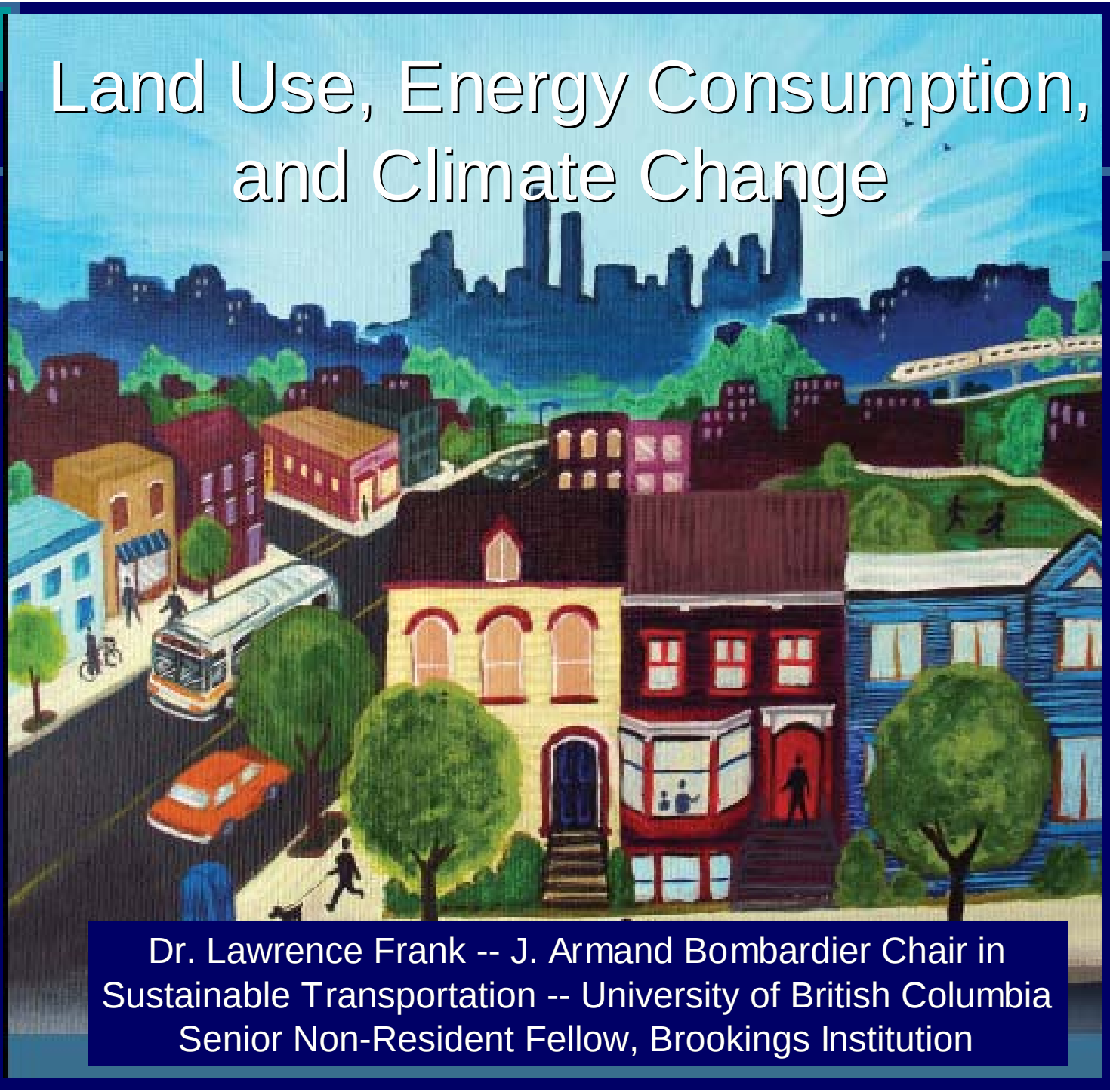
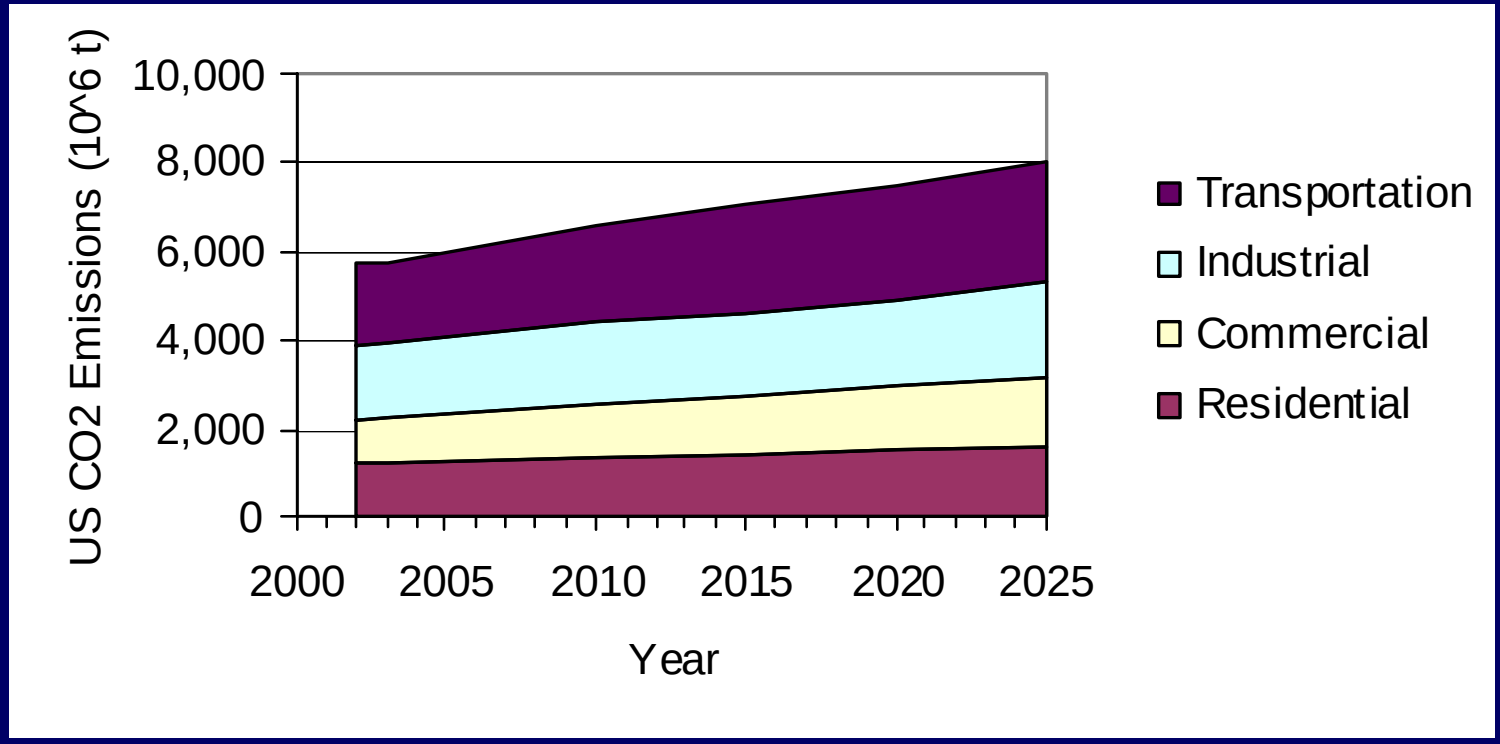
Land Use, Energy Consumption, and Climate Change



