The Potential Externalities from Improved Operations

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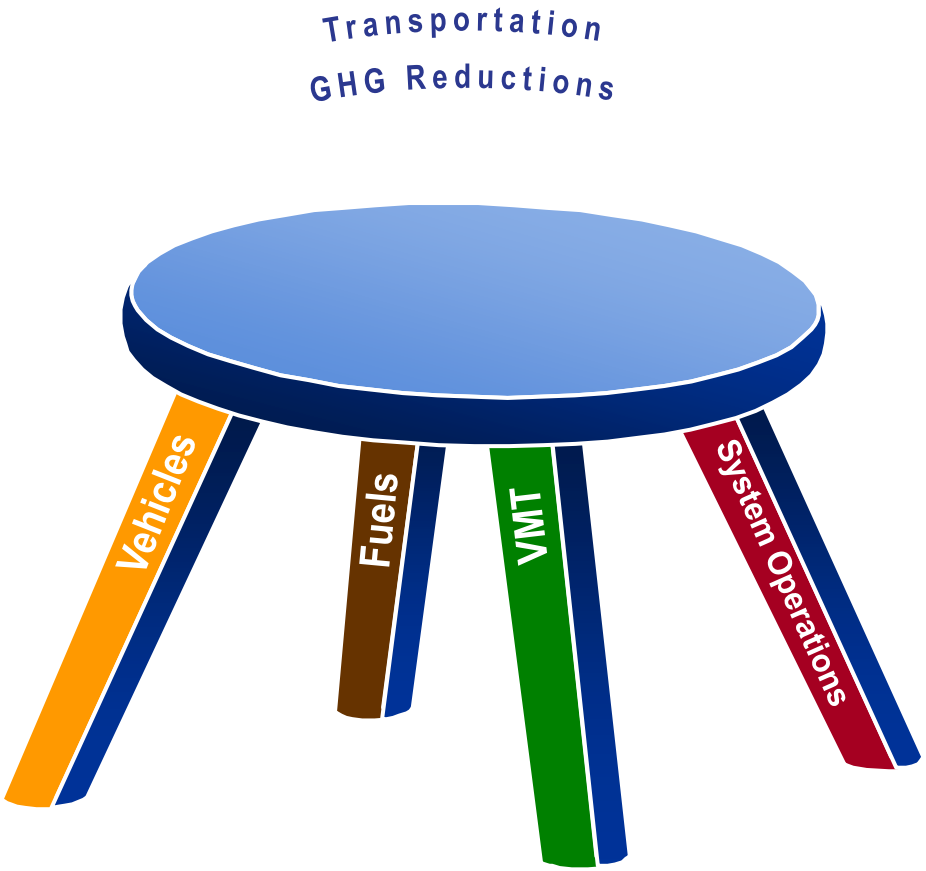
“4- Legged Stool” of Environmental Sustainability

- Improve **vehicle** fuel economy
- Reduce carbon content of the **fuel**
- Reduce amount of driving (**VMT**)
- Improve **operational efficiency** of the transportation network



Transportation Systems Management & Operations

- Integrated Corridor Management (ICM)
- Active Travel Management (ATM)
- “Speed Harmonization” via Variable Speed Displays & Dynamic Lane Control
- Incident & Emergency Management
- Electronic Toll Collection
- Managed Lanes (HOV, HOT)
- Multi - Modal Traveler Information
- Transit Enhancements (Transit Signal Priority, BRT)
- Ramp Management
- Road Weather Management

