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

Kristina Marie Currans
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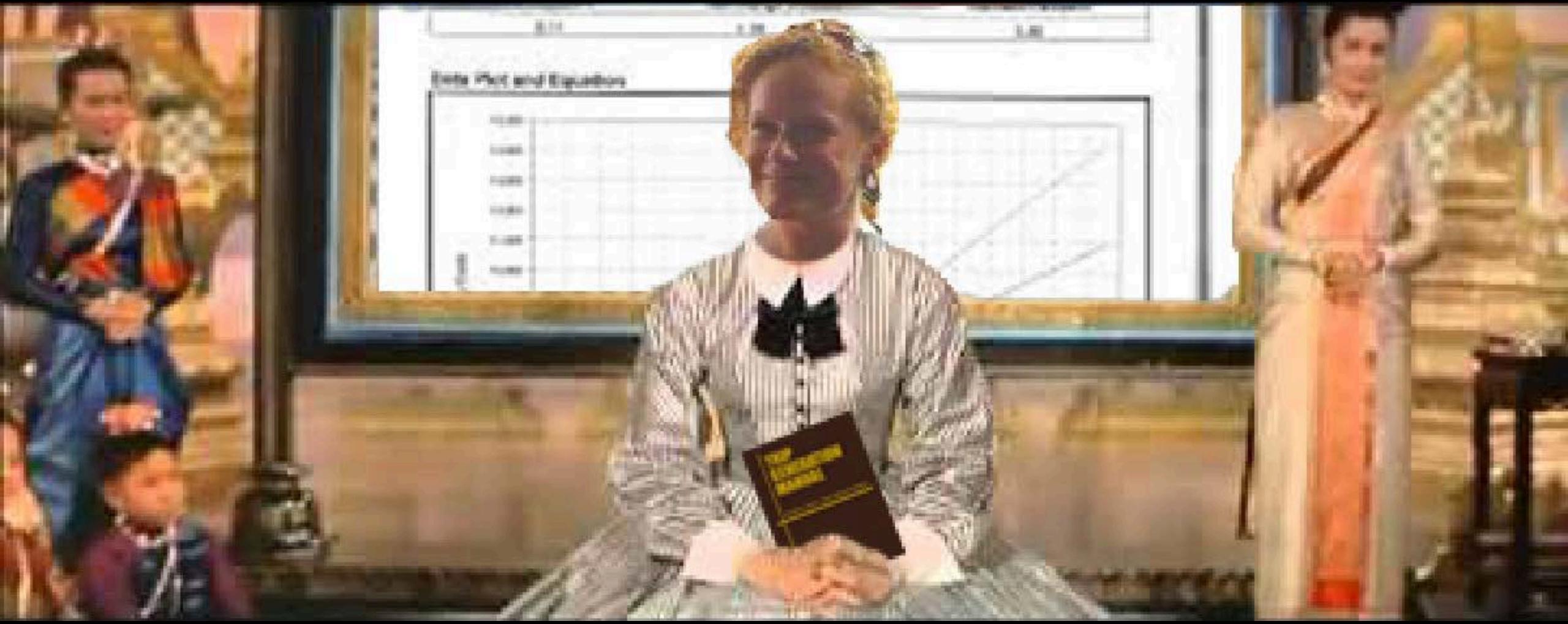
Getting to Know the Data



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

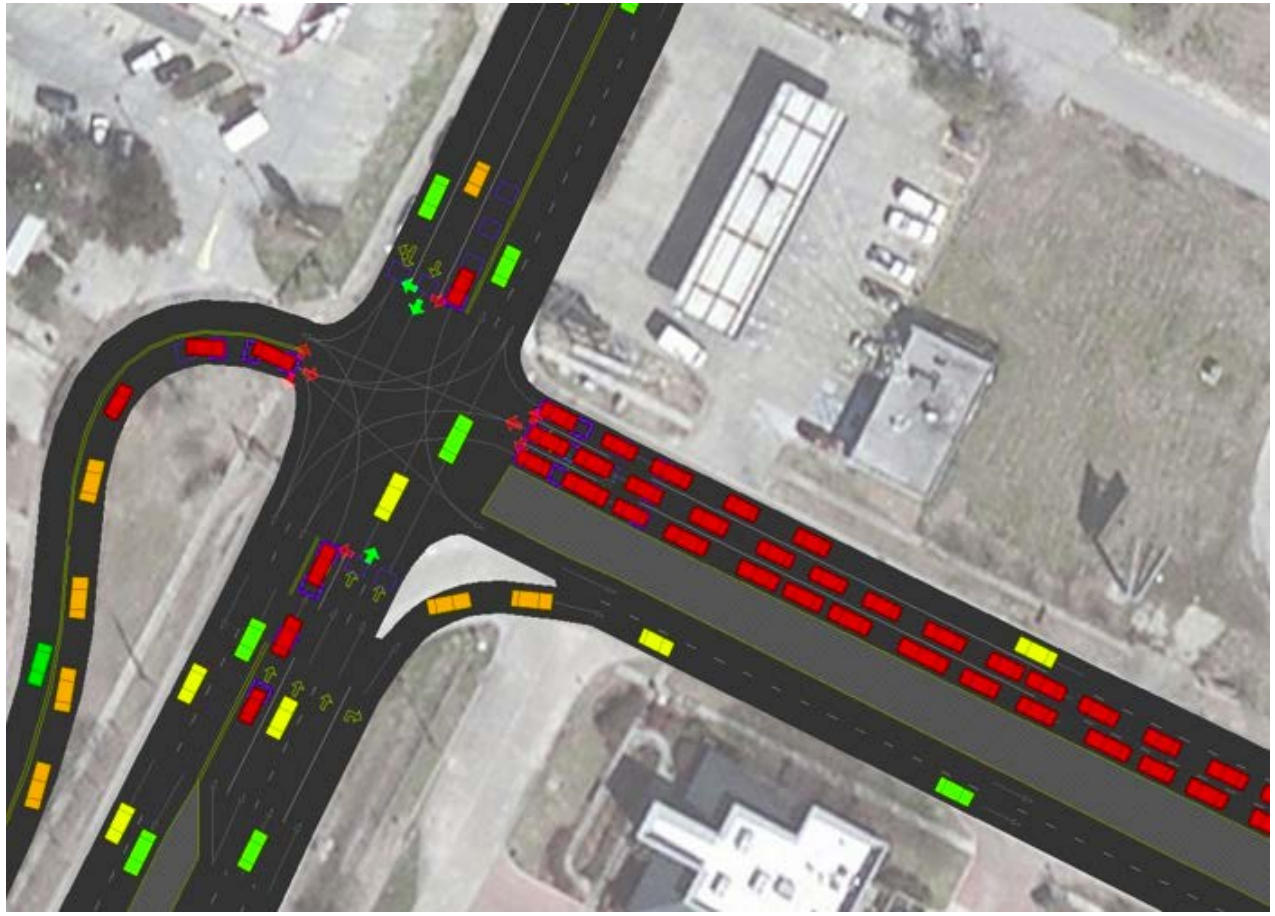
"an example of poor professional judgment is to rely on rules of thumb without understanding or considering their derivation or initial context" (Institute of Transportation Engineers, 2014, p. 3).

What's a Traffic Impact Analysis?