Dr. Lawrence Frank -- J. Armand Bombardier Chair in Sustainable Transportation -- University of British Columbia
Senior Non-Resident Fellow, Brookings Institution

Where Can the Reductions Come From?

US CO2 Emissions from Fossil Fuel (projected)



Source: U.S. Department of Energy (2005), *Annual Energy Outlook 2005* Prepared by the Energy Information Administration. P. 164

The Three Policy Levers

Fuel mix (biofuels such as ethanol, biodiesel)

- Increase use of alternative fuel sources through regulations or incentives

Vehicle efficiency (amount of fuel consumed per unit of distance covered)

- Increase through emissions standards and requirements/incentives for electric, hybrid, or other low-emission vehicles

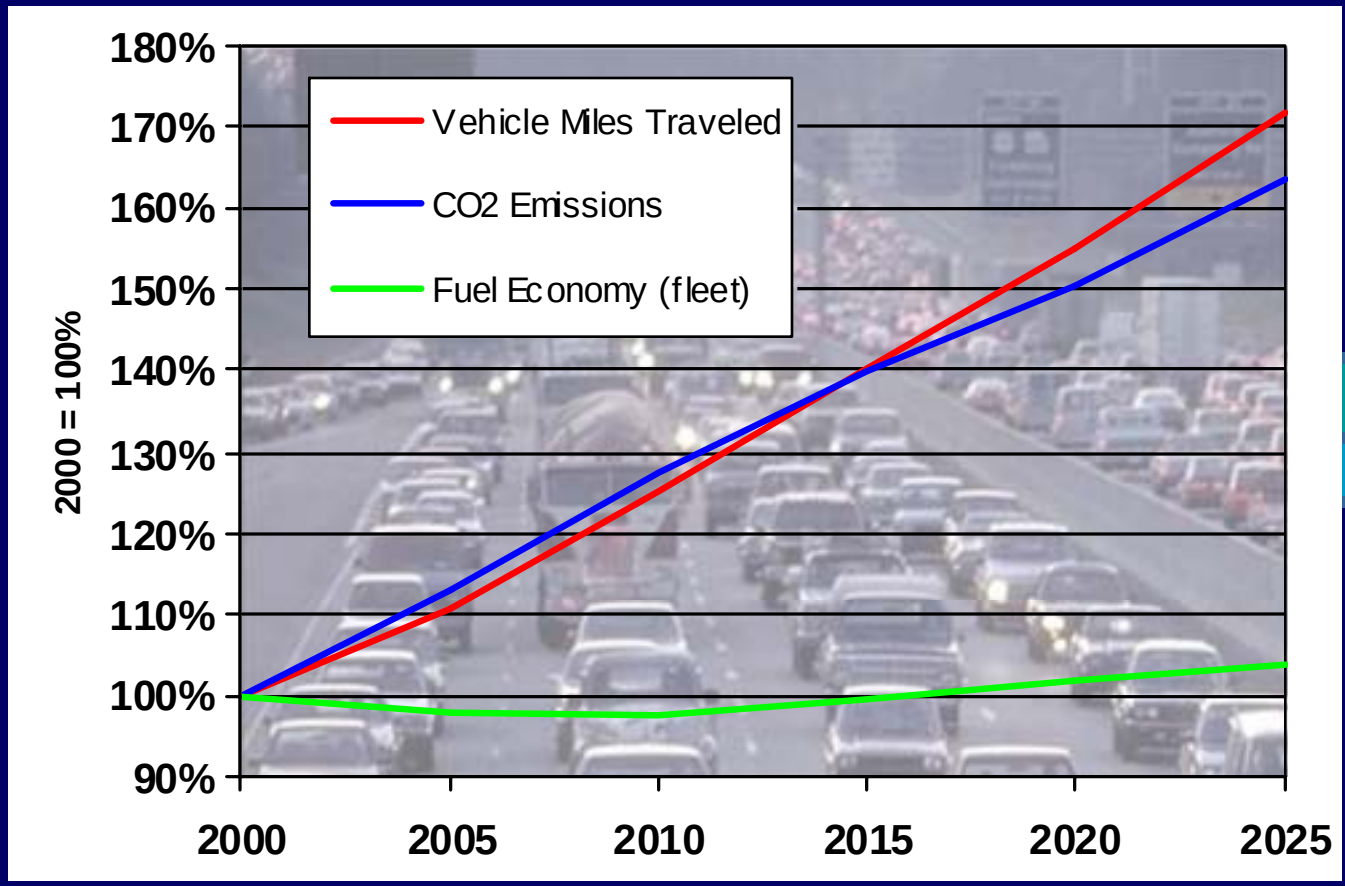
Demand / Travel Behavior (vehicle miles traveled)

- Can be decreased by a number of policy strategies, including transit investments, land use changes, Transportation Demand Management, and road pricing

In the U.S. and around the world, travel demand is increasing considerably faster than can be offset by technology and fuels alone (Greening 2004).

Are 'Techno-Fixes' Overpromised?

