



ITS Efficiency Issues in Transportation Systems

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Outline:

- **Role of Intelligent Transportation Systems for the Environment**
- **Energy/Emissions Measurement and Modeling Tools**
- **ECO-ITS Research Program**

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Approaches to Minimize Energy and Emissions Impacts of Transportation:

- **Build cleaner, more efficient vehicles:**
 - make vehicles lighter (and smaller) while maintaining safety
 - improve powertrain efficiency
 - develop alternative technologies (e.g., hybrids, fuel-cell, electric vehicles)
- **Develop and use alternative fuels:**
 - biofuels (cellulosic ethanol, biodiesel)
 - synthetic fuels
- **Decrease the total amount of driving: VKT reduction methods**
- **Improve transportation system efficiency: through ITS**





Transportation: Efficient Operations

We can improve the *operational efficiency* of the surface transportation network through the implementation of transportation systems management and operational (TSMO) strategies and the supporting *ITS technologies*

- Regional collaboration and coordination
- Incident & Emergency Management
- Integrated Corridor Management (ICM)
- Active Traffic Management (e.g., lane / speed control)
- Managed Lanes (HOV, HOT)
- Coordinated Traffic Signal Timing/ Adaptive Control
- Traveler Information
- Commercial Vehicle Operations
- Transit enhancements (Bus Rapid Transit and signal priority)
- Ramp Management
- Road Weather Management

Focus: Congestion Reduction and Increased Reliability

Reduce Vehicle-Hours of Travel (VHT)

Minimal Impact on VKT

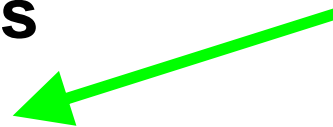


- many ITS programs are already environmentally beneficial
- many ITS projects can be designed *specifically* for energy/environmental benefits

ITS Targets:

- **Improving Safety**
 - reducing accidents
 - making accidents more survivable
- **Improving Transportation Efficiency:**
 - increasing throughput
 - reducing congestion
 - maximizing economics
- **Energy/Environment:**
 - in-direct benefits of lower emissions and fuel savings
 - directed benefits to *target* lower emissions/fuel

***Our Research Focus:
ECO-ITS***





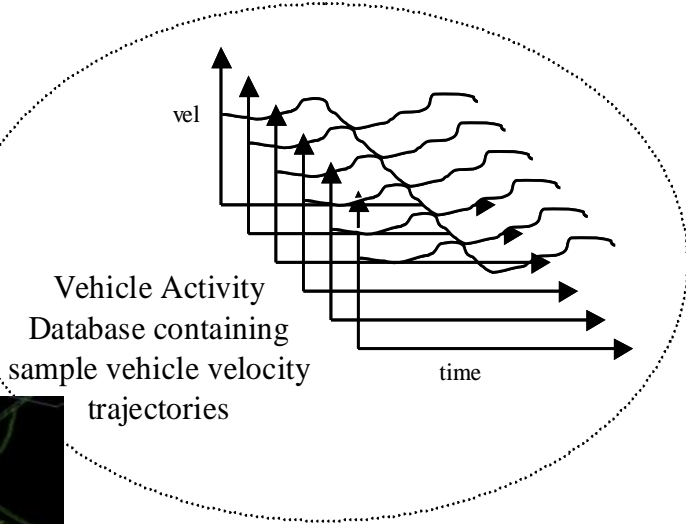
UC Riverside ECO-ITS Research Program

- **Quantifying Energy/Emission Impacts of ITS Projects**
 - developed new mesoscale modeling methodology
 - vehicle activity research using probe vehicles
 - real-time traffic data monitoring techniques
- **Dynamic ECO-Driving Research**
 - en-route driving information
 - variable speed management
- **ECO-Routing Research**
 - light-duty vehicle implementation and testing
 - heavy-duty vehicles implementation (in Los Angeles)
 - research on congestion and road grade effects
 - navigation mobility index development