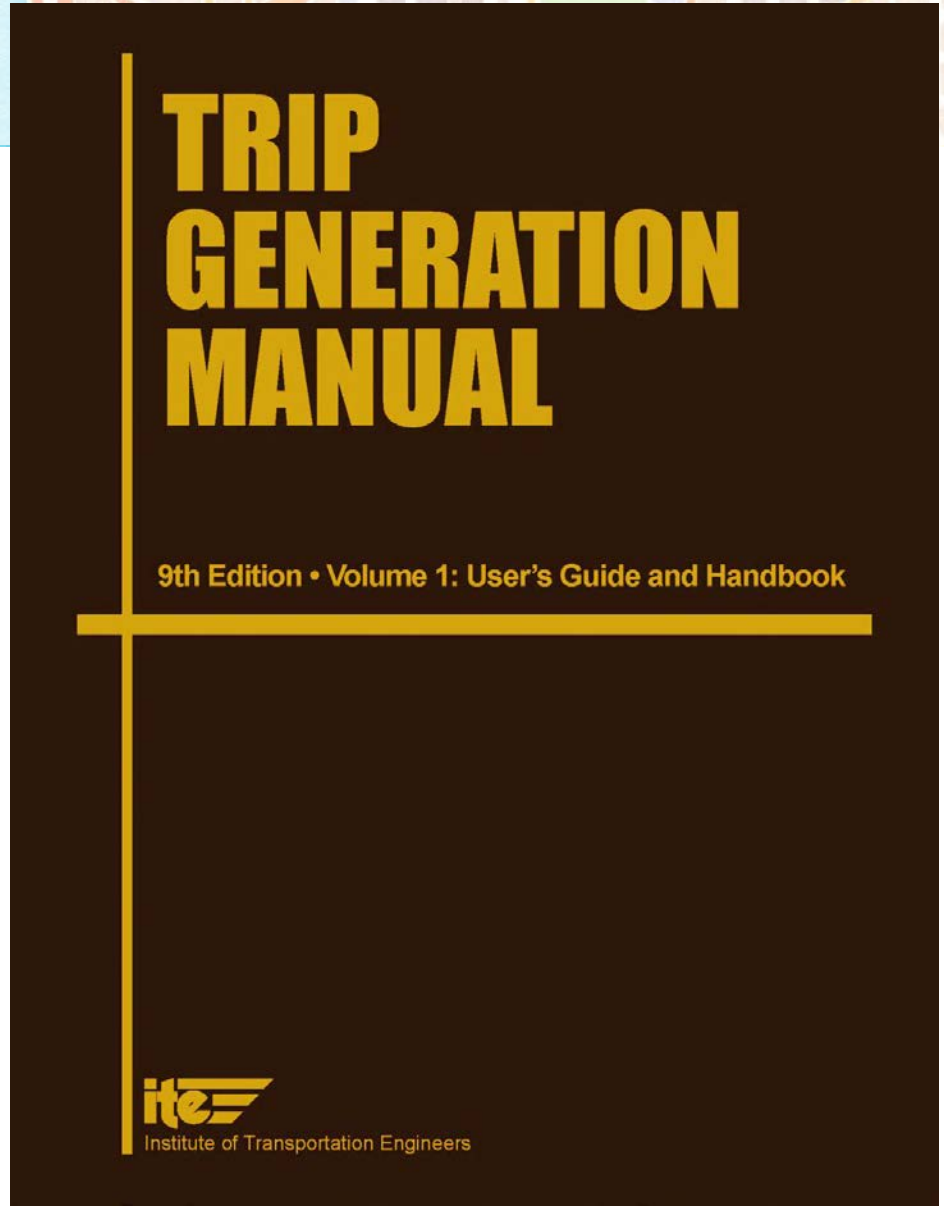
Why conduct transportation impact studies?

- 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

Shopping Center
(820)

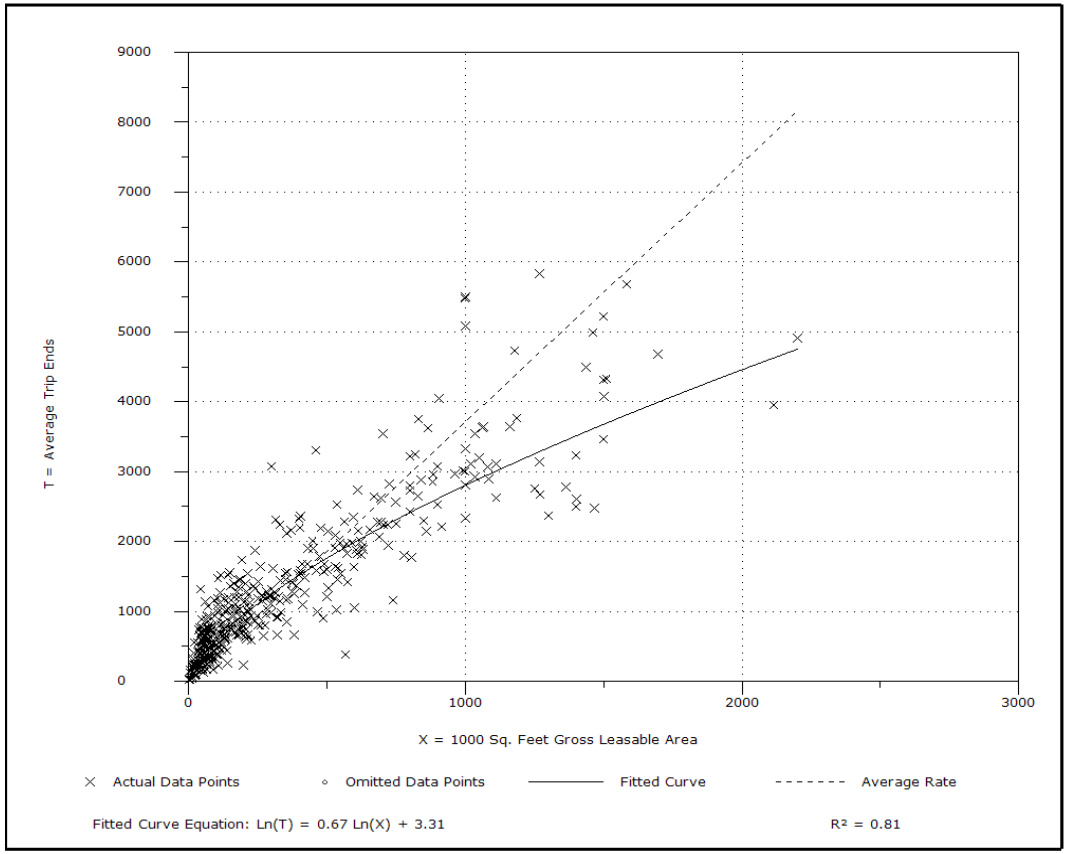
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Leasable Area**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Number of Studies: 426
Average 1000 Sq. Feet GLA: 376
Directional Distribution: 48% entering, 52% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

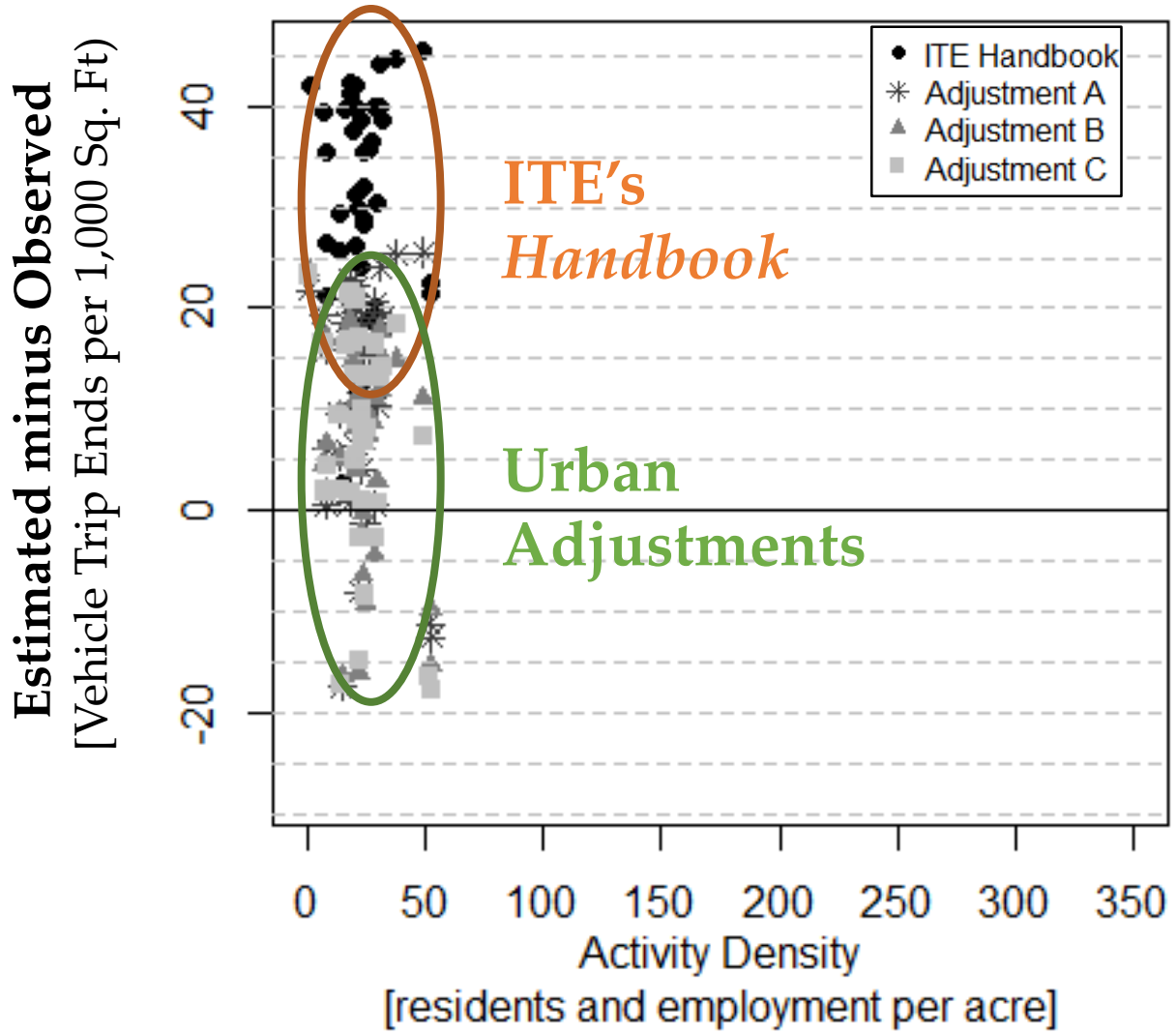
Average Rate	Range of Rates	Standard Deviation
3.71	0.68 - 29.27	1.95

Data Plot and Equation



Trip Generation, ITE-TGM 9th Edition

Overestimation of Urban Land Uses



Overestimated

Currans, Kristina M.; Clifton, Kelly J. Improving Vehicle Trip Generation Estimations for Urban Contexts: Using Household Travel Surveys as a method to Adjust ITE Trip Generation Rates. Journal of Transport and Land Use, Vol. 8, No. 1, 2015, pp. 85-119.