Projected growth in VMT and CO2 emissions exceed projected improvements in fuel economy



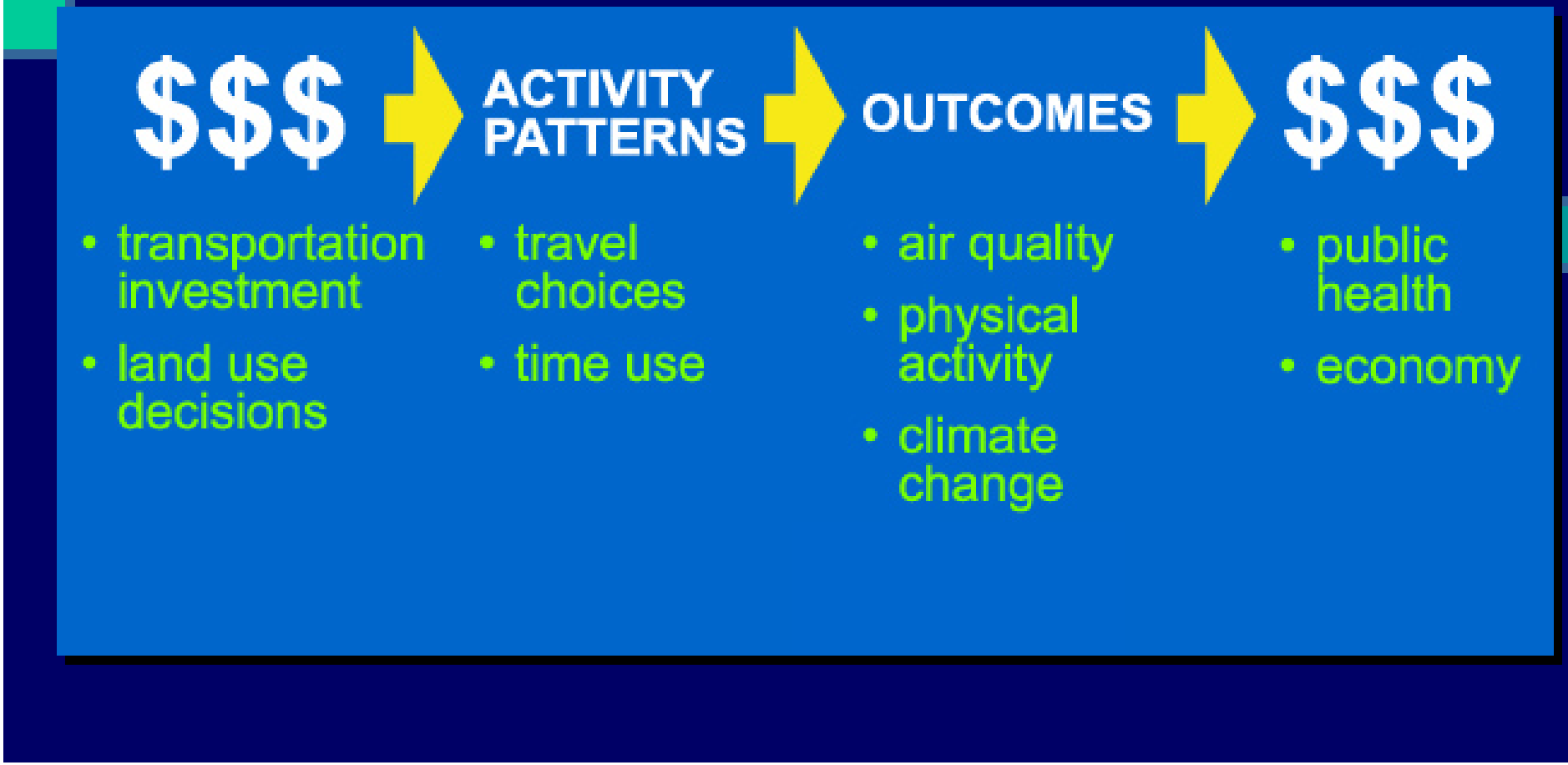
Source: Center for Clean Air Policy, EIA data

Puget Sound Scenario Testing – To meet 2050 80% Reduction in Greenhouse Gases

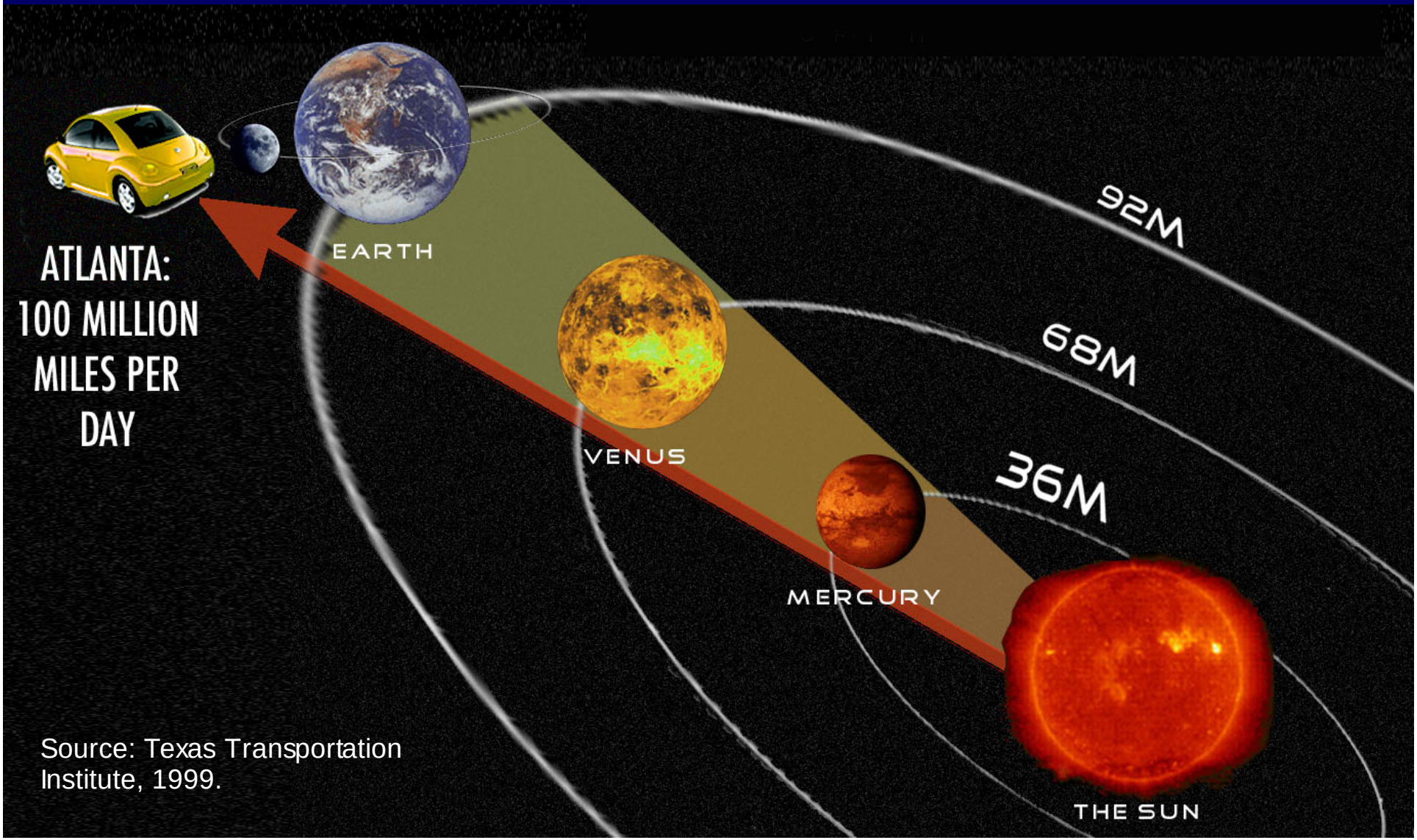
		Fleet Fuel Economy		Fuel GHG		VMT/Capita	
Scenario	Year	MPG	Change	lb/gal	Change	VMT/cap	Decrea
Reference	2005	19.6	0%	19.64	0%	23.3	0%
Base	2050	19.6	0%	19.64	0%	28.2	21%
Medium Tech	2050	48.2	146%	15.7	-20%	**9.0**	**-61%**
Aggressive Tech	2050	75.6	286%	11.8	-40%	**19.0**	**-18%**

