



# The Low Carb Toolbox: Reducing VMT

Cutting Carbs: A Professional Development Workshop for  
Transportation Professionals on Reducing Greenhouse Gas Emissions  
December 3, 2008  
Portland, Oregon

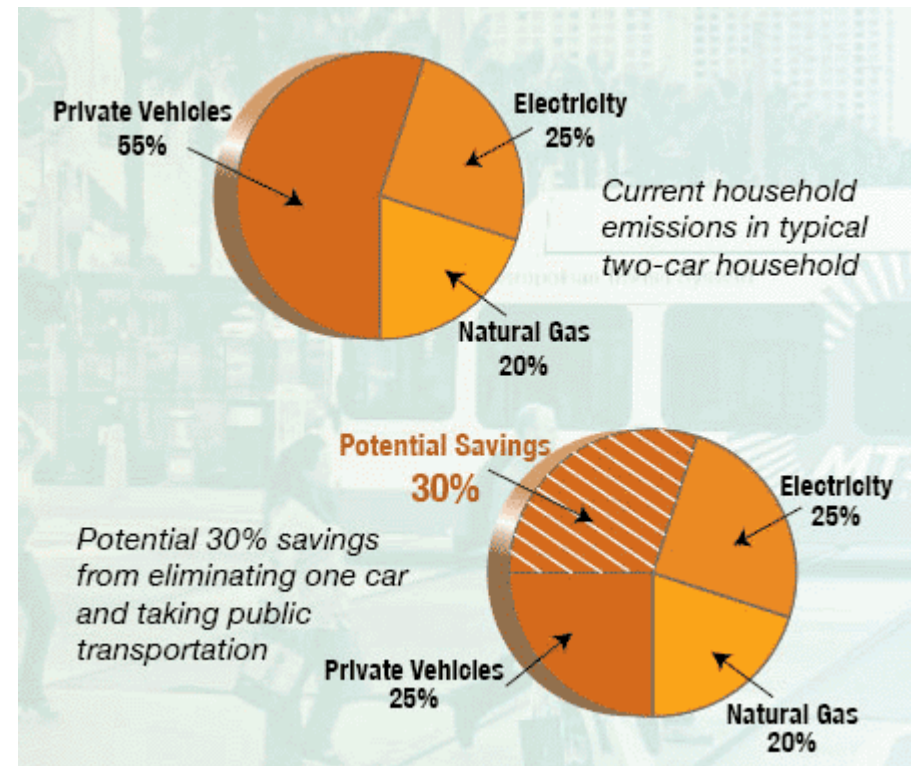
Jeffrey Ang-Olson, Principal  
[jangolson@icfi.com](mailto:jangolson@icfi.com)

# Presentation Overview

- The Potential of TDM
- The Toolbox: Strategies to Reduce VMT
- Analysis Issues

# Potential of TDM and Transit

- The private vehicle is the largest contributor to a household's carbon footprint
- A household with one car that uses public transportation saves an average of \$6,251 every year, compared to an equivalent household with two cars without access to transit.