Problems in Data And Methods

Adjustments to ITE methods are band aid

Not consistent with theory

All urban environments

Only estimate vehicle trips

Inability to link to goals & plans

Changes over the day, week, season

Clearer distinctions for land use types

Limited Statistical Rigor

All modes

Limited set of independent variables

Location info

Age of data

Person trips

Pricing

Trip length distribution

Rely on too many assumptions

Focus on peak hour

Vehicle occupancy

Who are the People

Travel time

Cannot compute new performance measures

No access

Site & immediate environment

Data gaps limit advancement of new methods

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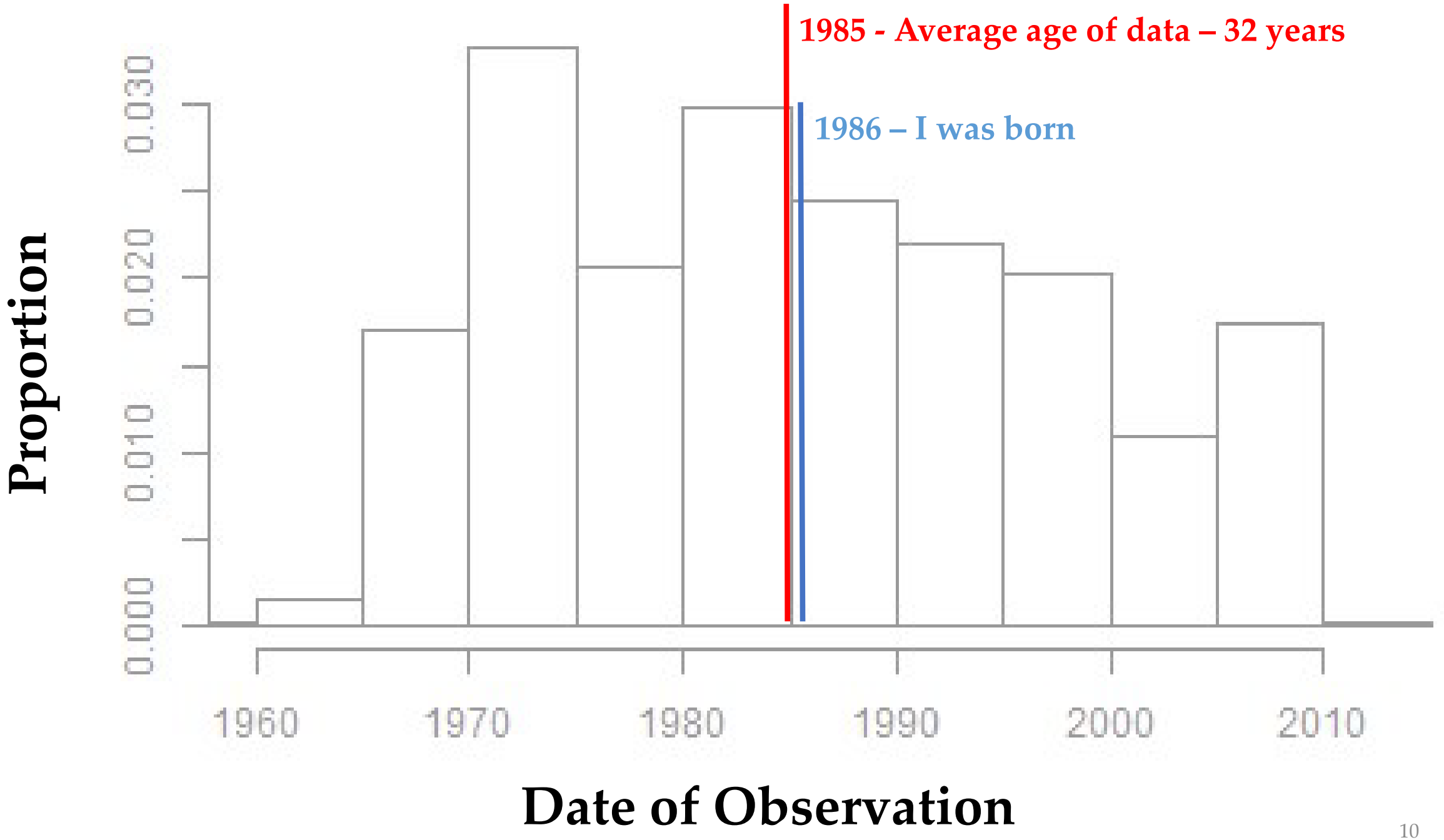
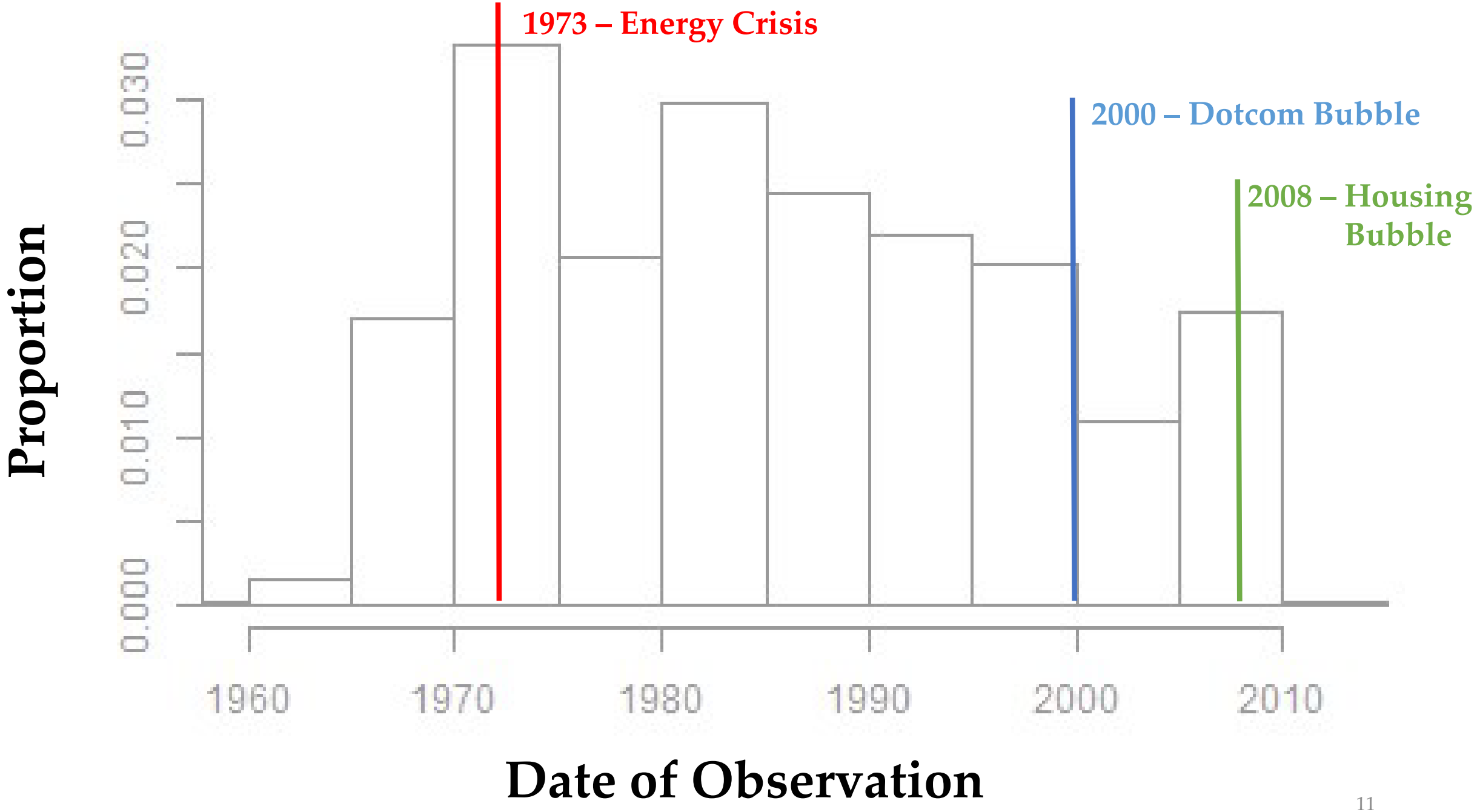
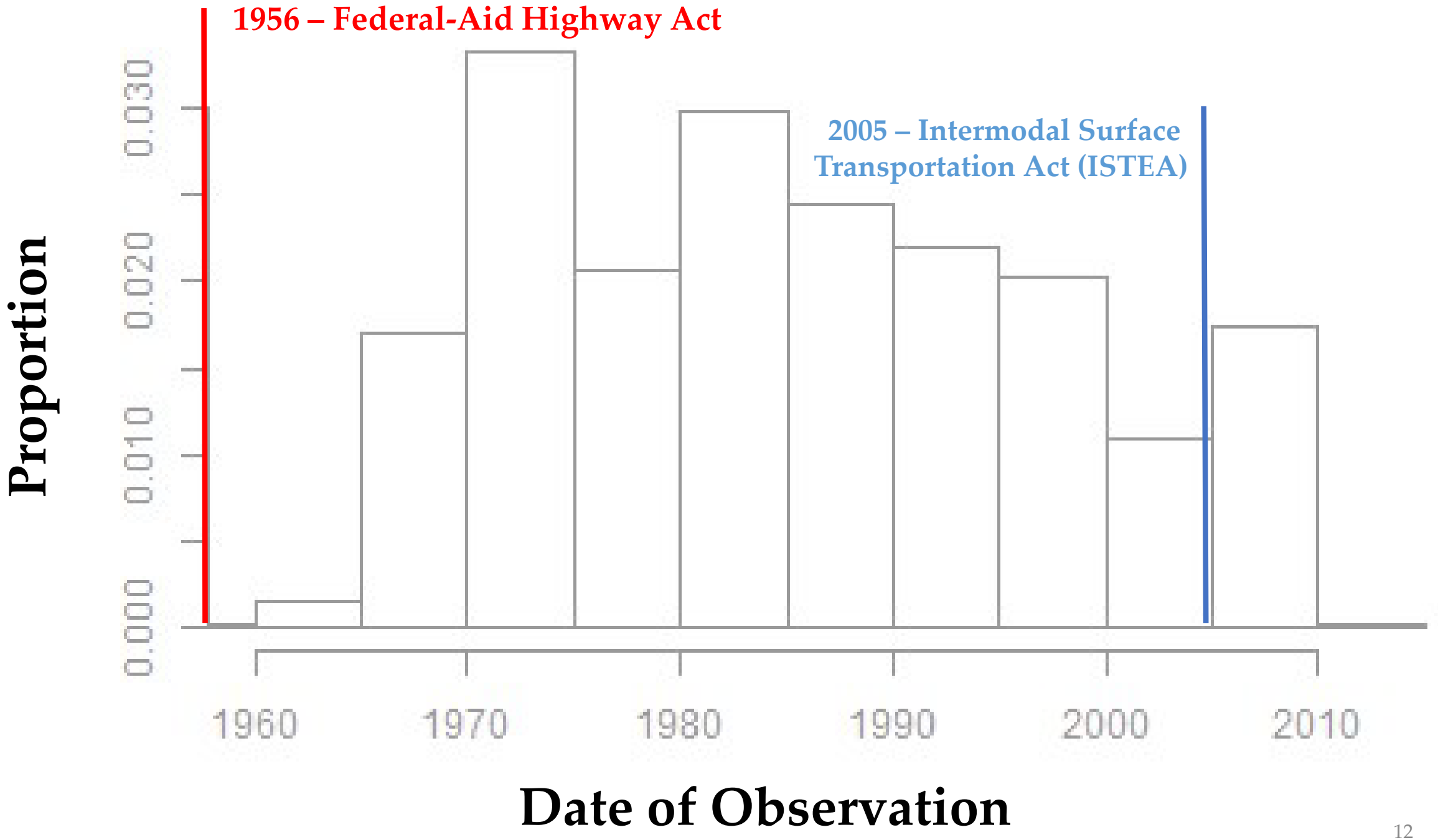
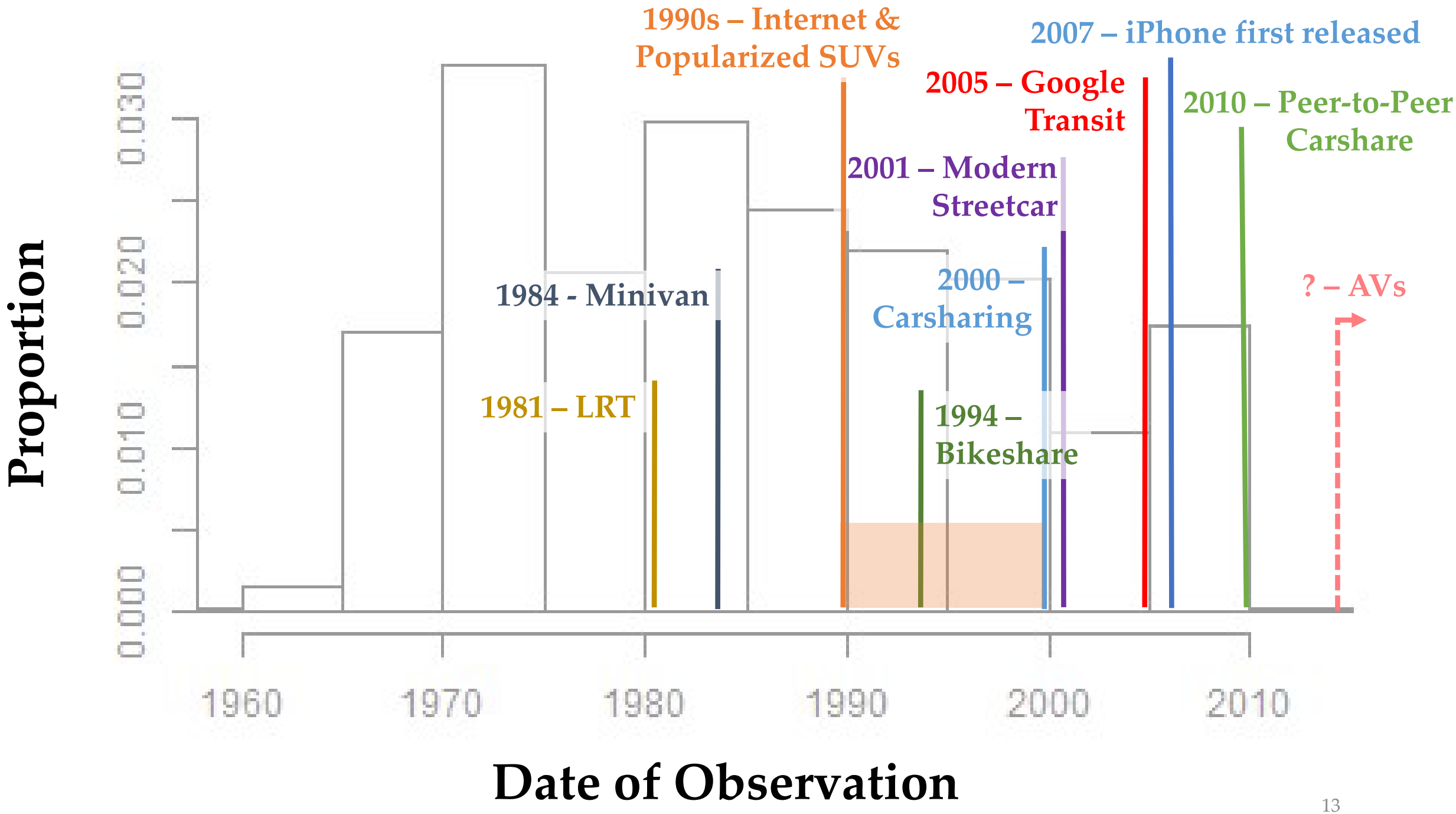

1985 - Average age of data – 32 years
1986 – I was born
Proportion
0.000
0.010
0.020
0.030
1960
1970
1980
1990
2000
2010
Date of Observation


1973 – Energy Crisis
2000 – Dotcom Bubble
2008 – Housing Bubble
Proportion
0.000
0.010
0.020
0.030
1960
1970
1980
1990
2000
2010
Date of Observation


1956 – Federal-Aid Highway Act
2005 – Intermodal Surface Transportation Act (ISTEA)
Proportion
0.000
0.010
0.020
0.030
1960
1970
1980
1990
2000
2010
Date of Observation