Source: Steve Winkelman, CCAP

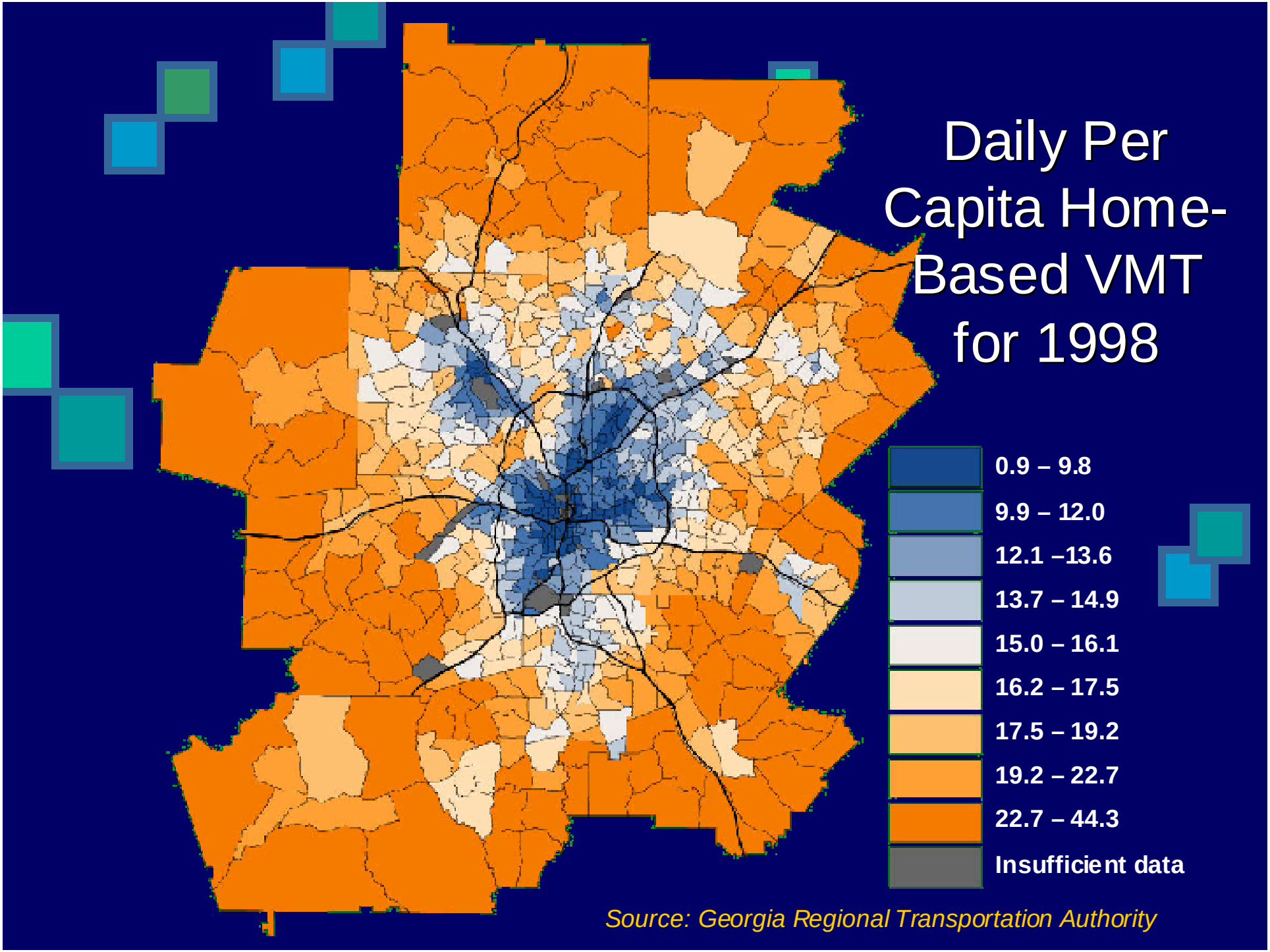
Transportation $$$, travel choices and outcomes