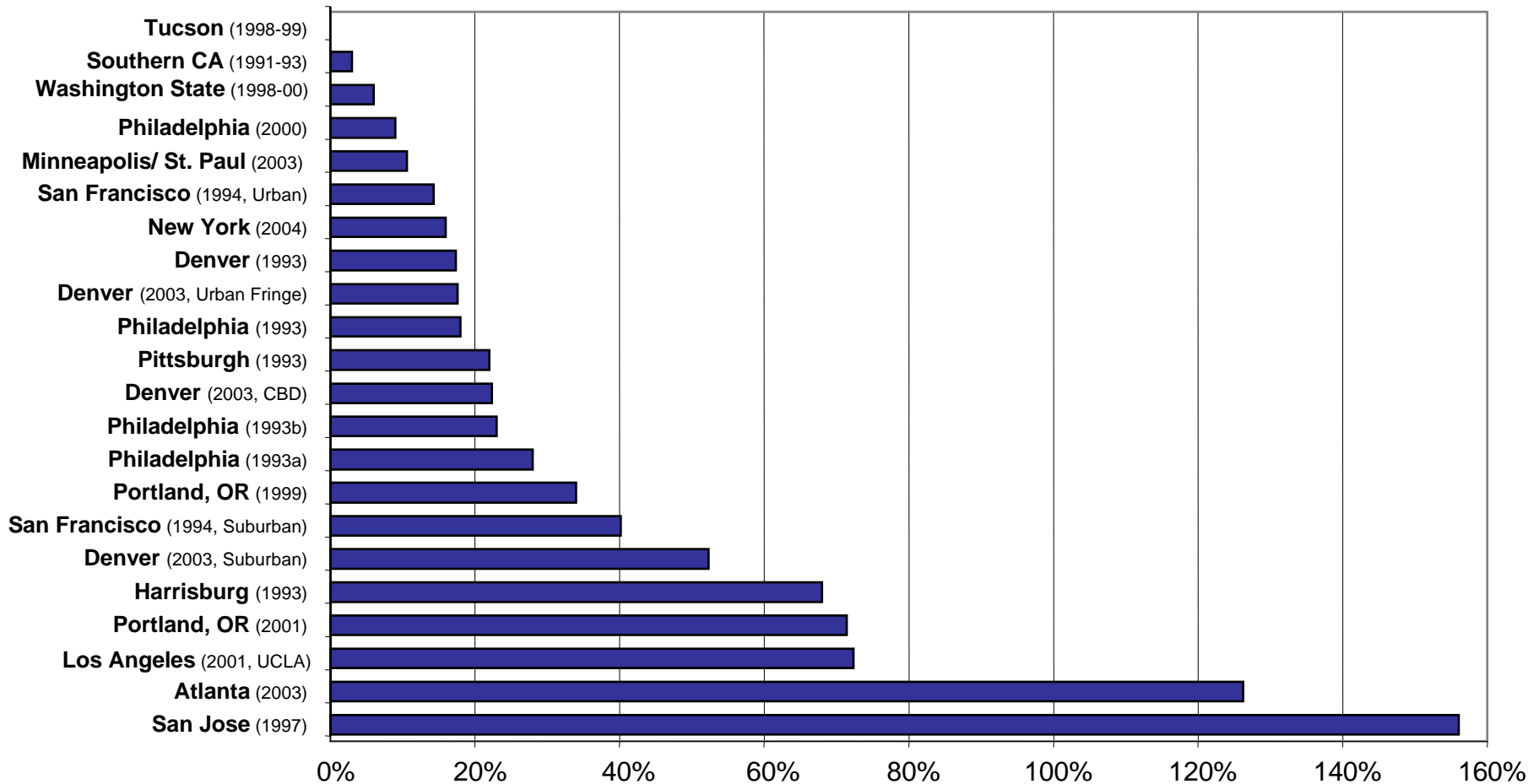
Sources:

SAIC, *Public Transportation's Contribution to Greenhouse Gas Reduction*. Prepared for American Public Transportation Association (APTA), September 2007.

ICF International, *Public Transportation and Petroleum Savings in the U.S.: Reducing Dependence on Oil*. Prepared for American Public Transportation Association (APTA), January 2007.

# Analyzing Commuter Benefits Programs: surveys

## Percent Increase in Transit Riders



Source: ICF International and CUTR, *Analyzing the Effectiveness of Transit Benefits Programs*, Transit Cooperative Research Program.

# Strategies to Reduce VMT

- Public Transit
- Parking Management
- Shared Ride Programs/Projects
- Bicycle and Pedestrian Programs/Projects
- Pricing
- Employer-based TDM Programs
- Non-employer-based TDM Programs
- Outreach/Marketing/Education
- Smart Growth Strategies
- Other Options



# VMT Reduction Strategies - examples

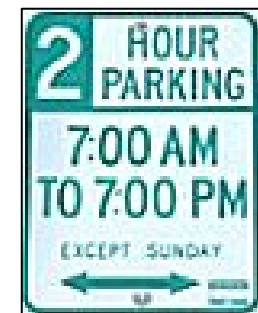
## Public Transit

- New transit routes/services
- More frequent service
- Longer service hours
- Faster travel times/improved system performance
- Passenger amenities
- Improved transit access
- Transit information, marketing, and promotions
- Reduced fares/free services
- Fare structure/convenience improvements
- “Try it” transit pass give-aways



## Parking Management

- Parking pricing / fees
- Parking supply limits
- Preferential parking for carpools/vanpools
- Parking cash-out program



# VMT Reduction Strategies - examples

## Shared Ride Programs/Projects

- Park-and-Ride facilities
- HOV lanes
- Regional rideshare outreach/matching
- Carpool and vanpool incentives
- Encourage shared ride taxis
- Regional vanpool network
- Short-distance vanpools



