Smart Growth and Air Quality: Design Concepts to Protect Human Health

Presented to:

The California Air Resources Board

Study Session on Relationship Between Location of Sensitive Receptors and Air Pollution Sources

University of Southern California

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Smart Growth Has a Wide Range of Environmental, Personal, and Societal Benefits

- Smart growth reduces the loss of wild lands or agricultural lands, and reducing endangered species conflicts cuts the amount of paved surfaces, reducing water pollution.
- By far the largest and most quantifiable benefit of smart growth development is reductions in the need to drive.
  - Reduced driving also has multiple benefits
  - In Southern California, reduced driving cuts air pollution

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Some Benefits of Smart Growth Can be Quantified

- Reduced personal transportation expenditures
  - Transportation is the second largest household expenditure at 18%.
- Enhanced equity: better access for all segments of the population.
- Reduced time spent in driving
  - Suburban mothers spend 17 full days a year behind the wheel, more than the average spends dressing, bathing, and feeding a child.
- Reductions in driving reduce air pollution, including greenhouse gas pollution
- Smart growth can reduce traffic congestion.

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Quantifying the Smartness of Growth

- Recent research allows us to calculate how much people drive as a function of community characteristics.
- Efficient cities and efficient neighborhoods cause people to demand less automobile ownership and use, controlling for income.
- More efficient cities could cut smog in Southern California significantly.

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Some Smart Growth Benefits Are Less Measurable

- Mixed use neighborhoods increase livability.
- Mixed income neighborhoods provide the benefits of diversity.
- Smart growth neighborhoods have access to recreational areas and open space.

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The Concept of Efficient Cities is New

- Before 1973, it was easy to explain growth in vehicle miles traveled (VMT) by cars;
  - Cars were newly available.
  - Income was rising.
  - Costs of cars were decreasing.
  - Highway systems were growing.
- Little work was done comparing VMT Levels between different cities or nations.

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The Concept of Efficient Cities is New

- Unabated growth of VMT After 1973 is harder to explain.
- Cost of driving no longer dropping.
- Income no longer growing

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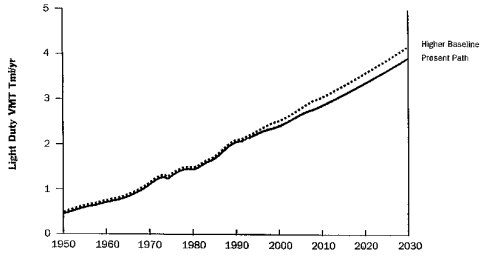
Vehicle Miles Traveled (VMT) Car and Light Truck VMT, Trillion Miles Per Year, U.S.



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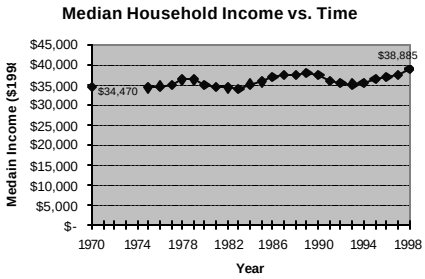
Income vs. Time, U.S.



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Location Efficiency

- Cities are not all alike in their consumption of VMT.
- Density (housing units per acre or per hectare) is a key explanatory variable.

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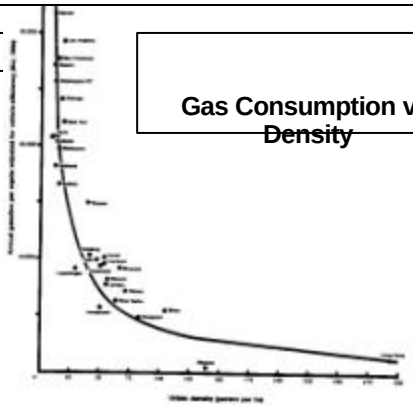
Gas Consumption vs. Density



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Location Efficiency: Developing Scientifically Robust Relationships I

- Statistical analysis performed for 4 major U.S. metropolitan areas.
- Unit of analysis was a neighborhood
  - The metropolitan areas had 500 to 3,000 neighborhoods.
- Dependent variables: automobile ownership per household and vehicle miles traveled (VMT) per automobile.