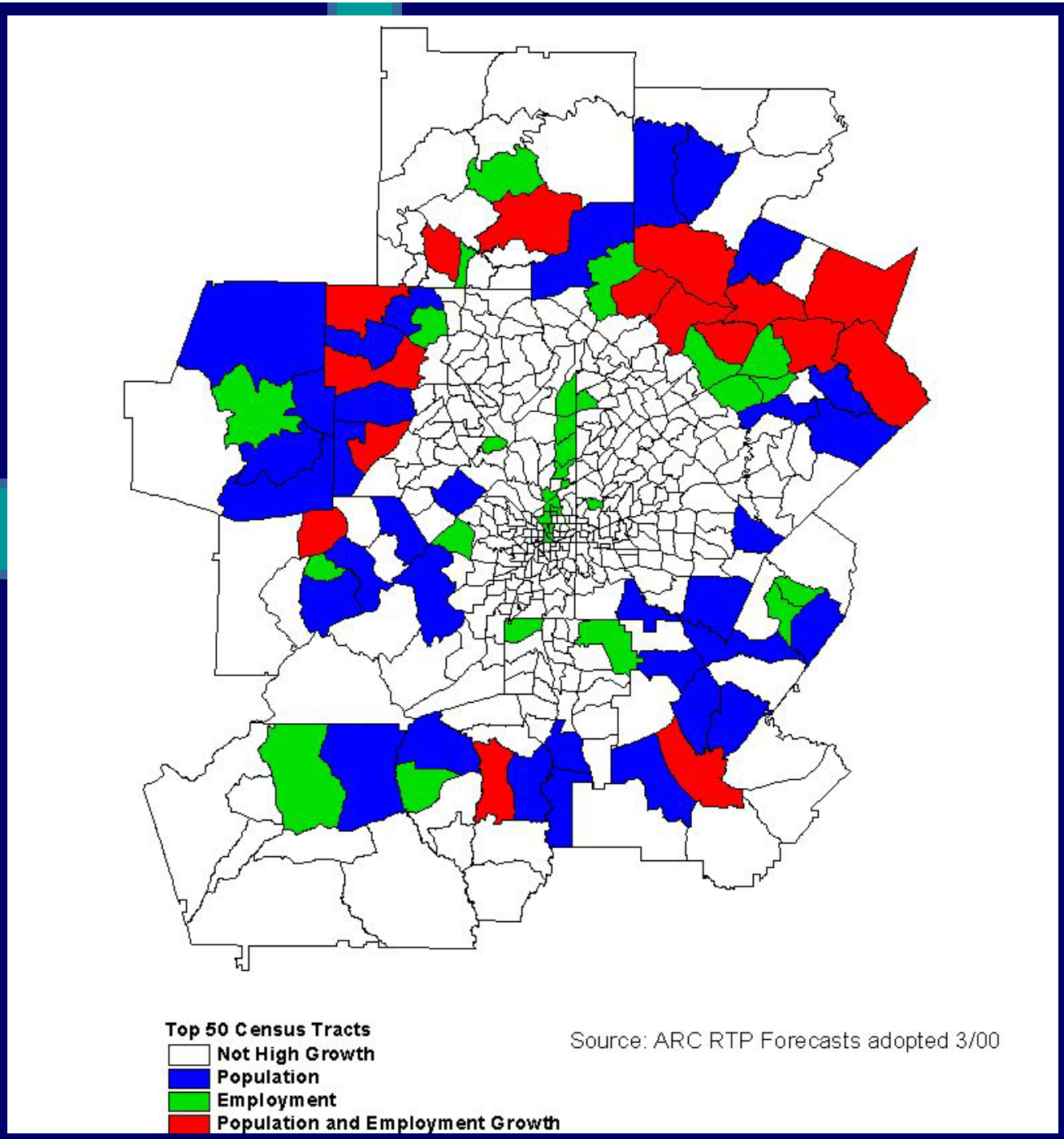
Metro Atlantans drive further than the distance to the SUN each day.



Source: Texas Transportation Institute, 1999.



HIGH GROWTH AREAS 1995-2025



CO2 and Housing Density

Source: LUTAQH final report, King County ORTP, 2005

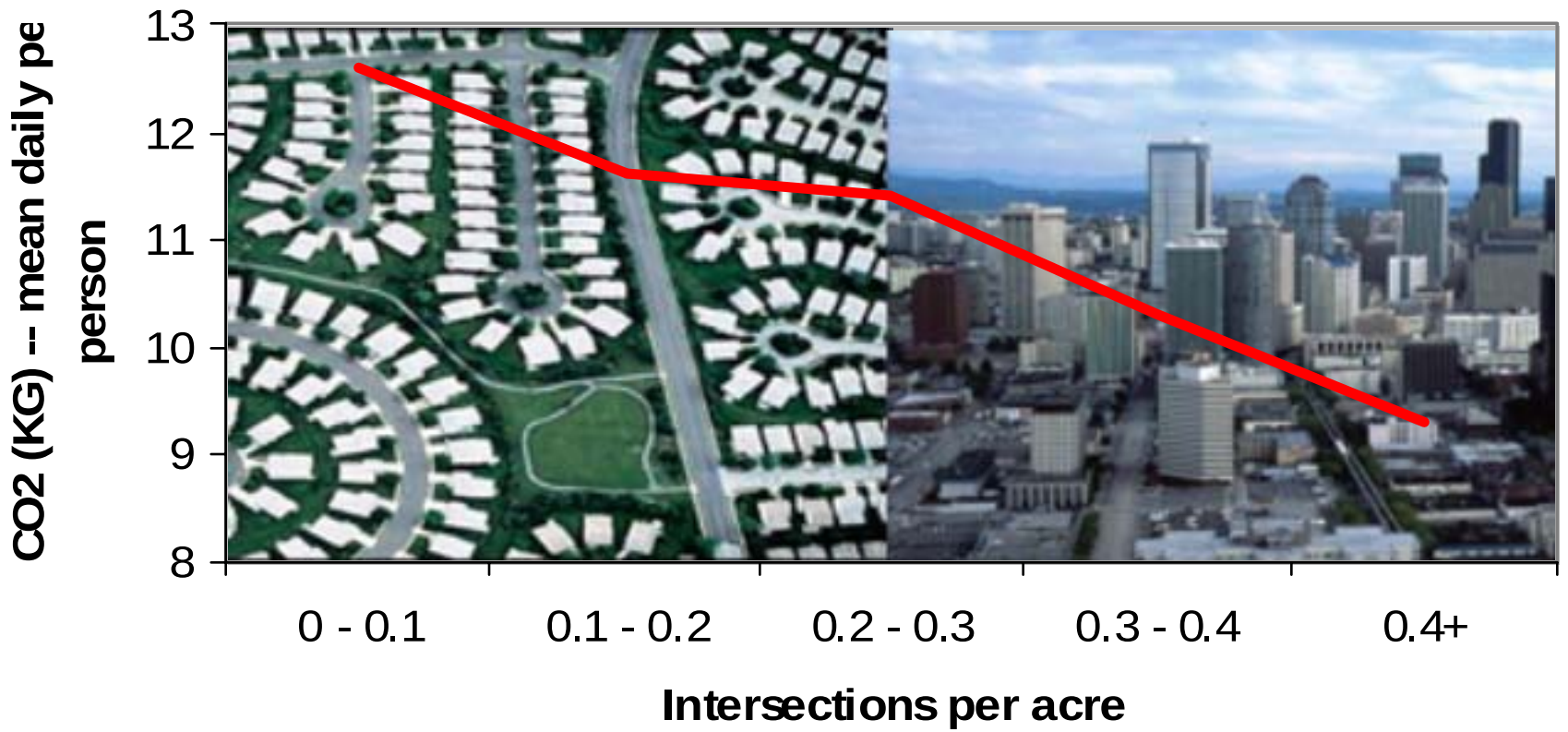
Analysis controlled for gender, age, income, education and drivers' license availability