## Bicycle and Pedestrian Programs/Projects

- New bicycle paths, lanes, routes
- Bicycle parking
- Bikes on transit programs
- Bicycle information
- Bicycle share programs
- Financial incentives to own bicycles
- Pedestrian connections/ sidewalks
- Enhancing the pedestrian environment



# VMT Reduction Strategies - examples

## Pricing

- Road pricing
- Cordon pricing
- Variable priced tolls
- Variable parking fees
- Pay-As-You-Drive auto insurance
- VMT-based registration fees



## Employer-based TDM Programs

- Employer marketing and support
- Telecommuting support/incentives
- Telework centers
- Incentives for employer-based transit/vanpool/ carpool programs
- Implement programs at gov't worksites
- Mandatory commute trip reduction programs
- Regional guaranteed ride home program
- Support proximate commuting



# VMT Reduction Strategies - examples

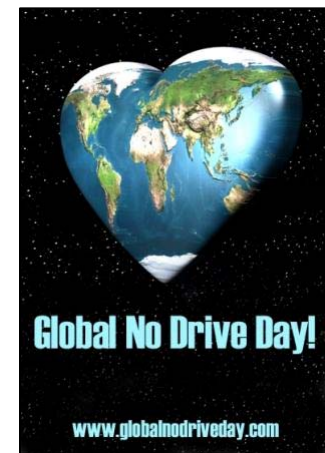
## Non-employer-based TDM Programs

- School-based programs
- Campus programs
- Community-based programs
- Development-based programs
- Airport-based programs
- Tourism promotions
- Special events-based programs



## Outreach/Marketing/Education

- Media campaigns/Public service announcements
- Voluntary "No Drive," "Share a Ride" Days
- Educational curriculum
- Transportation management organizations



# VMT Reduction Strategies - examples

## Smart Growth Strategies

Transit-oriented development (TOD)  
Infill development  
Urban design  
Neighborhood schools  
Incentives to live near work/transit/downtown



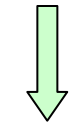
## Other Options

Auto-free zones  
Limit access to HOVs only  
No Drive Days  
Carsharing programs  
Using technology to avoid vehicle trips

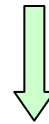


# Analysis Issues: The Basic Equation

$$\text{CO2 Impact} = [\text{Change in VMT}] / [\text{Fuel Economy}] * [\text{Fuel Carbon Content}]$$

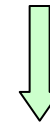


?



LDV Fleet Avg MPG	
2010	20.3
2015	21.5
2020	23.7
2025	26.1
2030	27.9

Source: DOE Annual Energy Outlook, Table A7



Kg CO2/gallon	
Gasoline	8.80
Diesel	10.15

Source: US EPA

## N2O, CH4?

- For emission factors: EPA US GHG Inventory 2008, Annex 3, Table A-88
- Ignore in most cases

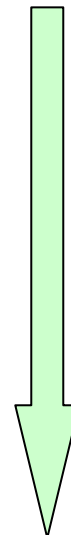
2020 LDV CO2-equivalent	
CO2	99.5%
N2O	0.4%
CH4	0.1%

# Analyzing Public Transit Strategies



## Continuum of Analysis Options

Time and complexity



- Rough estimate of VMT reduction, from literature
- Spreadsheet analysis of ridership and transit service changes
- Regional travel model with mode choice component