1990s – Internet & Popularized SUVs
2007 – iPhone first released
2005 – Google Transit
2010 – Peer-to-Peer Carshare
2001 – Modern Streetcar
2000 – Carsharing
? – AVs
1984 - Minivan
1981 – LRT
1994 – Bikeshare
Proportion
0.000
0.010
0.020
0.030
1960
1970
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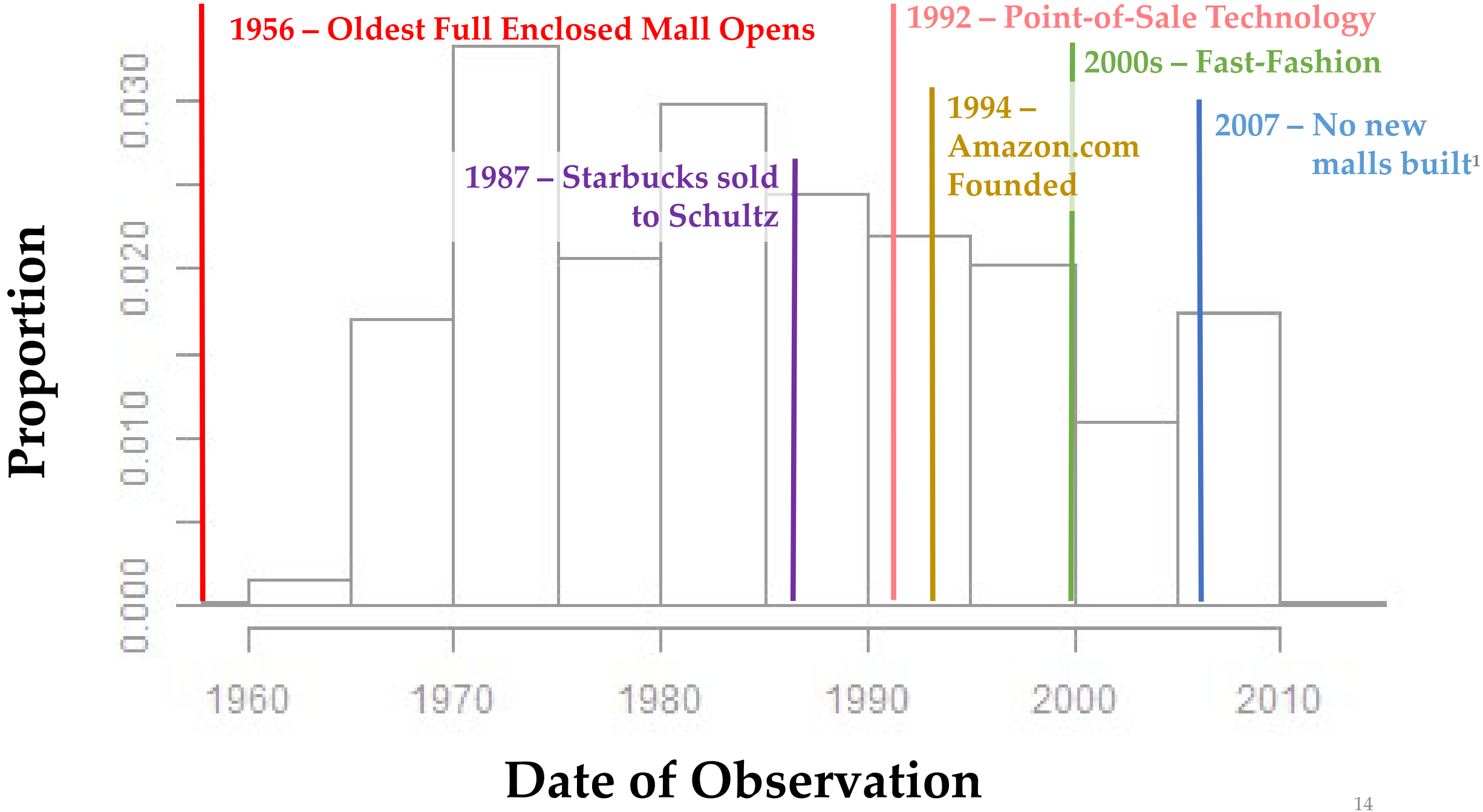
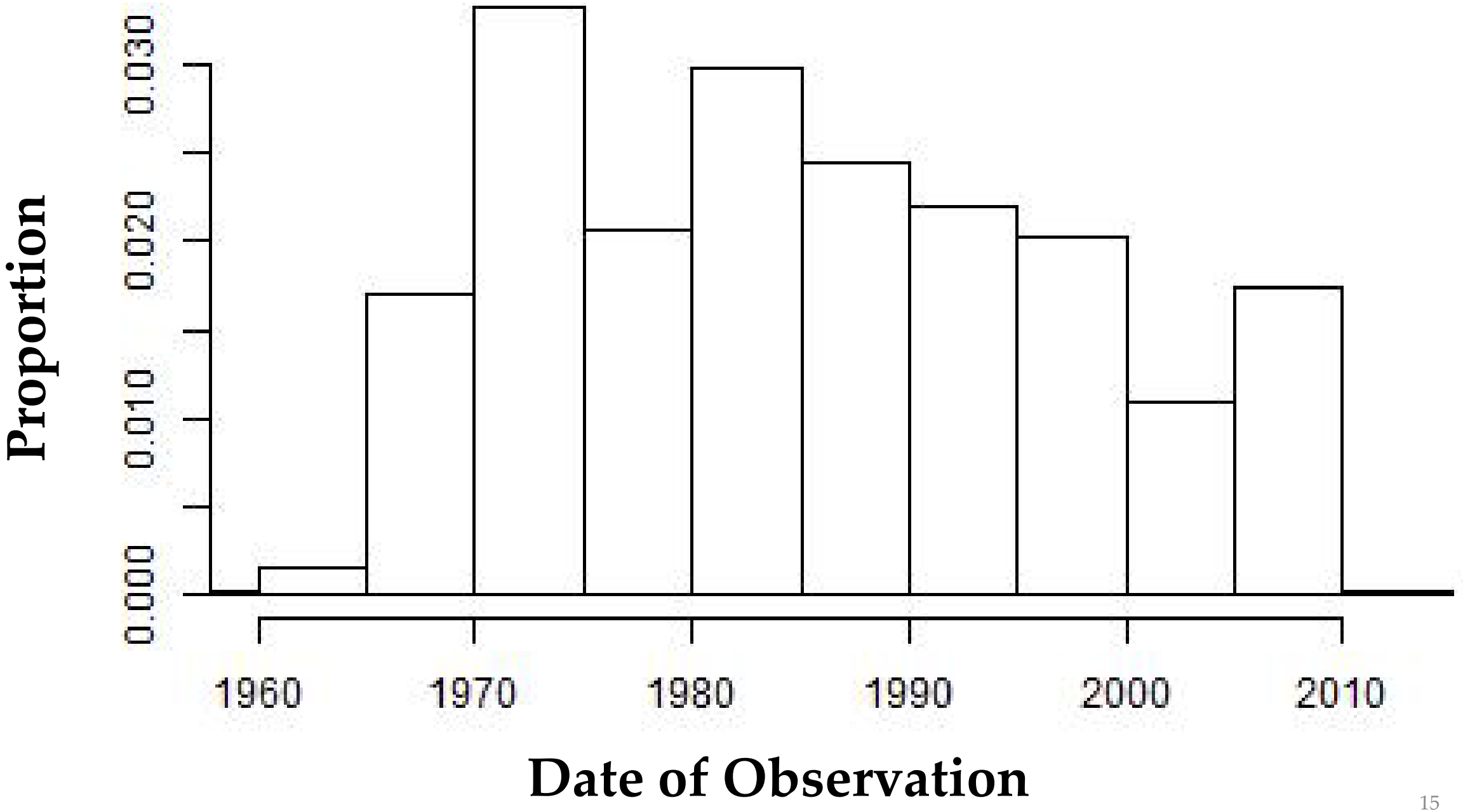


[1] *http://www.bbc.com/culture/story/20140411-is-the-shopping-mall-dead*


Proportion
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Problems in Data And Methods


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Not consistent with theory


All urban environments


Only estimate vehicle trips


Inability to link to goals & plans


Changes over the day, week, season


Clearer distinctions for land use types

Limited Statistical Rigor


All modes


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Rely on too many assumptions