CO2 and Retail Availability

Source: LUTAQH final report, King County ORTP, 2005

Analysis controlled for gender, age, income, education and drivers' license availability

CO2 & Street Connectivity



Source: LUTAQH final report, King County ORTP, 2005

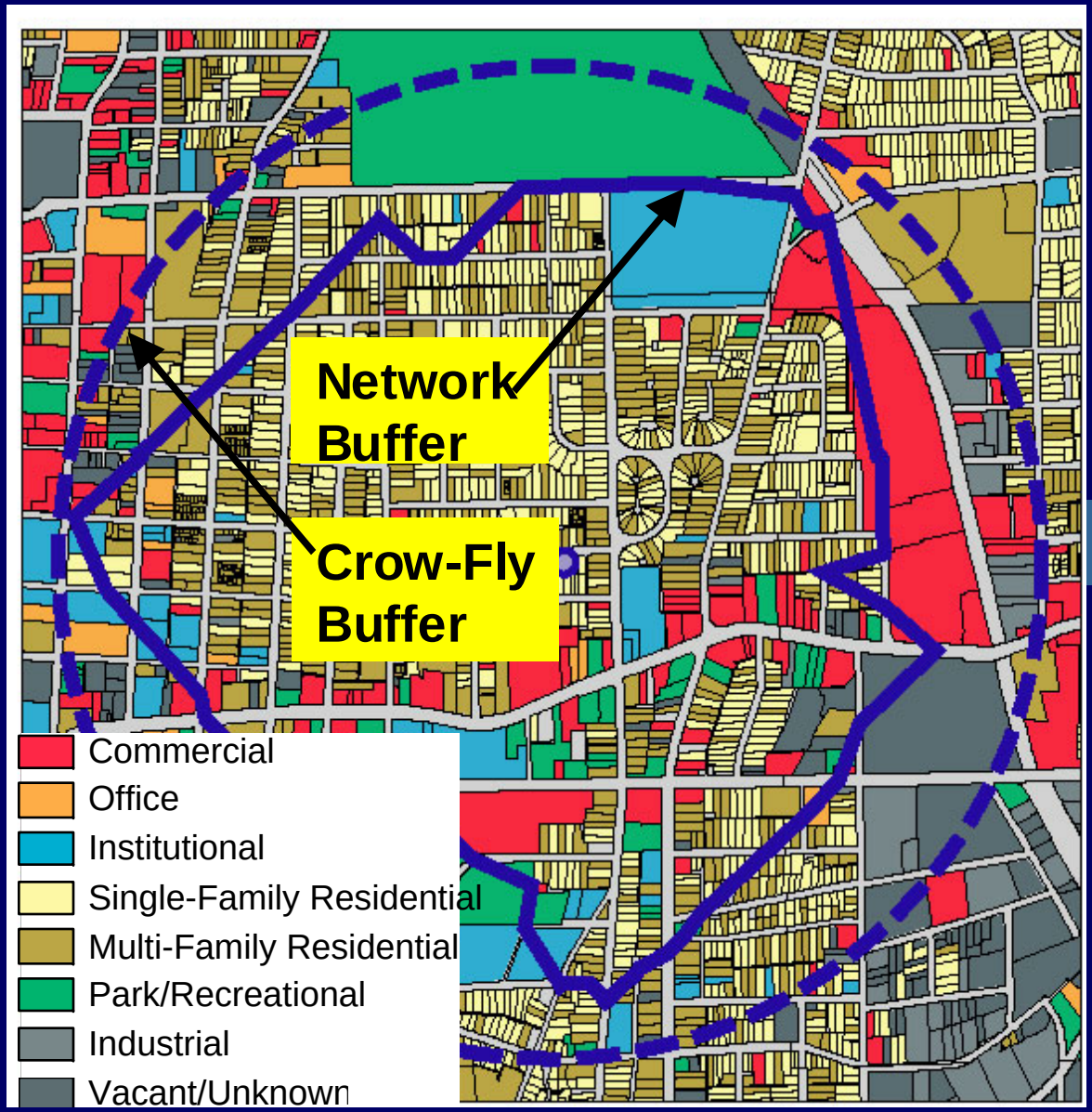
Analysis controlled for gender, age, income, education and drivers' license availability