SUPPORTED BY ITS TECHNOLOGIES

Manage Congestion / Increase Reliability – Economic Sustainability

Enhance Safety / Reduce Crashes – Social Sustainability

Reduce Stops & VHT (Emissions) – Environmental Sustainability

Examples of GHG Reductions from TSMO

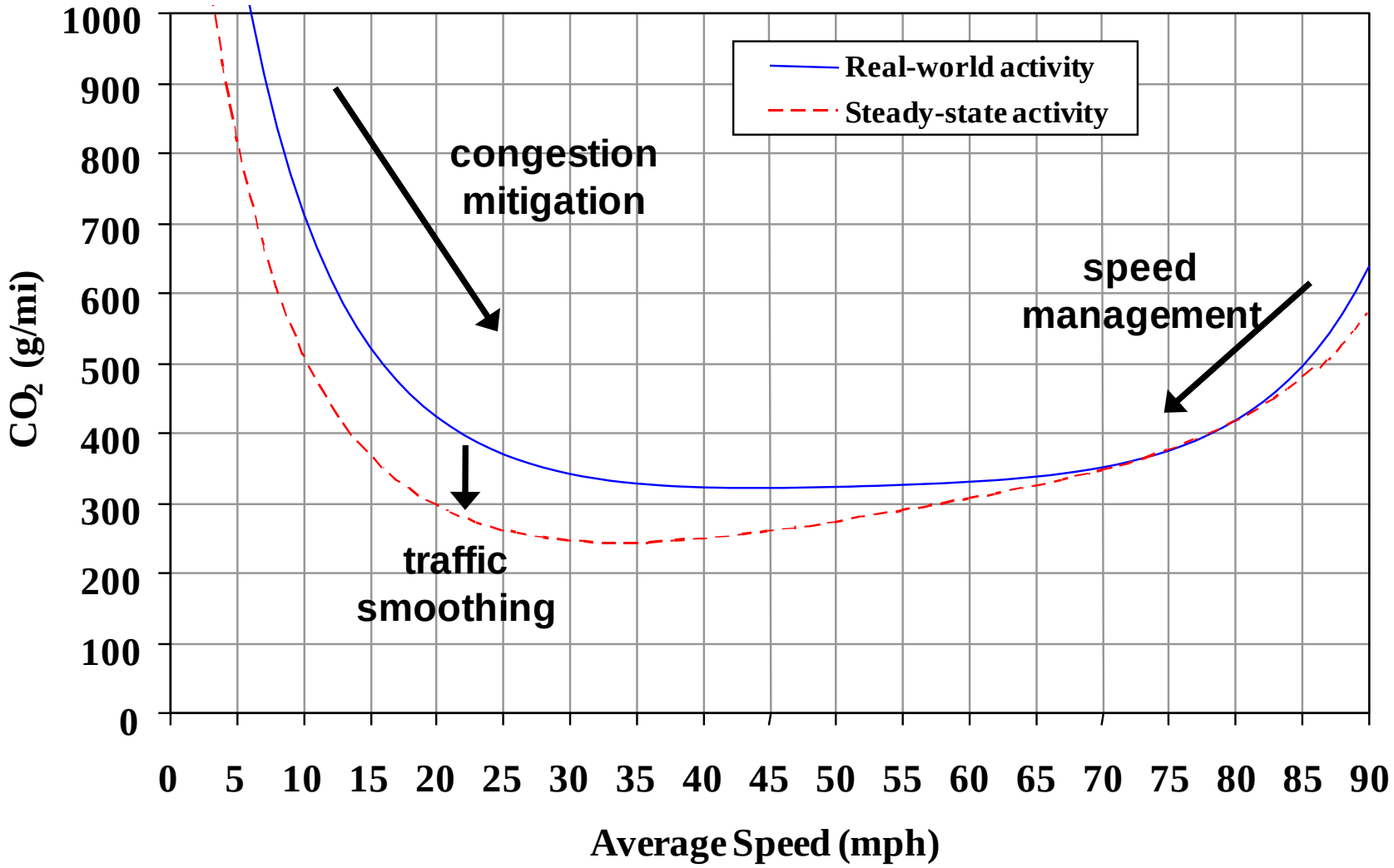
- "The National Traffic Signal Report Card" (ITE)
  - By achieving an "excellent" rating, traffic signal management could achieve annual savings of nearly 150 MMT of CO2 saved.
  - **11.5 % of highway GHG emissions nationwide**
- Matt Barth (U-Cal) 2008 TRB paper (freeway simulation) – "Each of 3 methods could potentially lower CO^2 by 7-12%":
  - Congestion mitigation strategies (incident & ramp management)
  - Speed management techniques (automated enforcement)
  - Shock wave suppression techniques (variable speed limits)
  - **Cumulative effect of around 20%**

GHG Reductions from ATM

- Variable Speed Limit System on England's M25 Motorway
  - Vehicle emissions cut by nearly 10%
  - Crash rate reduced by 20%
  - The weekday traffic noise reduced by 0.7dB.