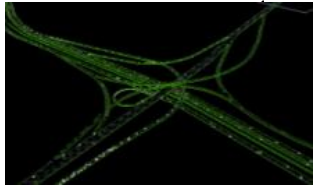
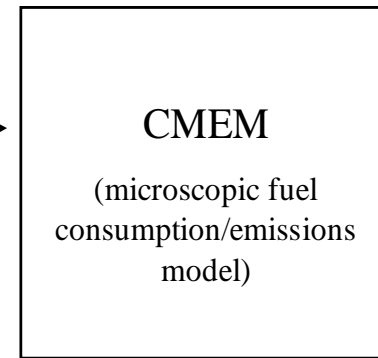
Emissions as a Function of Traffic Parameters



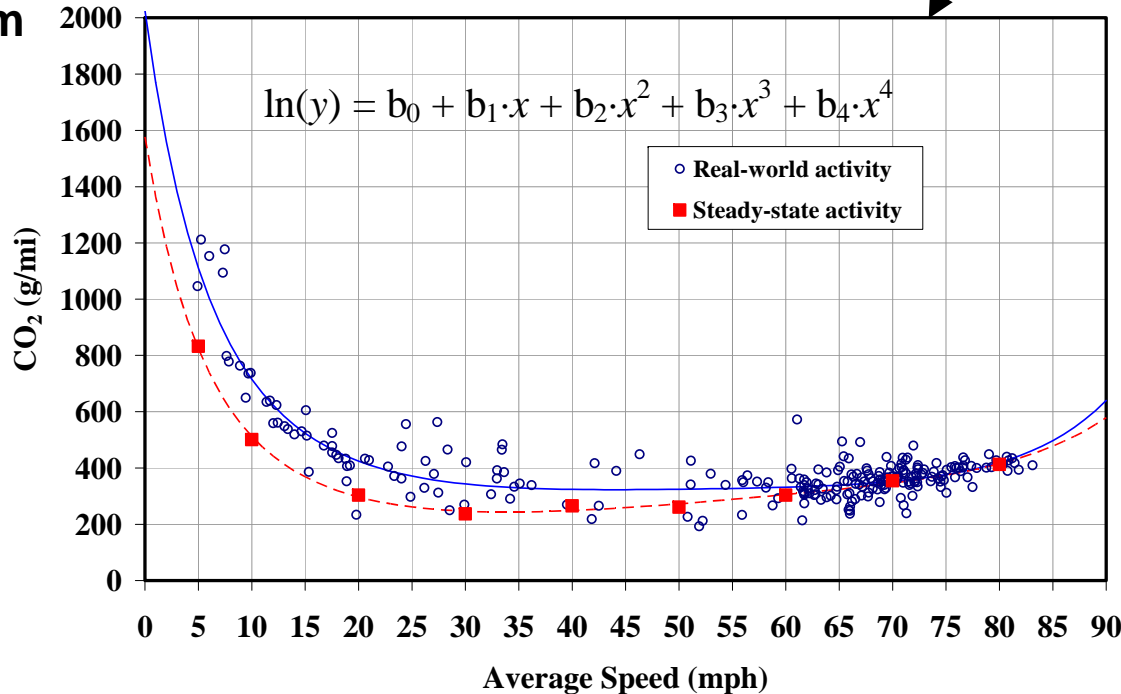
GPS



vehicle/technology category selection