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Location Efficiency: Developing Scientifically Robust Relationships II

- Independent variables tested:
  - Density (housing units per acre)
  - Public transportation availability (buses per hour within walking distance).
  - Neighborhood jobs/services: number of retail businesses within walking distance.
  - Access to jobs.
  - Pedestrian and bicycle friendliness.
  - Income.
  - Household size.

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Location Efficiency: Study Results

- Excellent statistical fits.
  - R^2 for auto ownership equation exceeds 80%-90% for some cities.
- 4 variables highly significant:
  - Density
  - Transit
  - Income
  - Household size
- 2 variables modestly significant:
  - Pedestrian/bicycle friendliness
  - Proximity to jobs

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Location Efficiency: Interpretation of Study Results

- Proximity to jobs had only modest statistical significance
  - Proximity to jobs reduced miles driven per car, but not car ownership, resulting in very modest improvements in regional air emissions.
  - Proximity to jobs was defined as the number of jobs within one half hour commuting distance.
  - Thus, there is little or no evidence that setbacks around polluting industrial facilities will increase driving.

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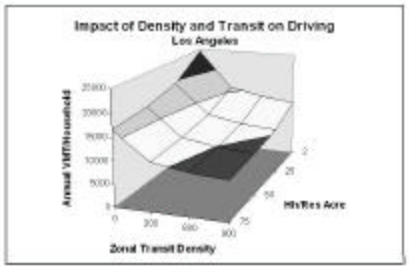
Results:



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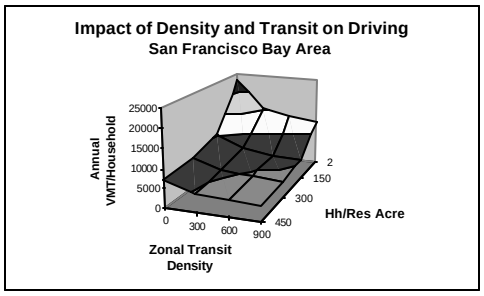
Results:



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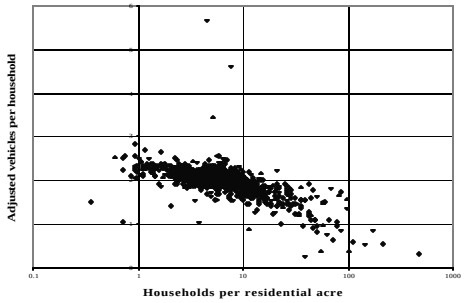
Vehicles per Household vs. Households per Residential Acre – San Francisco



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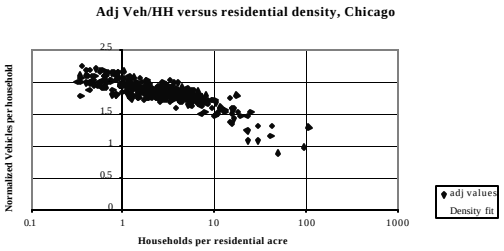
Vehicles per Household vs. Households per Residential Acre – Chicago



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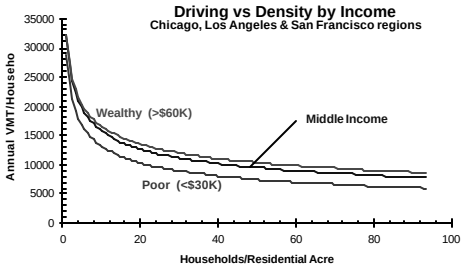
The Results Are Similar Across Incomes