- Matt Barth simulation of "dynamic speed recommendations" (2009 TRR Paper):
  - Smoothing traffic flow during congested conditions could result in approximately 10% to 20% reductions in fuel consumption and CO2 emissions

TSMO Strategies and GHG Recommendations



Other GHG Reductions

- 183A Toll Road (Central Texas Regional Mobility Authority)
  - Limited access toll facility - parallels US 183 (4-lane undivided highway with signals)
  - 2009 Study of operations along toll road relative to US 183
  - 28% Reduction in CO2
  - 26% Reduction in fuel consumption

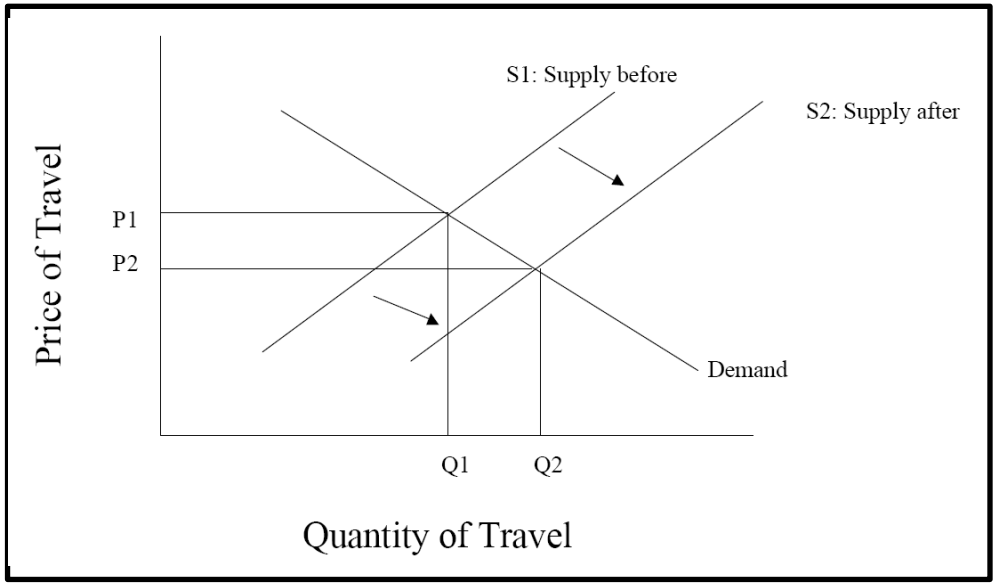
- Other countries (e.g., Japan and Sweden) using operations and ITS as an integral part of their efforts to satisfy Kyoto

Potential Externality of Improved Operations

- The ability of TSMO and ITS technologies to reduce GHG emissions is not universally accepted
  - Particularly by some in the environmental community
- “Making the roadway operate better only results in additional traffic using it – negating any short term benefits”
- Issue of **Induced Demand**

Induced Demand

- "Additional travel that occurs as a result of lowering the generalized cost of travel" (e.g., travel time, fuel, accidents, tolls, maintenance, parking)
  - Economics of supply and demand

