - 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

# Gulf Coast Study, Phase 2

Rob Kafalenos

Sustainable Transport and Climate Change Team

FHWA Office of Natural Environment





# Gulf Coast Study: Goals

- Comprehensive assessment of how climate change will affect transportation in the Gulf Coast area
- Phase I
  - Overview of climate change impacts on transportation infrastructure, and general options for addressing these challenges
  - Mobile to Houston, completed in 2008  
(<http://www.climatescience.gov/Library/sap/sap4-7/default.php>)
- Phase II
  - Seeks to develop:
    - More definitive information about multimodal impacts at the local level in a single MPO
    - Precise tools and guides on how to adapt to climate impacts; determine vulnerability for key links for each mode; assess risk
  - Test in Mobile area, with intent to make process transferable to other MPOs
  - Timeframe: 2010-2012

# Gulf Coast Study, Phase 2: Overview

- Focus on the Mobile, AL Metropolitan area
  - Identify "critical assets" in Mobile region
  - Evaluate projected climate change effects & stressors
  - Determine vulnerability of key links and assets; conduct vulnerability assessment & detailed engineering analyses for selected assets
  - Develop risk assessment & risk management tools
  - Work with stakeholders in Mobile throughout project; take lessons learned & identify tools to make process, lessons learned, & methods accessible to other MPOs
  - Include major findings in a final report



## Task 1:

# Identify Critical Transportation Systems

Determine Subset of Entire Transportation Network on Which to Perform Vulnerability Assessment and Identify Adaptive Measures

Need a process applicable to all modes in study area:  
Highways, Rail, Airports, Ports, Pipelines, and Transit



# Task 1:


## Identify Critical Transportation Systems

### Recent Activity:

- Conducted in-person interviews with Mobile port and rail representatives to obtain data on facilities and operations
- Conducted criticality assessment on all major transportation modes
- Assembling a memorandum outlining critical transportation assets
- Conducted a careful review of relevant transportation models
- Developing GIS layers of critical transportation assets, for later study tasks

## Task 2: Collect Climate Data and Assess Transportation Exposure & Sensitivity

### Three main areas of work:

1. Collect historical and projected weather and climate data
  - Assistance from USGS 
2. Conduct storm surge and wave modeling, SLR analysis, and estimate potential inundation of transportation assets (i.e., exposure)
3. Assess the extent to which particular transportation systems are affected by climate variations (i.e., sensitivity)

Approach will be different than Phase I, e.g.

- Focused explicitly on Mobile
- Use of more advanced models (e.g., downscaling)
- Estimation of near-term, mid-term, and end-of-century futures

# Tasks 3 & 4:

## Vulnerability & Risk Management

- **Task 3: Determine Vulnerability for Key Links & Assets in Each Mode**
  - Apply Task 2 results to critical structures identified in Task 1 to determine link- and asset-specific vulnerability
  - Assess role of each asset in system vulnerability
  - Multiply criticality & vulnerability scores to create a prioritized list of structures
  - Conduct engineering analysis and assessment
- **Task 4: Develop Risk Management Tools**
  - Could be GIS maps of infrastructure overlaid with vulnerable infrastructure; Excel-based or web-based decision-support tool; or a guidance document detailing best practices for MPOs to assess climate-related risks & identify transportation options
  - Consistent with tools & approaches in use within region; developed in consultation with MPO, region, and state

# Task 5: Working with Mobile

- Engage Mobile MPO, local and state partners, other key groups & the public throughout the project to ensure:
  - The most important transportation assets & links are identified
  - Analysis tools are developed in a way that will be most useful to transportation agencies and operators, and decision-makers
  - The importance of planning for adaptation is understood & incorporated into MPO and partner agencies' approach
  - Public outreach incorporated at appropriate times

# Upcoming Air Quality, Climate Change & Sustainability Activities

Diane Turchetta

Sustainable Transport and Climate Change Team

FHWA Office of Natural Environment





# Air Quality Research Activities

- Support Regional and Project level (hot-spot analysis)
  - Research to support CO and PM hot-spot categorical findings
- Emissions and air quality models implementation technical assistance, training and research
  - MOVES implementation support (training; technical assistance)
  - Air Quality models (CAL3QHCR and AERMOD)
- Near Roadway air quality data analysis
- Air Quality Outreach and Communications Strategies

# Climate Change: Mitigation Activities

- Effectiveness of Transportation Strategies in Reducing Greenhouse Gas Emissions
  - Mitigation Guidebook/Carbon Calculator
  - Research on Operational Strategies
- Workshops to help Integrate Climate Change Considerations into the Scenario Planning Process (mitigation and adaptation)
  - FDOT
  - WSDOT
  - ARC – Atlanta, GA
  - CCMPO – Burlington, VT
  - LCOG – Lane County, Eugene, OR
  - Cape Cod, MA
- Capacity Building
  - Peer Exchanges (3 mitigation and 3 adaptation)

# Climate Change: Adaptation Activities

- FHWA Adaptation Working Group
  - Developing a strategy to address adaptation to climate change effects
- Vulnerability/Risk Assessment
  - Development of a conceptual model on conducting assessments of transportation infrastructure vulnerable to the effects of climate change
    - Implementation Pilots for Framework
- Gulf Coast Study – Phase 2

# Sustainability: Activities

- FHWA Sustainable Highways Initiative
  - Evaluate and establish criteria of a sustainable highway
  - Develop a self-evaluation tool to assist in applying criteria
  - Establish an evaluation method to demonstrate progress & measure benefits of a sustainable project
- FHWA Sustainability Working Group
  - Lead, coordinate, promote, and communicate FHWA sustainability activities

# Air Quality and Climate Change Resources

- FHWA Climate Change Website
  - [www.fhwa.dot.gov/hep/climate/index.htm](http://www.fhwa.dot.gov/hep/climate/index.htm)
- US DOT Transportation and Climate Change Clearinghouse Website
  - [www.climate.dot.gov/index.html](http://www.climate.dot.gov/index.html)
- FHWA Air Quality Website
  - [www.fhwa.dot.gov/environment/aqupdate/index.html](http://www.fhwa.dot.gov/environment/aqupdate/index.html)
- STEP Website
  - [www.fhwa.dot.gov/hep/step](http://www.fhwa.dot.gov/hep/step)

# Questions and Answer Session

- The discussion is open to questions
  - Via phone
  - Via chat feature
- Stakeholders share experiences and answer questions about submitting lines of research to STEP

# For Additional Information

If you have general questions about STEP or this webinar, contact [Lisa.Colbert@dot.gov](mailto:Lisa.Colbert@dot.gov)

STEP emphasis contacts:

[www.fhwa.dot.gov/hep/step/contacts.htm](http://www.fhwa.dot.gov/hep/step/contacts.htm)

Air Quality and Climate Change Information

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