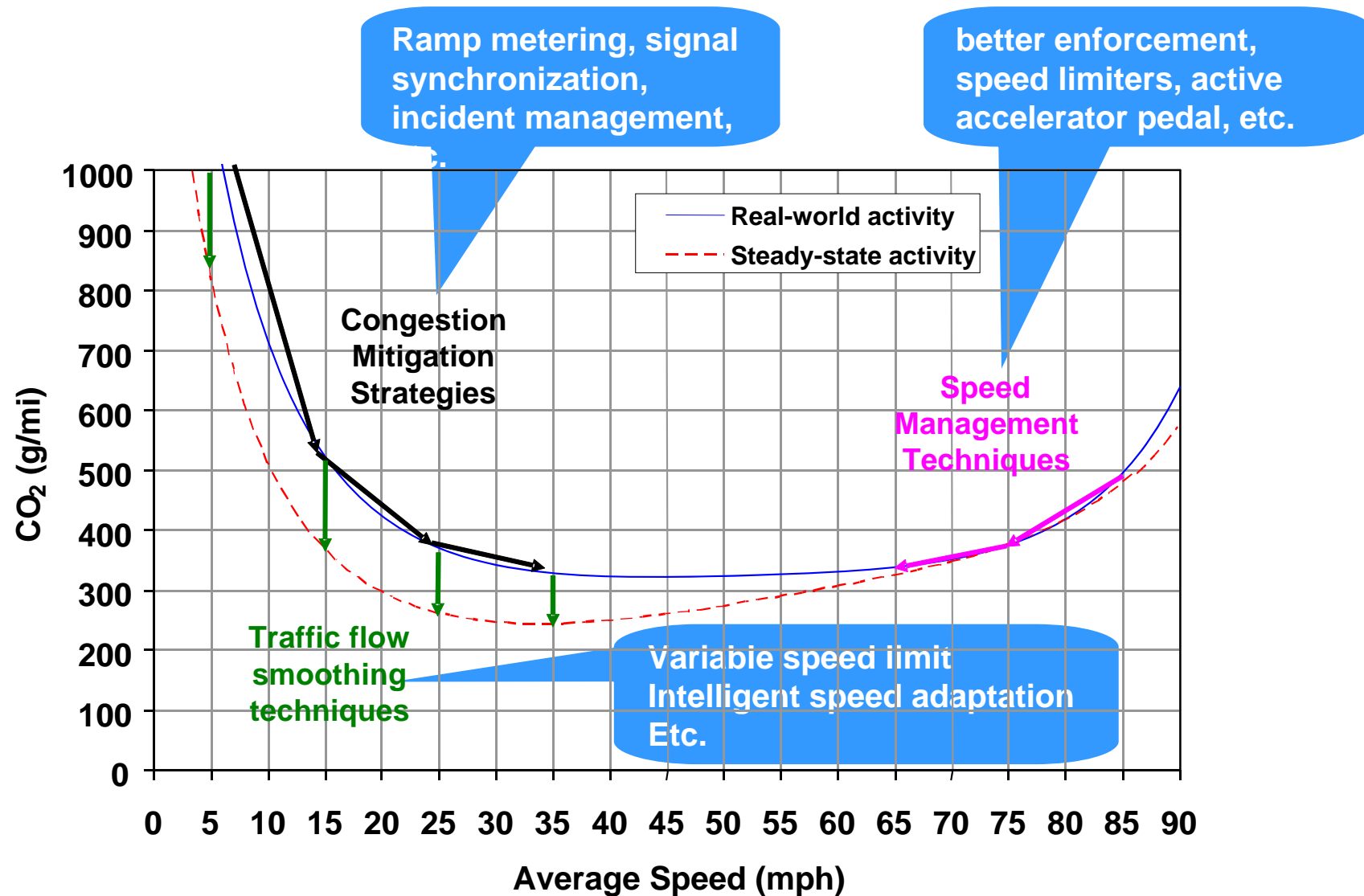


traffic sim





ITS strategies to reduce on-road emissions

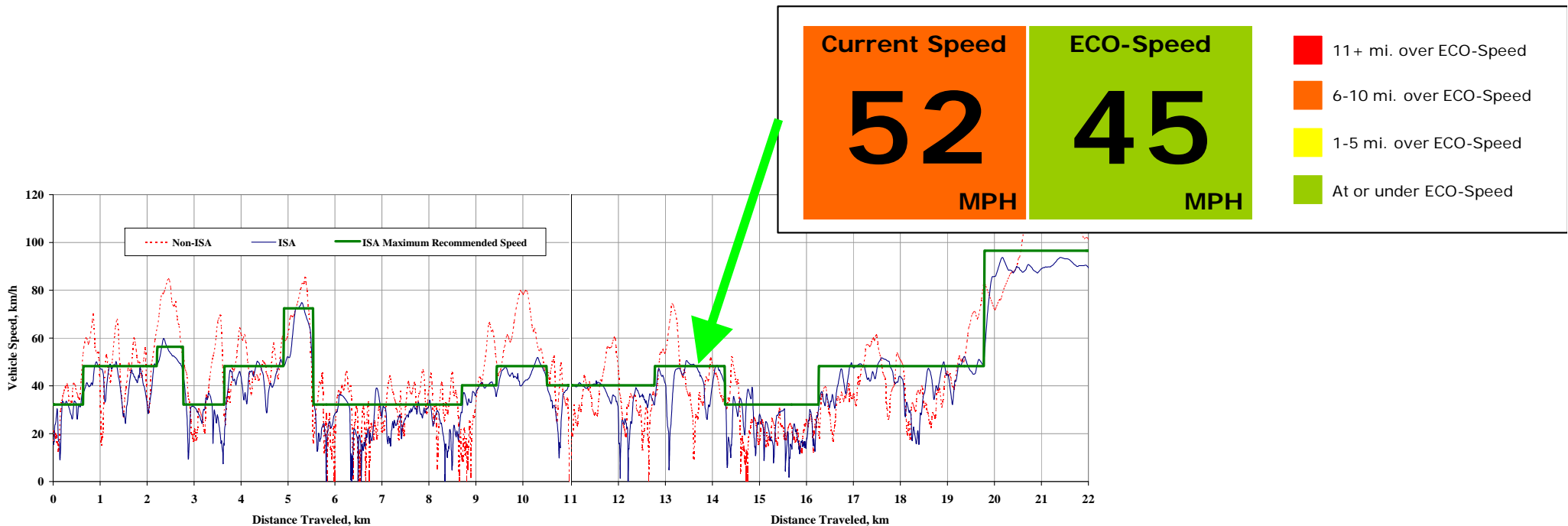




“Dynamic Eco-Driving”

ECO-Driving Advice with Dynamic Feedback

- **Dynamic ECO-Driving: providing real-time advice/feedback:**
 - Instantaneous fuel economy readings
 - Cumulative real-time travel cost display
 - Speed management, intelligent speed adaptation
 - Variable Speed Limits on Freeways:

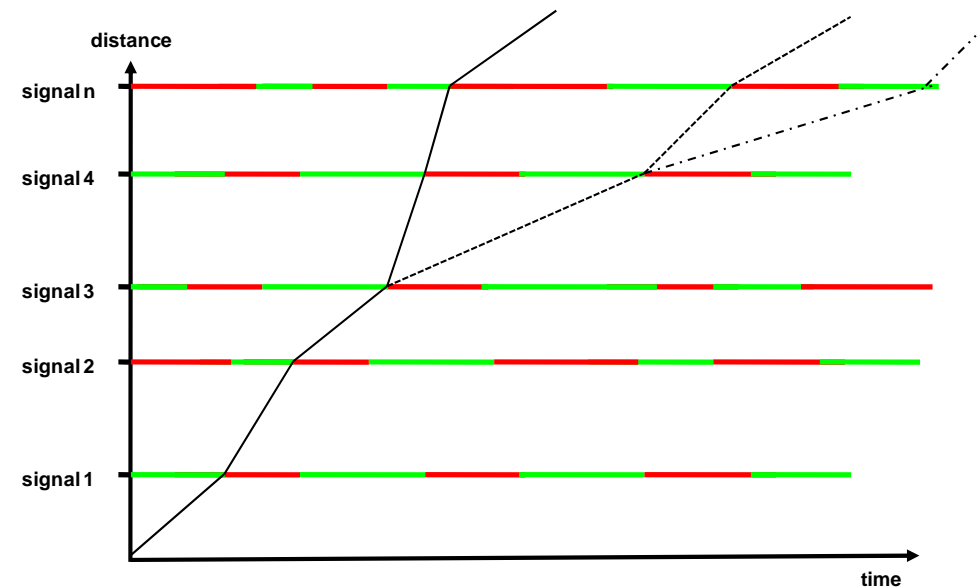
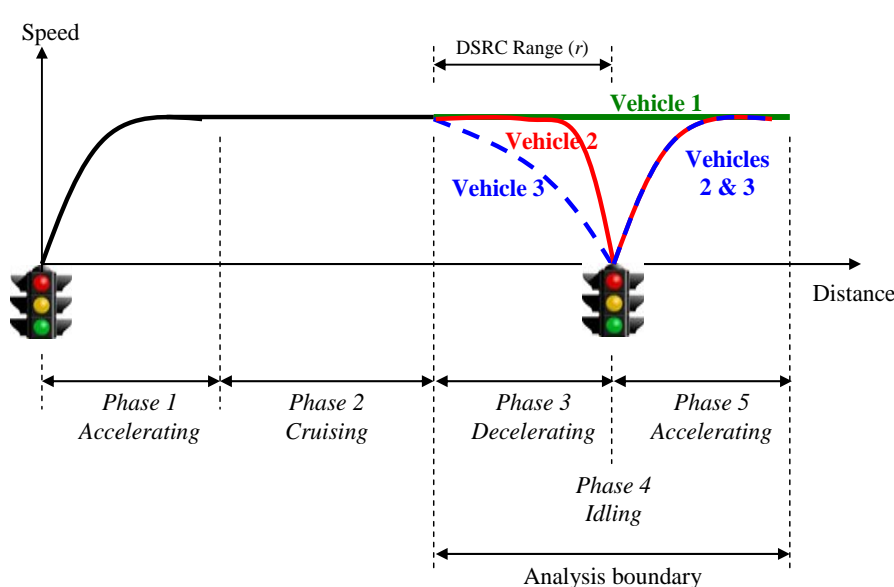




“Dynamic Eco-Driving”