Methodology

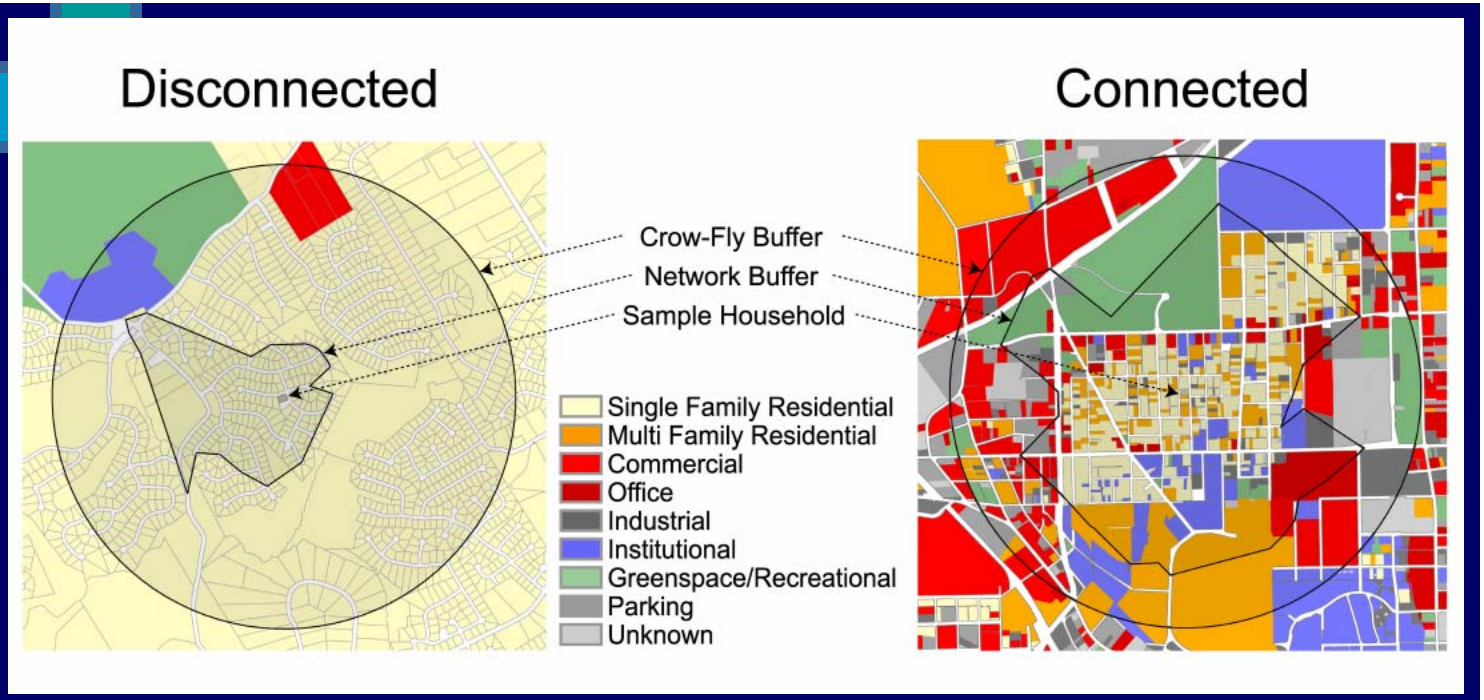
Step 1. Measuring Urban Form

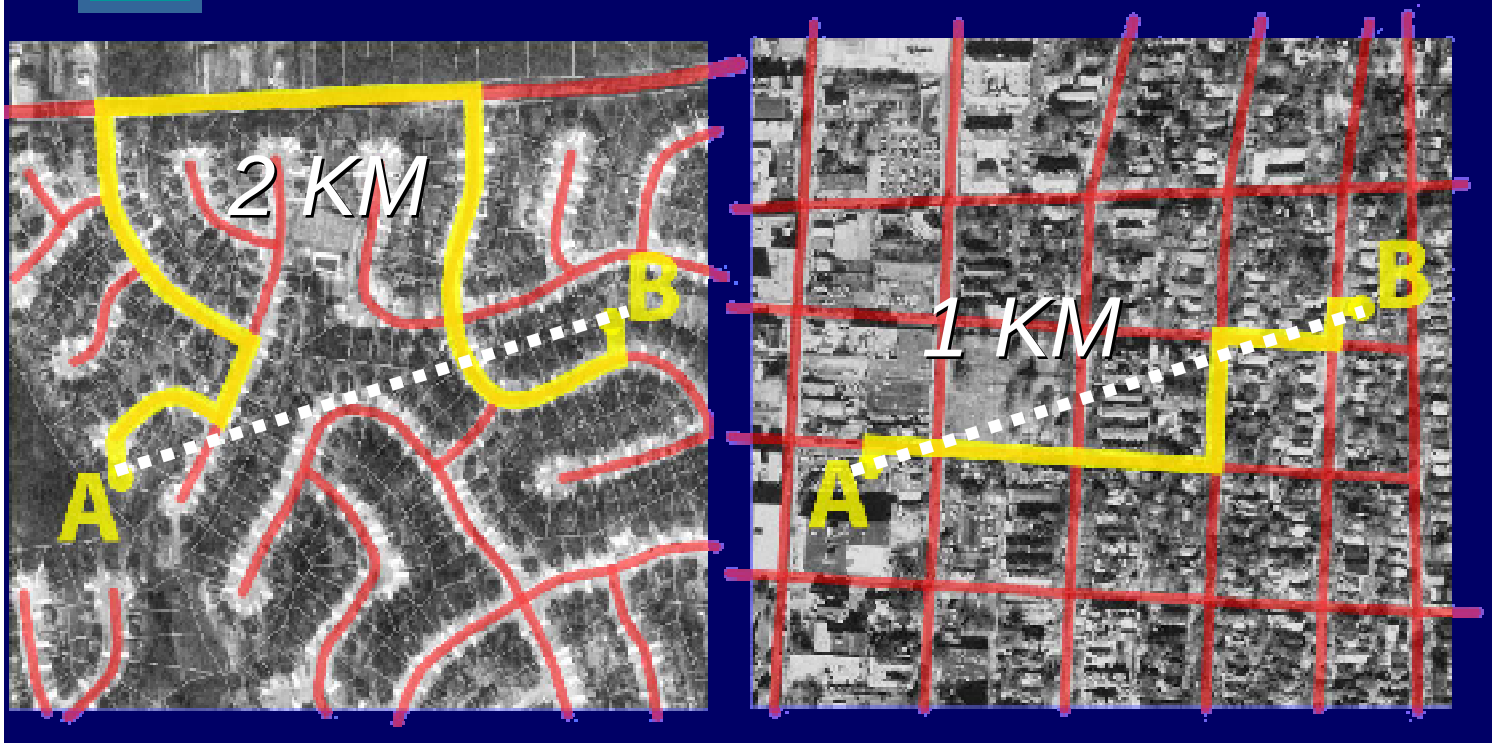
Proximity: Density and Land Use Mix

Directness: Street Network Connectivity



Proximity





Connect-ivity

Changing Urban Form to Reduce Emissions – Seattle Region DRAFT SCENARIO

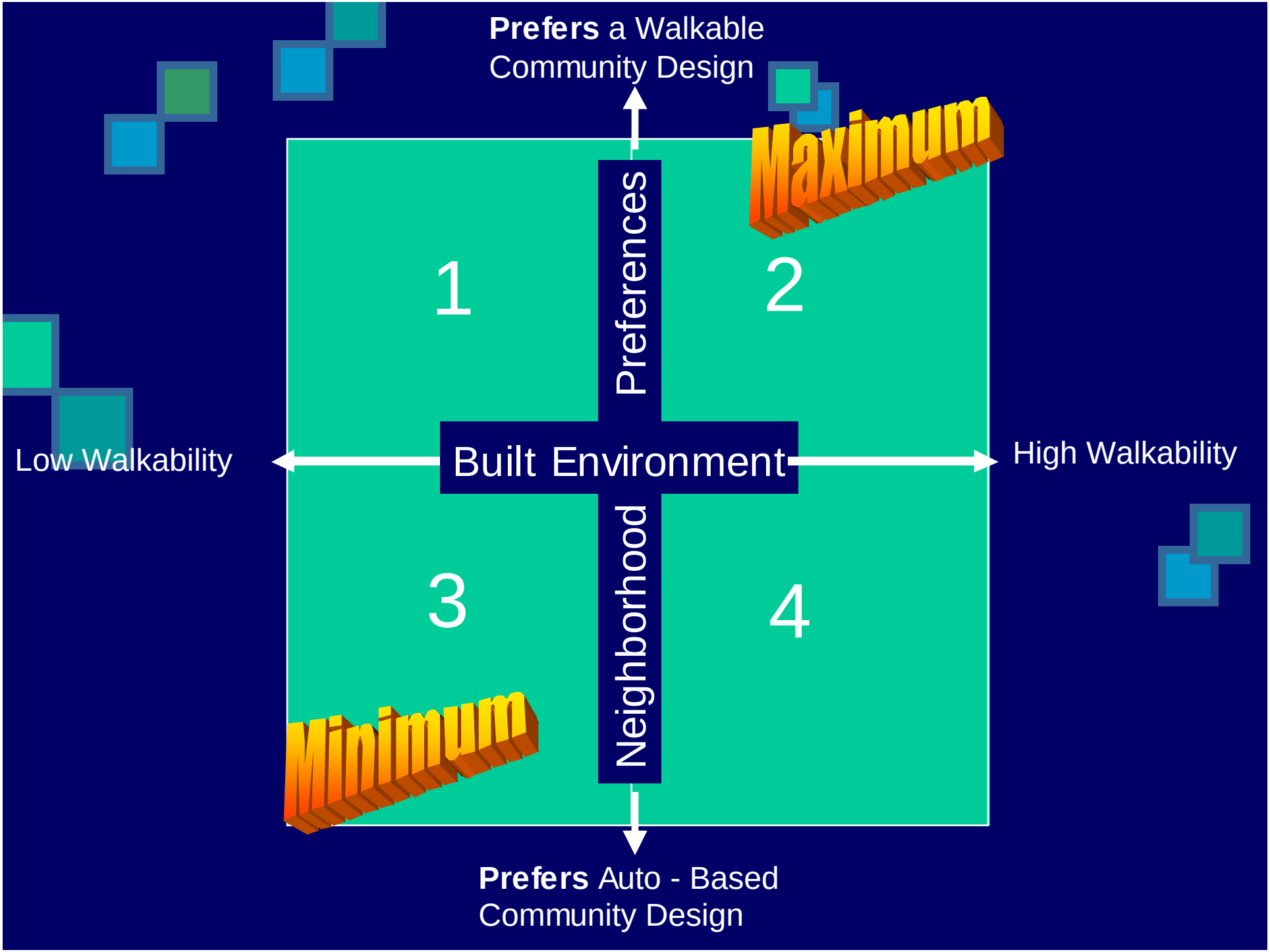
	Intersection Density / km	Net Residential Density / ac	Land Use Mix	Retail Floor Area	Walk Index*	Change in VMT
County Average	52	3.6	0.3	0.25	0.02	
Average + 20%	63	4.4	0.4	0.3	1.5	-6.5%
Average + 50%	78	5.4	0.47	0.38	3.2	-12.9%
Average + 100%	105	7.3	0.62	0.5	6.3	-24.1%

BASED ON:

Frank, L.D. Sallis, J.F., Conway, T., Chapman, J., Saelens, B. Bachman, W. (2006). Many Pathways from Land Use to Health: Walkability Associations With Active Transportation, Body Mass Index, and Air Quality. Journal of the American Planning Association.

Causation?

Controlling for Neighborhood Preference



PREFERENCE VS NEIGHBORHOOD DESIGN

	Walkability & Preference Groups		Percent Taking a Walk Trip (n)	Average Daily Vehicle Miles Traveled (n)
	Preference for Neighborhood Type	Walkability of Current Neighborhood		
I	**High**	**Low**	16.0% (188)	36.6 (188)
II	**High**	**High**	33.9% (446)	25.8 (446)
III	**Low**	**Low**	3.3% (246)	43.0 (246)
IV	**Low**	**High**	7.0% (43)	25.7 (43)

Causation and Self-Selection: SMARTRAQ Results

Results suggest that the environment is a stronger predictor of driving and preferences are a stronger predictor of walking

Both neighborhood preferences and built environments are significant predictors of the amount of walking and driving

Obesity Results – Driving and Walking

- Every additional 30 minutes spent driving per day translates into a 3 percent increase in the likelihood of obesity
  - Time spent driving increases as walkability decreases
- Every additional Kilometer (.6 miles) walked translates into 4.8 percent reduction in the likelihood of being obese
  - Distances walked increases with walkability

Frank, L., Andresen, M., and Schmid, T., Obesity Relationships With Community Design, Physical Activity, and Time Spent in Cars. American Journal of Preventive Medicine. June 2004.

The Current Evidence Suggests…

- **Changing Land Use**
  - Bringing Residential, Commercial, Office, Institutional, and Recreational Uses Closer Together
  - Increasing the ability to travel directly between Residential, Commercial, Office, Institutional, and Recreational Uses
  - Requiring open space within existing and newly developing communities
- **Transportation Investment Priorities**
  - Increased funding for pedestrian, bike, and transit facilities
  - Providing direct linkages between walk, bike (local) and transit (regional)
  - Focusing transportation investments in existing centers (aka LCI)