# Analyzing Public Transit Strategies: non-modeling

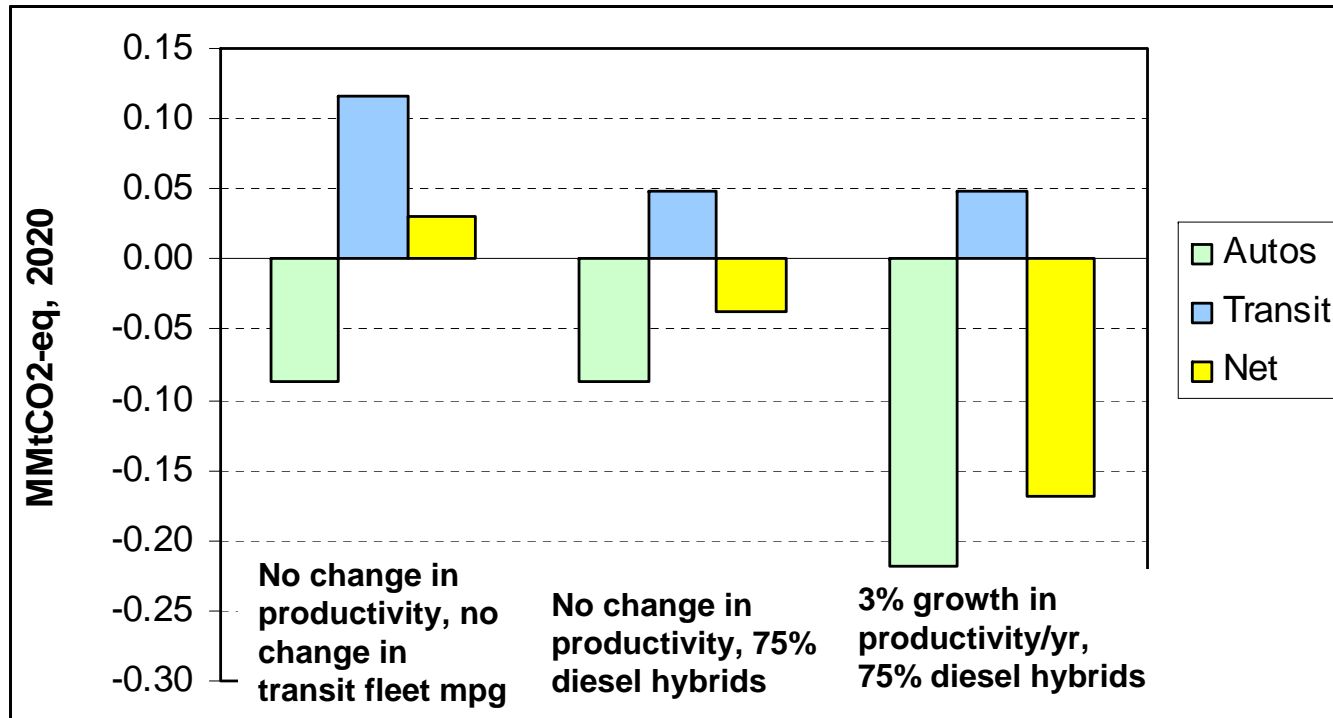
$$\begin{array}{ccccc}
 \text{Reduction in VMT} & = & \text{Increase in transit passenger miles} & \times & \text{Mode shift factor} \\
 & & \downarrow & & \downarrow \\
 & & \text{Long-range plan} & & \text{Model based} \\
 & & \text{Relate to service growth?} & & \text{Survey based} \\
 & & \text{Change in productivity?} & & \text{Defaults: 0.34 – 0.47 (by type/size of area)}
 \end{array}$$

$$\begin{array}{ccccc}
 \text{Increase in Transit GHGs} & = & \text{Increase in Transit Vehicle Miles} & / & \text{Transit Fleet Fuel Efficiency} & \times & \text{Carbon Content} \\
 & & \downarrow & & \downarrow & & \\
 & & \text{Proportional to ridership growth?} & & \text{Default: current energy use per vehicle mile (diesel, CNG, electricity)} & & \\
 & & \text{Change in productivity?} & & \text{Fleet changes? (e.g., hybrids)} & & 
 \end{array}$$

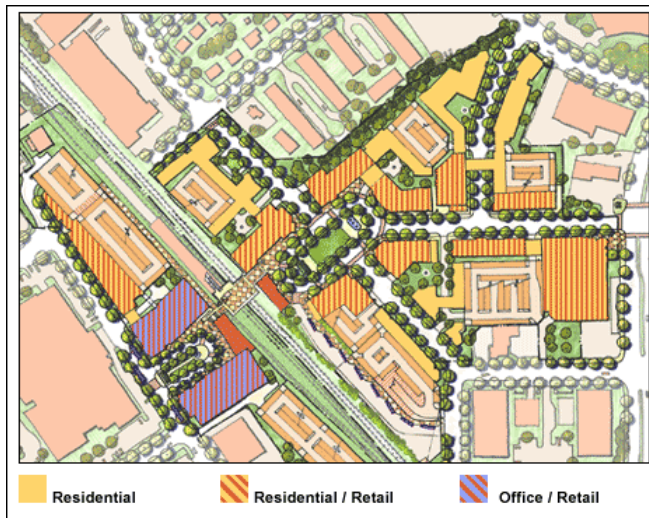
# Analyzing Public Transit Strategies: assumptions matter