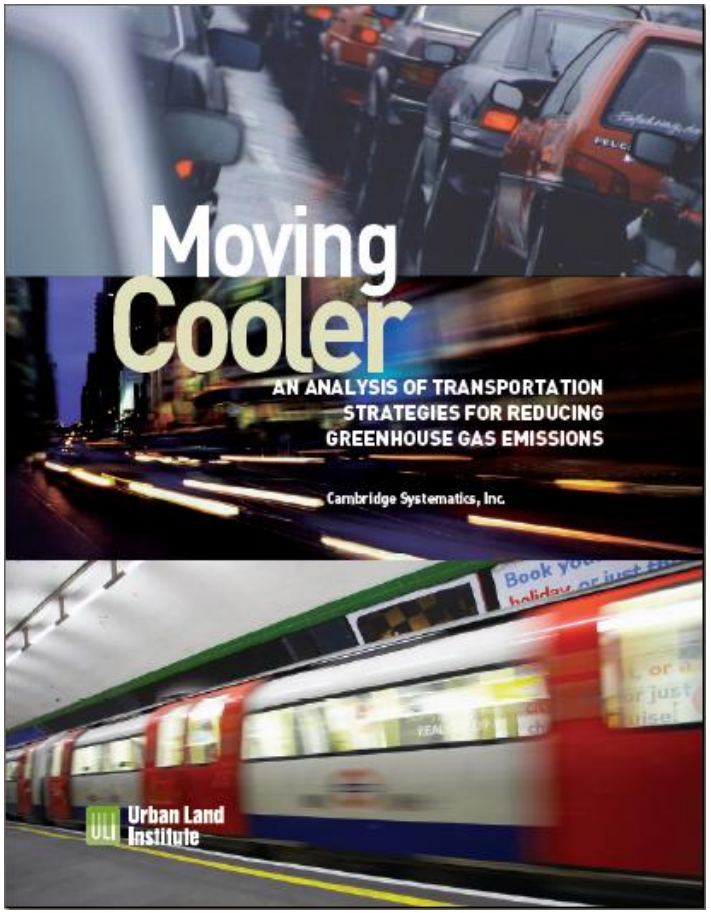


- Short term impacts
  - Spatial Convergence – drivers switch from alternative routes
  - Time Convergence – drivers who formerly traveled off peak
  - Modal Convergence – commuters switch from public transportation
- Long Term - new trips generated by new activities and developments associated with transportation improvements

Example of Analytical Impact of Induced Demand

- Sponsors of 2008 study included ITS America, FHWA, FTA, APTA. EPA, others
- Stated intent - to assess the potential effectiveness of a broad variety of transportation strategies to reduce GHG emissions
- Included induced demand in the analysis of ITS and operations

Offset of 63 to 74 percent of the cumulative (2010 – 2050) GHG reductions from reduced delay



Moving Cooler Results

Cumulative Reductions in GHG Emissions from Baseline: 2010 – 2050	Min	Max
PAYD Insurance + VMT Fees	**1.2 %**	**7.1 %**
Regional Congestion Pricing	0.8 %	1.8 %
Combined Land Use Strategies	0.3 %	2.1 %
Combined pedestrian / bicycling strategies	0.2 %	0.5 %
Transit Capital Improvements	0.4 %	1.1 %
Employer-Based Commute Strategies	NA	1.7 %
Lower / Enforced Speed Limits	2.0 %	3.6 %
Eco-Driving	1.1 %	2.7 %
ITS / Operations	**0.3 %**	**0.6 %**
Freight (Truck APUs / Rail Capacity)	NA	0.4 %
Highway Expansion / Bottleneck Improvements	Net increase in GHG	

Not So Fast With These Conclusions !!!

- Wide range in values of “demand elasticities” from literature
  - Demand Elasticity = indicator of the magnitude of induced demand
- Phenomenon is complex & difficult to understand - amount of the extra traffic is heavily dependent on **“context”**.
  - *Super Freakonomics*: “*Human behavior is influenced by a dazzlingly complex set of incentives, social norms, framing references, and the lessons gleaned from past experience – in a word context”.*
- Potential conflation of cause and effect
  - Might traffic growth induce road investments every bit as much as vice-versa?
  - What about increased VMT being part of a growing economy?

New Capacity vs. Operational Improvements

- Nearly all research on induced demand has been based on the demand inducing effects of **new transportation capacity** (new roads / widening)**.**
- Capacity actions and TSMO strategies both reduce travel times and user costs; but they are **NOT the same**.
  - TSMO strategies do **not** add capacity - they promote a more efficient use of the existing capacity (maximize throughput)
  - Capacity actions focus on increased peak-period mobility; operations aim to enhance **reliability** throughout the day
  - Potential differences in context - user perception to additional lanes compared to ITS and small operational improvements
- Few studies are available; but they infer that induced demand from “ITS / Operations” is less than new capacity

Externalities From Other "Legs"

Improve **vehicle** fuel economy (CAFE Standards)

Reduce carbon content of the **fuel** (electric vehicles)

Reduced Fuel Consumption

Less Gas Purchased / Reduced Gas Tax Revenues

Less Funding for Building, Maintaining, and Operating Transportation Infrastructure

Long Term Need for "VMT Tax", Toll Facilities, etc.