Focus on peak hour


Vehicle occupancy


Who are the People


Travel time


Cannot compute new performance measures

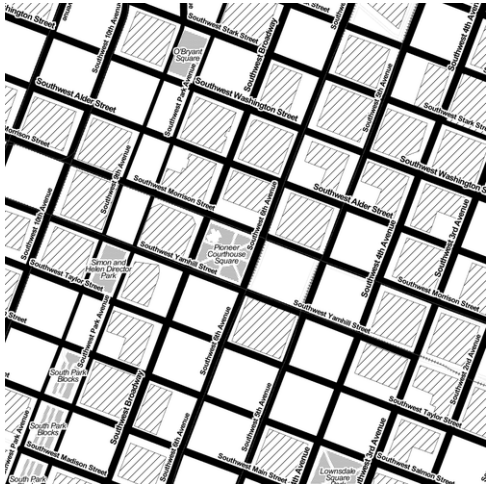

No access


Site & immediate environment

Data gaps limit advancement of new methods

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

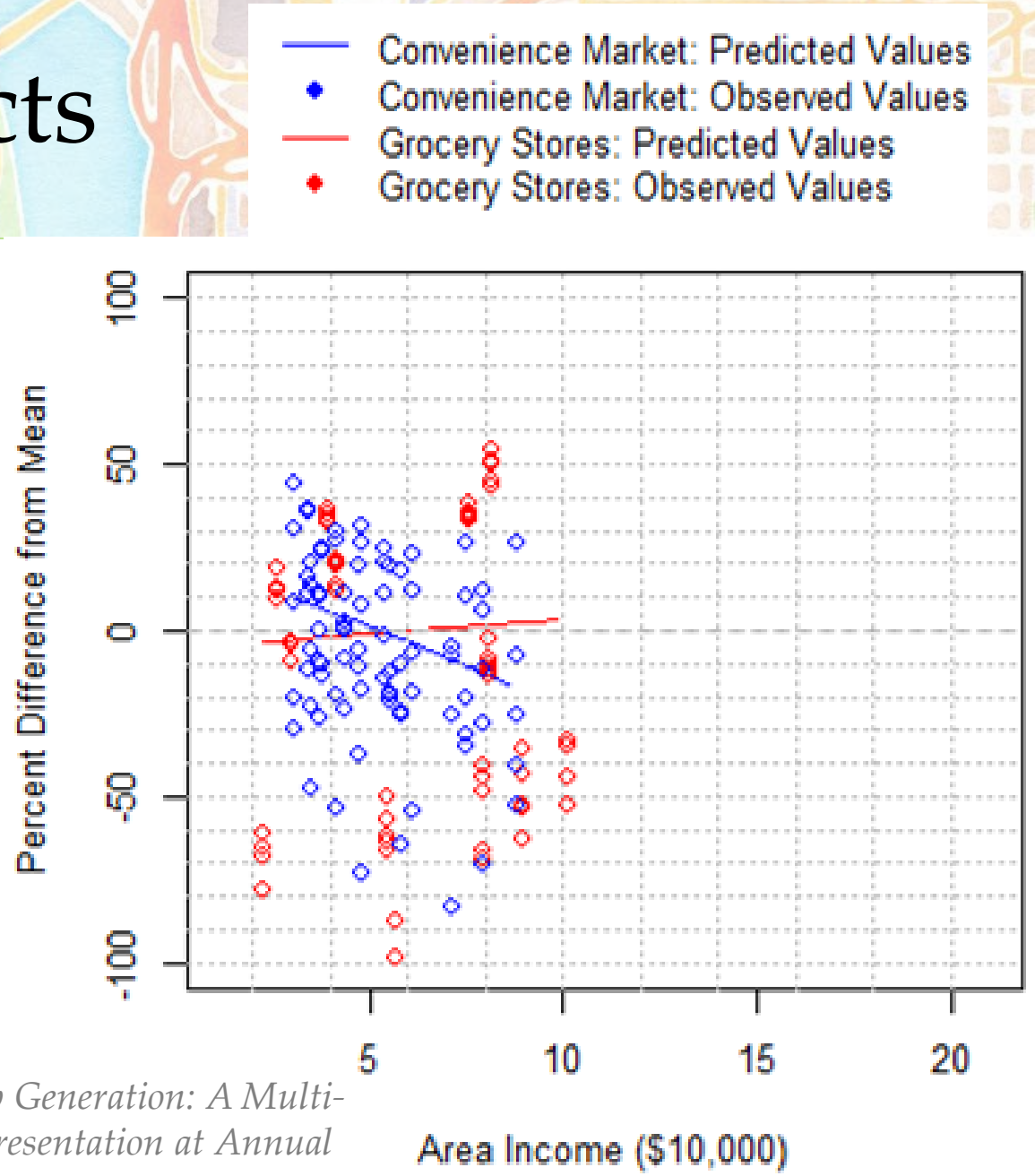


Site-level Attributes

- Range of variables not including meta-data
  - E.g., parking, pricing, orientation, set-backs, 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



Currans, K. M. & Clifton, K. J., 2017. Accessibility, Income, and Person Trip Generation: A Multi-level Model of activity at Food Retail Establishments in Portland, Oregon. Presentation at Annual Meeting of the Transportation Research Board.

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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

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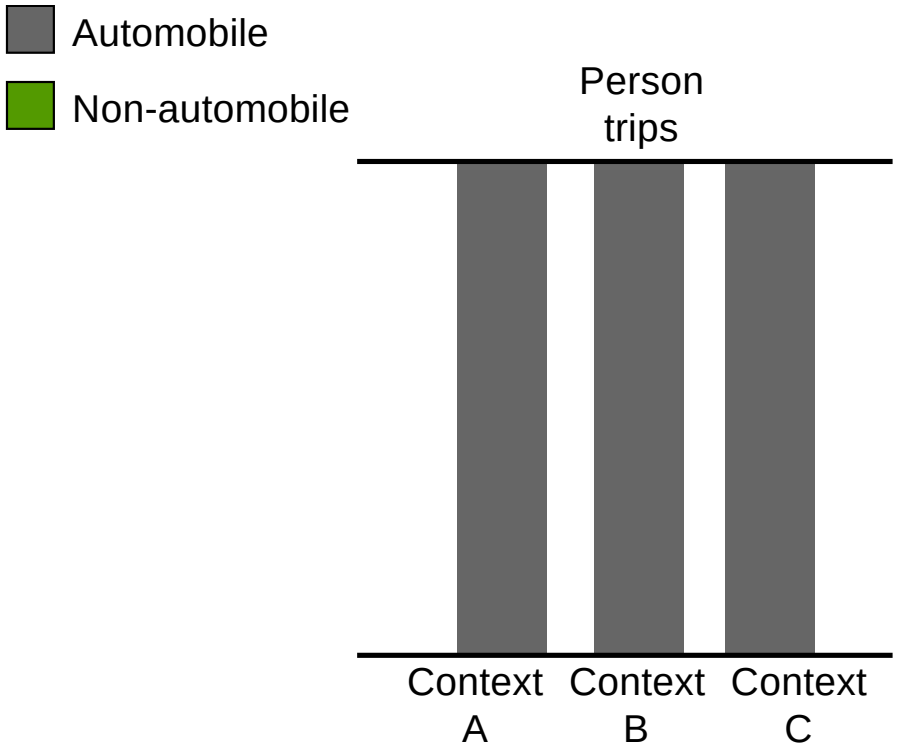
Person Trips



State-of-the-Practice

State-of-the-Art
Assumption No. 1

State-of-the-Art
Assumption No. 2

Clifton, Kelly J.; Currans, Kristina M. and Muhs, Christopher D. Adjusting ITE's Trip Generation Handbook for Urban Context. Journal of Transport and Land Use, Vol. 8, No. 1, 2015, pp. 5-29.

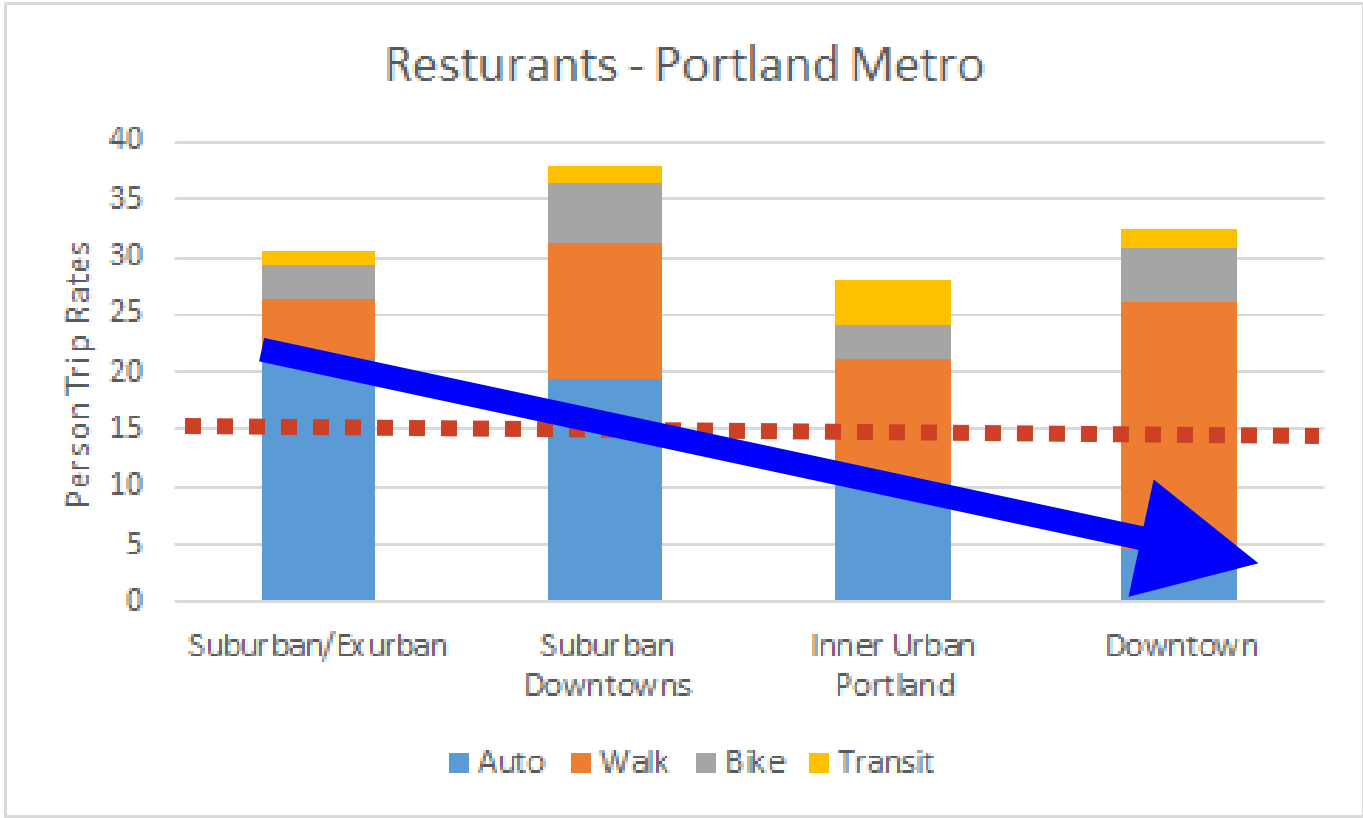
Do person trips vary?

