Scenario Assessment & Tea-Party Planning

Inputs, Processes & Outputs

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Land Use-Transportation Scenario Planning

Incorporating variable land use assumptions, but not broader economic and environmental considerations
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Scenario Assessment

U.S. Land Use-Transportation Scenario Planning Projects

Source: Bartholomew & Ewing 2010
Scenario Inputs

- Transportation system elements: *variable*
- Land use/growth allocations (the D’s): *variable*
- Growth levels: *some variable/most constant*
- Economic conditions (real estate markets & fuel prices): *constant*

Assessment Tools

- Land use allocation methods
- Travel demand modeling
- Other tools

Assessment Outputs

- Travel related
- Air quality & CO2
- Public costs
- Other
Scenario Inputs: Transportation System Elements

Road Lane Miles of Alternative Scenarios
percent difference compared to trend scenarios

mean = −1.19%

n = 92
Scenario Inputs: Transportation System Elements

Transit Service Hours of Alternative Scenarios
percent difference compared to trend scenario

n = 37

-9.82%  860.47%
Scenario Inputs: Land Use Elements

Persons per Developed Acre

$n = 145$

mean = 5.91

13.53
Scenario Inputs: Land Use Elements

Persons per Newly Developed Acre

mean = 23.89
Scenario Inputs: Land Use Elements

Density of Alternative Scenarios
percent difference in persons per developed acre compared to trend scenarios

mean = 19.82%

n = 119
Scenario Inputs: Land Use Elements

Households Near Transit
percent difference in percentage of total households within 1/4 mile of transit vs. trend scenario

-58.71%
327.50%
n = 62
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Assessment Tools

Steps to Improve UTMS Sensitivity to Smart-Growth Strategies

High-Sensitivity Models
Moderate-Sensitivity Models
Low-Sensitivity Models

Daily Vehicle Trip Model
Modeling Peak as well as Daily Travel
Simple Mode Choice
Transit Network and Daily Assignment
Supply and Demand Equilibration
Income Stratification in Distribution and Mode Choice
Auto Ownership Modeling Sensitivity to Land-Use Characteristics
Travel Time Feedback
Kernelized Modes in Mode Choice
Modeling Modes of Access to Transit
Distribution Sensitive to Multi-Modal Options
Disaggregate Simulation of Households
Explicit Representation of Pedestrian and Bicycle Networks
Activity- and Tour-Based Modeling
Integrated Land-Use/Transportation Modeling

Source: DKS, 2007
### Assessment Tools

<table>
<thead>
<tr>
<th>City Area</th>
<th>Daily vehicle trip model</th>
<th>Peak &amp; daily travel</th>
<th>Transit/highway mode choice</th>
<th>Transit network &amp; daily assignment</th>
<th>Supply &amp; demand equilibrium</th>
<th>Income strat. &amp; mode choice</th>
<th>Auto ownership sensitive to land use</th>
<th>Travel time feedback</th>
<th>Ped/bike in mode choice</th>
<th>Multiple modes of access to transit</th>
<th>Distr. sensitive to multi-modes</th>
<th>Dissaggregate simulation of HHs</th>
<th>Ped/bike networks</th>
<th>Activity- and tour-based modeling</th>
<th>Post-processing of D variables</th>
<th>Integrated land use-transportation model</th>
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</table>
Assessment Outputs

Daily Vehicle Miles Traveled per Person

\[ n = 150 \]

\[ \text{mean} = 25.78 \]

\[ \text{mean} = 12.06 \]
Assessment Outputs

Vehicle Miles Traveled of Alternative Scenarios
percent difference compared to trend scenarios

mean = -2.51%

n = 119

-30.27%
Assessment Outputs

Vehicle Hours of Travel for Alternative Scenarios
percent difference compared to trend scenarios

mean = -6.1%

n = 86

-48.85%
Assessment Outputs

Vehicle Hours of Delay of Alternative Scenarios
percent difference compared to trend scenarios

mean = 16.38%

n = 33
Assessment Outputs

Agriculture Lands Consumed by Alternative Scenarios
percent difference compared to trend scenarios

- 13.50%
- 20%
- percent difference compared to trend scenarios
- 20%
- 0%
- -20%
- -60%
- -40%
- -80%
- -100%

n = 42

-8239.42%
Assessment Outputs

NO\textsubscript{x} Emissions of Alternative Scenarios
percent difference compared to trend scenarios

-14% \quad -12% \quad -10% \quad -8% \quad -6% \quad -4% \quad -2% \quad 0% \quad 2% \quad 4%

n = 25

-11.41%
Assessment Outputs

Greenhouse Gas Emissions of Alternative Scenarios

percent difference compared to trend scenarios

45.72%

-23.16%

n = 31
Assessment Outputs

Lane Miles of Non-Local Roads vs. Vehicle Miles Traveled

R² = 0.8598

n = 106
Assessment Outputs

Lane Miles per Person vs. Vehicle Miles Traveled per Person

R² = 0.0046

n = 106
Assessment Outputs

Developed Acres vs. Vehicle Miles Traveled

$R^2 = 0.8072$

$n = 145$
Assessment Outputs

Persons per Acre vs. VMT per Person

\[ R^2 = 0.4326 \]
Assessment Outputs

Percent of Households Near Transit vs. VMT per Person

R² = 0.2927

n = 75
### Assessment Outputs

#### Hierarchical Model Results

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<td>4.14</td>
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Infrastructure Costs: Percent Difference Alternative vs. Trend Scenarios
Assessment Outputs

Infrastructure Costs: Percent Difference Alternative vs. Trend Scenarios

R² = 0.0803
n = 46
Assessment Outputs

Costs for Local and Collector Roads vs. Density

$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-

Road Costs per New Resident

Persons per Newly Developed Acre

R² = 0.1459

n = 39

n = 39
Assessment Outputs

Road Density = 0.151 * Population Density^{0.4314}

Source: Burchell, et al., 2002
Assessment Outputs

Local and Collector Road Mileage

n = 188
Assessment Outputs

Local and Collector Road Costs

- n = 188
- $12,222
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Assessment Outputs

Road Costs per Person: Alternative vs. Trend Scenarios
Assessment Outputs

Road Costs per Person vs. Development Density

Persons per Square Mile of New Development

0 5000 10000 15000 20000 25000 30000 35000 40000

Road Costs per New Resident

n = 188

$30,000

$25,000

$20,000

$15,000

$10,000

$5,000

$0

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Scenario Assessment
Synthesis

• Denser development patterns result in less driving per person, indicating an increased level of transportation efficiency.

• Denser development patterns are less costly per person for road infrastructure than more dispersed patterns; depending on the circumstances, the level of cost savings may be substantial.

• Scenario planning is an effective method for understanding these relationships and communicating with decisionmakers and the public about the issues.
Q & A