## Washington Statewide Bus Transit Scenarios

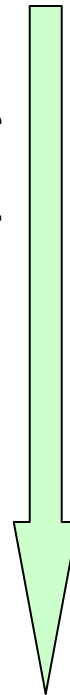
- Climate Action Team, Transportation Implementation Working Group
- Overall Goal: Double transit ridership by 2020



# Analyzing Smart Growth Strategies



Time and complexity

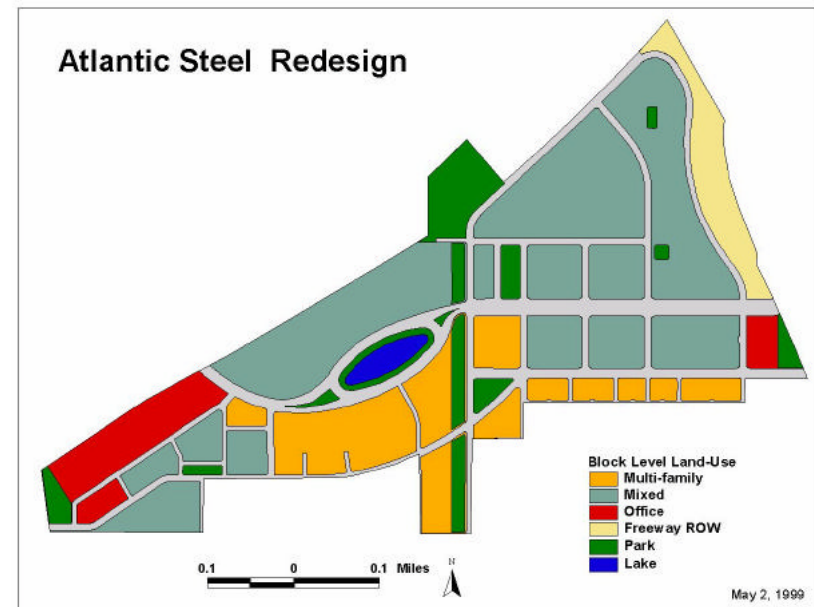
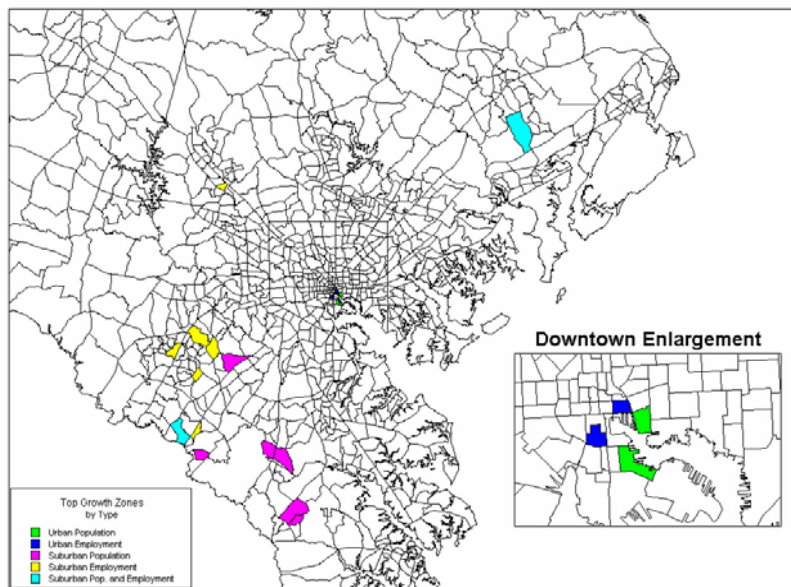


## Continuum of Analysis Options

- Rough estimate of VMT reduction, from literature
- Spreadsheet analysis of growth increment, market penetration, and smart growth benefits
- Neighborhood design and evaluation tools
- Regional travel model with alternative land use scenario(s)

# Analyzing Smart Growth Strategies: scale

Regional location benefits vs. site design benefits



# Analyzing Smart Growth Strategies: literature

- Studies of Individuals or Household Travel

Neighborhood Characteristic	Impact of Doubling the Characteristic	
	On Vehicle Trips	On VMT
Local Density	-5%	-5%
Local Diversity (Mix)	-3%	-5%
Local Design	-5%	-3%
Regional Accessibility	-	-20%

Source: Ewing, R. and R. Cervero. "Travel and the Built Environment." Transportation Research Record, Vol. 1780, 2001, pp. 87-114.

