4-14-2017

Getting to Know the Data: Understanding Assumptions, Sensitivities, Uncertainty, and Being "Conservative" While Using ITE's Trip Generation Data in the Land Development Process

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Getting to Know the Data

Kristina M. Currans

Friday Transportation Seminar | April 14th, 2017
Getting to know the data

Understanding Assumptions, Sensitivities, Uncertainty, and Being “Conservative” While Using ITE’s Trip Generation Data in the Land Development Process

“an example of poor professional judgment is to rely on rules of thumb without understanding or considering their derivation or initial context” (Institute of Transportation Engineers, 2014, p. 3).
What’s a Traffic Impact Analysis?
Why conduct transportation impact studies?

- Planning needs
- Addressing mitigations
- Evaluating performance
- Capacity analysis as part of concurrency or adequate public facility requirements
- Assessing fees or charges for projects
- Environmental impact studies
- Safety studies
- Transportation contributions to health impacts
Assessing travel demand for development

Caliper Corporation: accessed September 2016
http://www.caliper.com/transmodeler/transmodeler-se-analysis-software.htm
State-of-the-Practice

- Historic Data
  - 550 sites
  - ~5,000 data points
  - 172 land uses
- Average rates or regressions
- Vehicle trip counts
- Based on:
  - Square footage
  - Employees
  - Seats
  - Dwelling units
Overestimation of Urban Land Uses

Overestimated

Problems in Data And Methods

- Adjustments to ITE methods are band aid
- Inability to link to goals & plans
- Limited set of independent variables
- Focus on peak hour
- Cannot compute new performance measures
- Not consistent with theory
- Changes over the day, week, season
- All modes
- Person trips
- Pricing
- Vehicle occupancy
- Who are the People
- Trip length distribution
- Clearer distinctions for land use types
- Limited Statistical Rigor
- Location info
- Age of data
- Rely on too many assumptions
- Travel time
- Data gaps limit advancement of new methods
- Only estimate vehicle trips
- Site & immediate environment
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1985 - Average age of data – 32 years

1986 – I was born
1956 – Federal-Aid Highway Act

2005 – Intermodal Surface Transportation Act (ISTEA)
1981 – LRT
1984 – Minivan
1990s – Internet & Popularized SUVs
2000 – Carsharing
2001 – Modern Streetcar
2004 – Bikeshare
2005 – Google Transit
2007 – iPhone first released
2010 – Peer-to-Peer Carshare

? – AVs
1956 – Oldest Full Enclosed Mall Opens

1987 – Starbucks sold to Schultz

1992 – Point-of-Sale Technology

1994 – Amazon.com Founded

2000s – Fast-Fashion

2007 – No new malls built

1 http://www.bbc.com/culture/story/20140411-is-the-shopping-mall-dead
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Urban Context

- Urban context influences travel decisions
  - Often defined by built environment
- No consensus on method to address trip rates and context
- Important to collect & incorporate a variety of urban built environment measures
- Geo-referencing needed for changes over time
- Important factors well known
Site-level Attributes

• Range of variables not including metadata
  • E.g., parking, pricing, orientation, setbacks, turning bays
  • Not including: densities, regional accessibility, market area
• Not typically included in analysis
• Common mitigations in land development negotiations
• Synergy with context
Other contextual aspects

- Socio-demographics
  - Food retail
  - Controlling for accessibility
- Grocery stores:
  - Positive w/Income
  - 77 to 83 transaction/SQFT
- Convenience Markets:
  - Negative w/Income
  - 220 to 280 transaction/SQFT

Problems in Data And Methods

- Limited Statistical Rigor
  - Limited set of independent variables
  - Rely on too many assumptions
  - Age of data

- Limited set of independent variables
  - Person trips
  - Travel time
  - Vehicle occupancy

- No access
  - Site & immediate environment

- New performance measures
  - Cannot compute vehicle occupancy

- Clearer distinctions for land use types
  - All urban environments

- Only estimate vehicle trips

- Not consistent with theory
  - All modes

- Changes over the day, week, season
  - Trip length distribution

- Inability to link to goals & plans
  - Location info

- Adjustments to ITE methods are band aid

Data gaps limit advancement of new methods

Who are the People
- Pricing
- Person trips

Changes over the day, week, season
- All modes
- Trip length distribution

Better estimates of vehicle trips

Adjacency to ITE methods are band aid
Donation-based Sampling

• Data provided through calls for data, donated
• “Suburban”
  • Little to no bike/ped/transit;
  • Single land use development;
  • Free and unconstrained parking, not shared
• “Region” is the lowest level of context
  • Pacific, Central, Mountain, Eastern
• Newer data is likely to be categorized a priori
  • E.g., “urban core”, “suburban”
  • Undetermined process, TBD
Problems in Data And Methods

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Person Trips

Adopted from (Clifton, Currans, Muhs 2013)

Do person trips vary?

Restaurants in Portland

Examining average person trip rates by mode

Vehicle trips decreases

Person trips vary
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Common Conversion: *Office*

- **Under-Estimate Person Trips**
- **Over-Estimate Person Trips**
Common Conversion: Residential

Under-Estimate Person Trips

Over-Estimate Person Trips
Common Conversion:

Service

Underestimate Person Trips

Overestimate Person Trips
Common Conversion: Retail

Underestimate Person Trips

Overestimate Person Trips
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- MIND THE GAP
- Age of data
% Inflation

Trips by ITE’s Definition

Housing

Retail/Service
How do they vary in time?
Modal “Peak Hour”

- Puget Sound Regional Council Household Travel Survey
- Dining Out

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Bike</td>
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<td>Vehicle</td>
<td>3,228</td>
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<td>Walk</td>
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</tr>
</tbody>
</table>

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Predictions Distributions

A single prediction may derive an average estimate of **550 counts** with a 95% confidence interval of **350 to 1250 counts**.

If 550 counts just barely warrants that adjacent street must be widened, that implies that approximately 50% of the time the warrant would apply (and 50% it wouldn’t).

And now you know that these data represent an **Average Maximum** count…

…and this is an urban location…

What if this problems represents the PM peak hour— which accounts for 8% of the day?
Mechanisms for Change

Conclusions
Relationships

• Broader & coordinated stakeholder involvement
• Independent efforts across the US (and elsewhere) but little coordination
• ITE has control of their “product” – Trip Generation Handbook
• State DOTs involvement somewhat limited - concurrency new & performance measures
  Strategic partnerships are key
  • ITE-NACTO-Universities
  • TRB-ULI-ITE
• Who takes the lead?

Invest in the data you use

- Wide variety of travel metrics to choose from
- Move away from unsolicited submissions to ITE
- Strategic sampling
- Make use of new technologies
- Monitoring & adjustments over time
- QA/QC
- Transparency
- Legal barriers & precedent

Continue to Study the Data We Have/Use

“an example of poor professional judgment is to rely on rules of thumb without understanding or considering their derivation or initial context”

(Institute of Transportation Engineers, 2014, p. 3).