ECO-Driving Advice with Dynamic Feedback

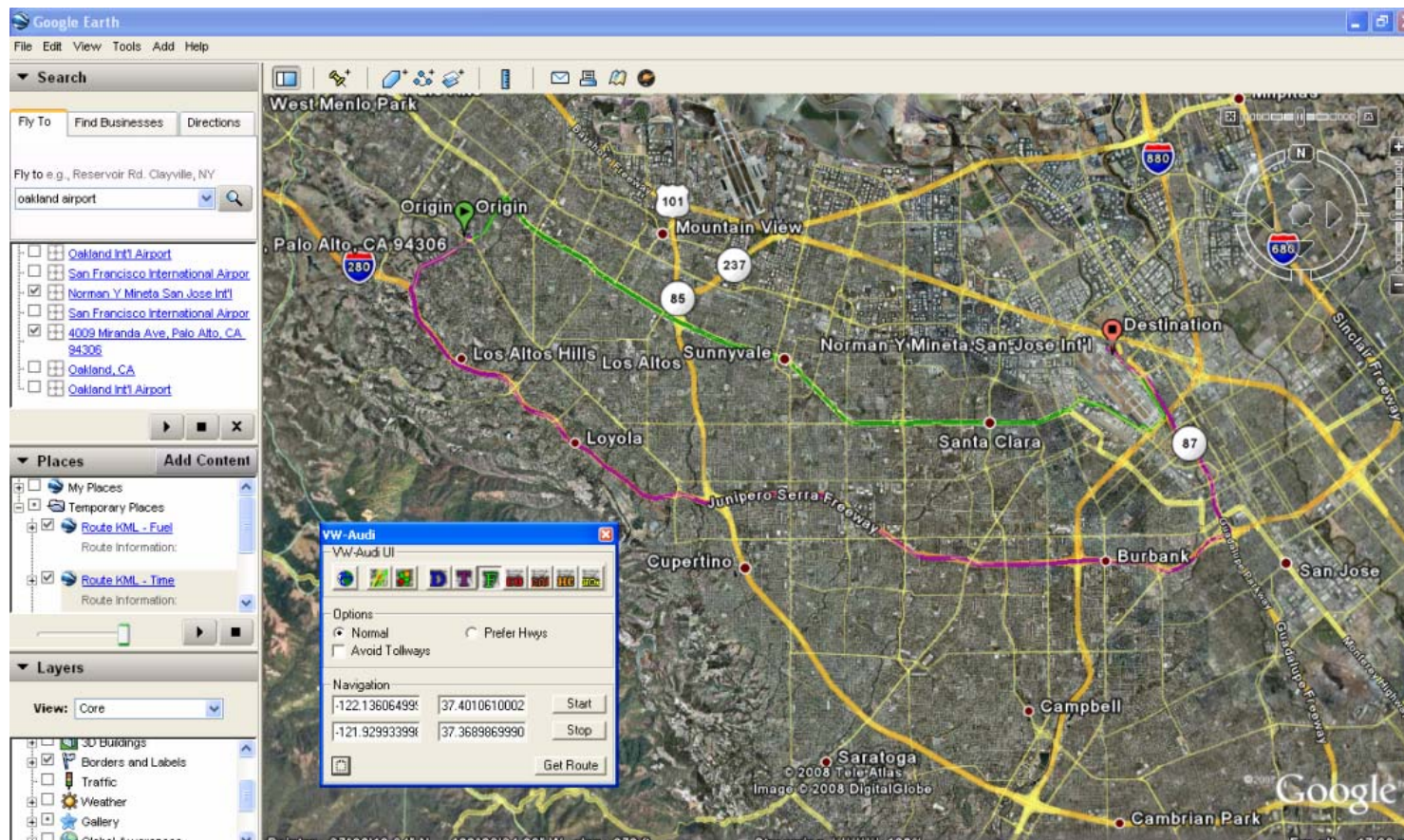
- **Dynamic ECO-Driving: providing real-time advice/feedback:**
 - **Arterial Corridor Speed Management**
 - **provide information to vehicle/driver on signal phase and timing**
 - **corridor movements can be made much more efficient**





New Navigation Tool: ECO-Routing:

- shortest-distance or shortest-duration path will often be the path that minimizes energy use or emissions
- **roadway congestion** and other factors (e.g. **grade**) create scenarios where minimum-energy and minimum-emissions path may be different than shortest duration or distance





Summary of Energy/Environmental Beneficial ITS Strategies:

Each ITS Program can save 5 to 15% energy/emissions

However:

Recent reports from U.S. DOT:

- **Moving Cooler Report: ITS will only reduce GHG emissions by 1 or 2 percent**
- **primary reason: induced demand (research needed)**
- **is induced demand from ITS different from simply adding lanes?**
- **New Categorization of ITS projects:**
 - **technology solutions (research underway)**
 - **behavior solutions (research needed)**



Summary of Energy/Environmental Beneficial ITS Strategies:

UC Riverside ECO-ITS Research Summary:

- **ITS goals and strategies of improving safety and improving traffic performance often reduce energy consumption and CO₂ emissions as a side benefit**
- **Dedicated ITS strategies and systems can be designed to explicitly reduce energy consumption and CO₂ emissions**
- **Each ITS strategy can potentially reduce CO₂ emissions by approximately 5 – 15%; however with multiple strategies, greater savings can be achieved**
- **ITS Programs most likely have to be accompanied by some kind of **vehicle demand management** component**