- Studies Involving Regional Growth Simulation

Case Study Name	Max VMT Impact	Study Year	Forecast Year
Sacramento Blueprint	-31.7%	2004	2050
Columbus Regional Growth Strategy	-17.1%	2004	2030
Smart Growth Twin Cities	-17.0%	2002	2030
PSRC Vision 2040	-11.5%	2007	2040
Atlanta Northern Sub-Area	-7.3%	2003	2025
LUTRAQ Study	-6.4%	1997	2020
Denver Metro Vision 2035	-6.2%	2007	2035
SF Bay Area Regional Livability Footprint	-4.6%	2002	2020
Envision Utah	-3.0%	1999	2020
Albany, NY New Visions	-2.8%	1995	2015
DVRPC Regional Analysis of What-If	-1.1%	2003	2030

## Analyzing Smart Growth Strategies: simple calculation

$$\begin{array}{ccccccc}
 \text{Reduction} & & & & & & \\
 \text{in VMT} & = & \text{\% Market Share} & \times & \text{\% of Total} & \times & \text{\% VMT} \\
 & & \text{of Compact} & & \text{Development} & & \text{Reduction} \\
 & & \text{Development} & & \text{Built between} & & \text{with Compact} \\
 & & & & \text{Now and} & & \text{Development} \\
 & & & & \text{Forecast Year} & & \\
 & & 30\% - 70\% & & ? \text{ (CA assumes} & & 20-40\% \\
 & & & & \text{25\% by 2020)} & & 
 \end{array}$$

- See Reid Ewing et al, *Growing Cooler: The Evidence on Urban Development and Climate Change*. Urban Land Institute, 2008.
- Offset GHG benefits 5-10% due to less efficient trips

## Analyzing Smart Growth Strategies: software tools

### Transportation and Land Use Analysis Tools

INDEX  
I-PLACE<sup>3S</sup>  
URBEMIS  
Conventional travel demand models  
Integrated transportation/  
economic/land use models  
(e.g. PECAS, UrbanSim)

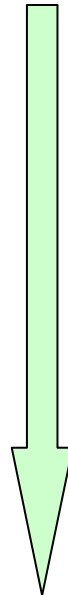
### Multi-Sector GHG Inventory Tools

Clean Air and Climate  
Protection (CACCP) software -  
ICLEI  
CARROT  
Climate Footprint Calculator  
Climate Leadership in Park  
(CLIP) tool

# Analyzing Commuter Benefits Programs



Time and complexity



## Continuum of Analysis Options

- Scale based on others' surveys
- Spreadsheet analysis
- COMMUTER Model
- Regional travel model with mode choice component

# Analyzing Commuter Benefits Programs

- EPA's Guidance for Quantifying and Using Emission Reductions from Best Workplaces for Commuters (2007)



# Analyzing Commuter Benefits Programs: COMMUTER Model

## Inputs – Background Info

- Analysis scope (areawide vs. individual user)
- Metro area population size and area type
- Affected employment base
- Existing work-trip mode shares
- Average trip lengths
- Average vehicle occupancy
- Peak period duration and % of work trips

## Inputs – Program Info

- Employer support programs
  - Carpool (matching, etc.)
  - Vanpool (matching, etc.)
  - Transit (info)
  - Bicycle (amenities)
- Alternative work schedules
  - Flexible work hours
  - Staggered work hours
  - Compressed work week
  - Telecommuting
- Time/cost strategies
  - Site access improvements
  - Changes in parking costs
  - Transit fare subsidies

# Looking Ahead

- Increase in attention to TDM due to convergence of factors, of which climate change is one
- Related social/economic factors motivating TDM interest
  - High gas prices, energy security
  - Increased traffic congestion
  - Funding limitations – Highway Trust Fund running out...
  - Public health concerns / obesity
  - Increased emphasis on efficient system management & operations (pricing, etc.)
  - Quality of life issues / sustainability



***Thank you!***

**For more information:**

**Jeffrey Ang-Olson**

**ICF International**

**916-452-2400**

**[jangolson@icfi.com](mailto:jangolson@icfi.com)**

**[www.icfi.com](http://www.icfi.com)**