Restaurants in Portland

Examining average person trip rates by mode

Vehicle trips decreases

Person trips vary



Discussion from Currans, Kristina. Accessibility, Income, and Person Trip Generation: A Multi-Level Model of Activity at Food Retail Establishments in Portland, Oregon. In development.

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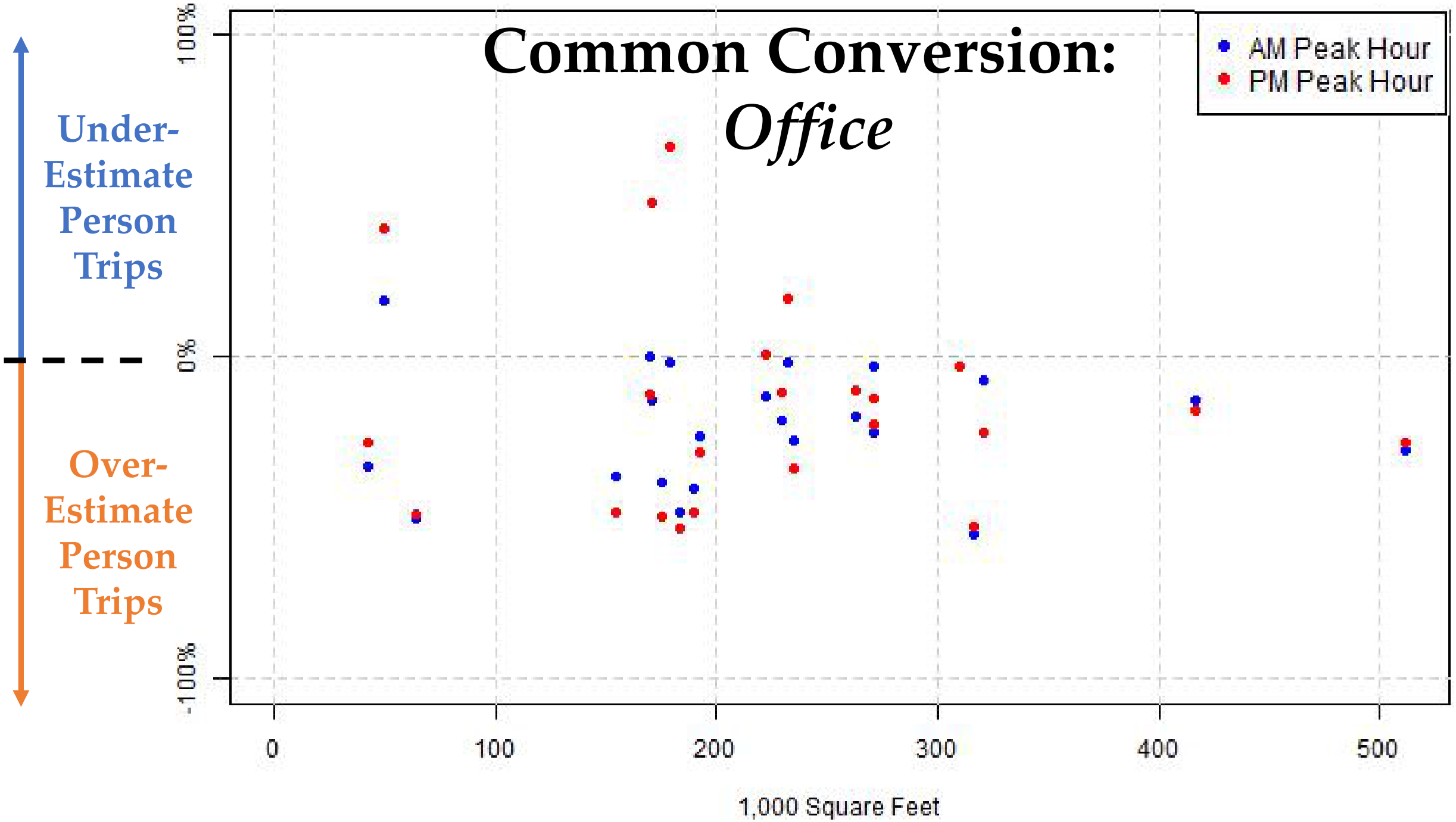
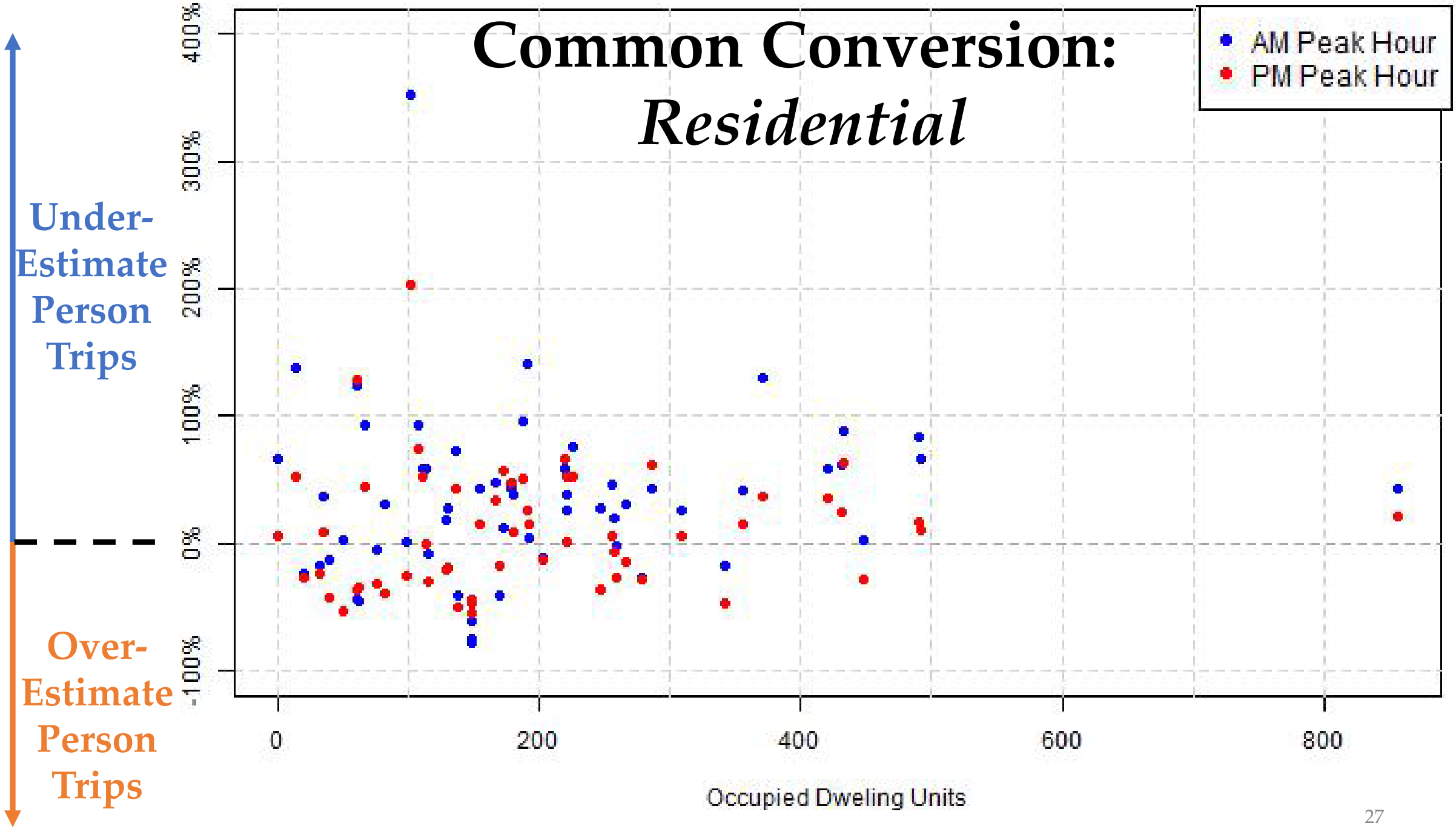
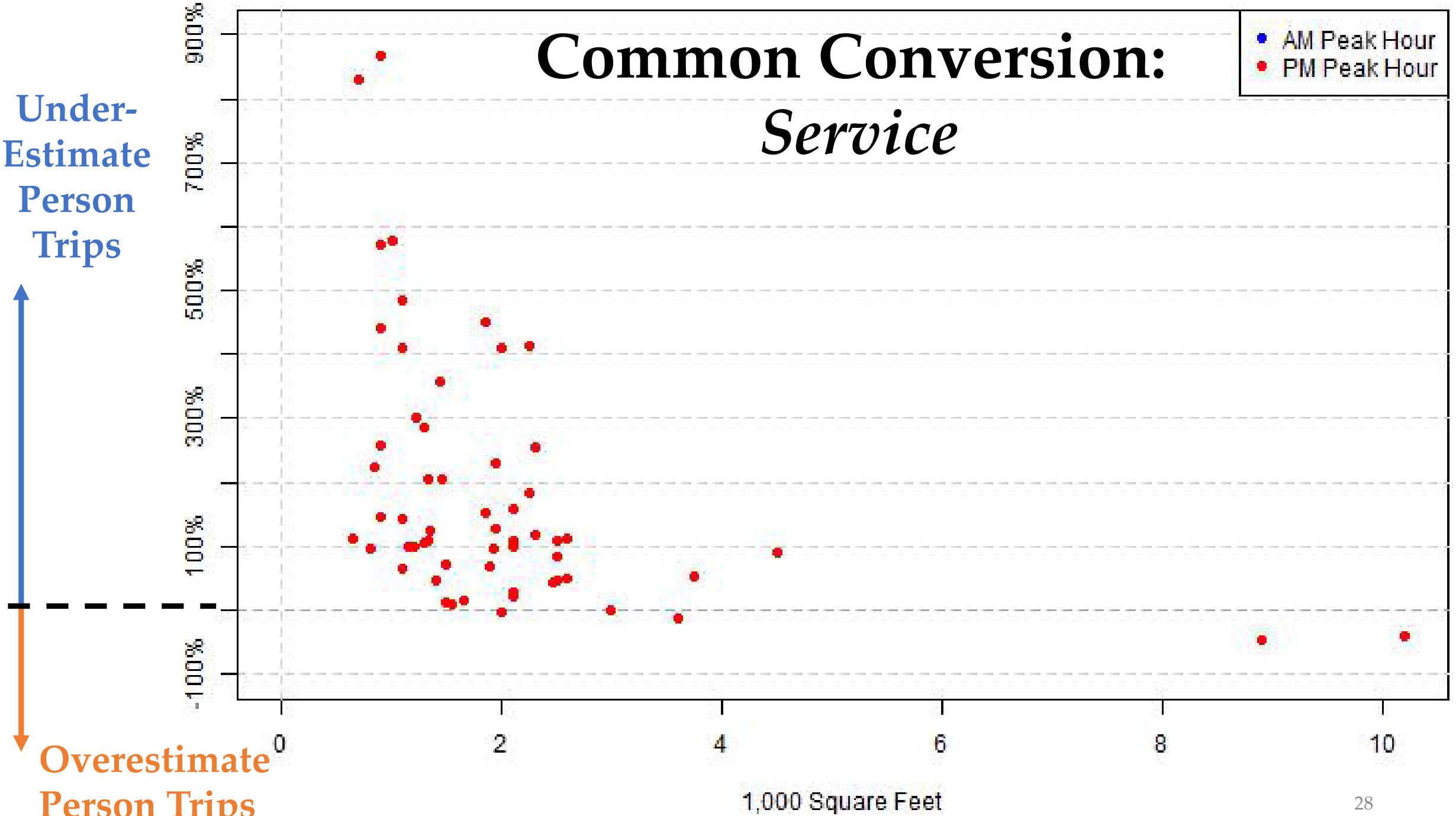
Common Conversion: *Office*