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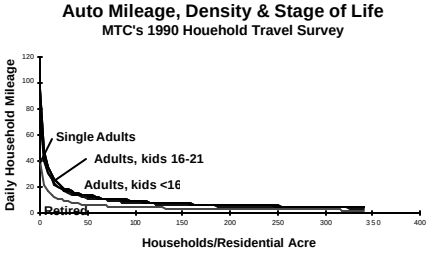
The Results Are Similar Across Lifestyles



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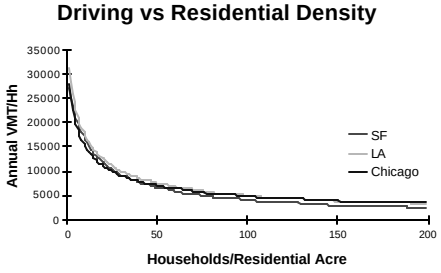
The Results Are The Same Everywhere



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Significance of Location Efficiency Results I

- Urban design choices made in the U.S. affect VMT by 3:1.
  - This increases to at least 5:1 for infill development.
- Higher densities are most important.
  - The most significant variable of all was the number of residential units per residential acre. Putting some acres off-limits to development will not affect this variable, and thus will not conflict with smart growth objectives.
- Transit access is more important than previously believed:
  - 1 passenger-mile on transit may reduce VMT by 4 to 8.
  - Better transit can reduce traffic congestion by a lot.

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Significance of Location Efficiency Results II

- Transit access is defined as the number of buses or rail vehicles per hour within walking distance of a home.
  - Siting transit stations in highway rights of way reduces drastically the number of households that can live within walking distance of the transit stop.
  - For this smart growth reason, major transit rights of way should be at least one half mile from a freeway.
  - This is consistent with the proposal to require setbacks from major highways.

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Significance of Location Efficiency Results III

- Lower VMT reduces consumer costs:
  - Cars are almost 18% of household expenditures in the U.S.
- Lower VMT reduces the need to invest in highways.
- Effectiveness of transit alters the tradeoff between railroads, buses, and highways.
  - Transit can be far more cost effective due to reduction in passenger-miles.

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Smart Growth Issues Not Addressed by Location Efficiency

- Since mixed use can most rigorously be justified as an amenity rather than a way to reduce traffic, separating polluting industrial uses from residential enhances mixed-use goals.
  - Some smart growth model developments intentionally place industrial and trucking related facilities near the outskirts of the development along the freeway exits, while placing heavy commercial and residential development around a transit station located away from the highway.
  - There is little or no evidence that setbacks around industrial facilities could increase driving.
  - Siting development near freeways may increase driving.

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Research Ideas

- Location of businesses may also affect VMT.
  - Does clustering uses in a metropolitan or regional downtown reduce driving?
  - Is locating businesses close to transit access more important than locating homes near transit?
- How much do economic factors affect the results?
  - Impact of free or paid parking.
  - Impact of gasoline prices and taxes/subsidies for auto ownership.
- Do results from large metropolitan areas apply to small towns as well?

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Smart Growth Can Be Smarter

- No need for "smart development" or affordable housing to put residents in harm's way.
- Homes that are too close to large pollution sources expose residents to air toxics Residents pay the price in increased health care $ & diminished quality of life.

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Setbacks Should Be Standard

- Designating setbacks between pollution sources and homes does NOT constrict development.
- In many cases a one block radius around a pollution source can be a sufficient setback, allowing for commercial development or open space.
- Residential design elements can often take care of setback requirements: Access roads, landscaping, etc.

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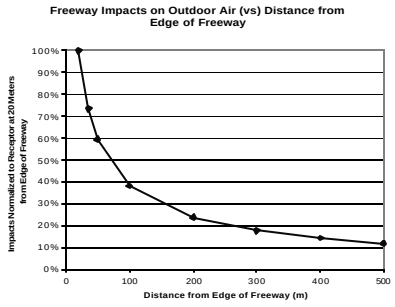
Setback: The distance it takes for pollutants to drop to near background levels



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