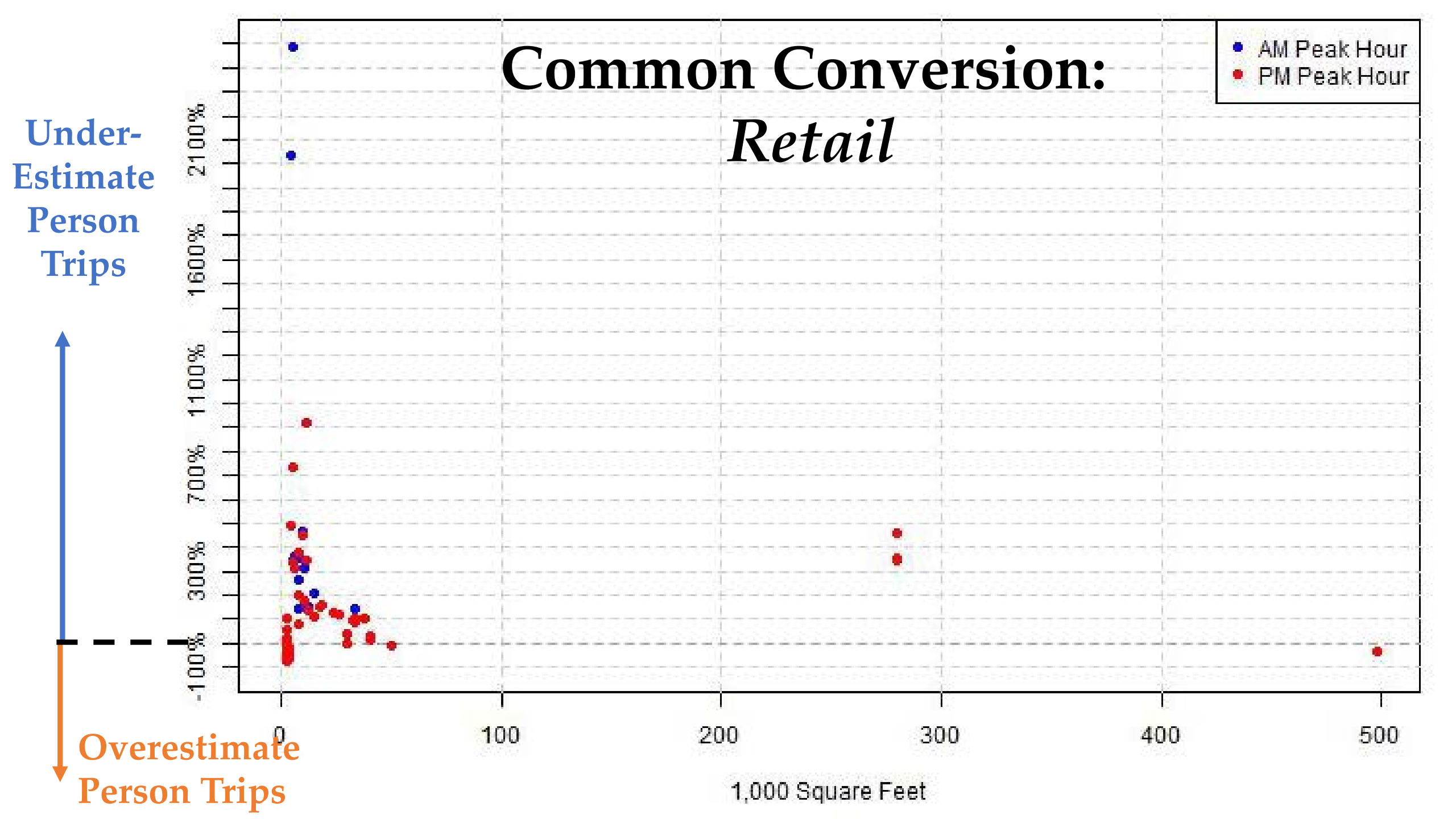
Common Conversion: *Residential*



Common Conversion: *Service*



Common Conversion:
Retail



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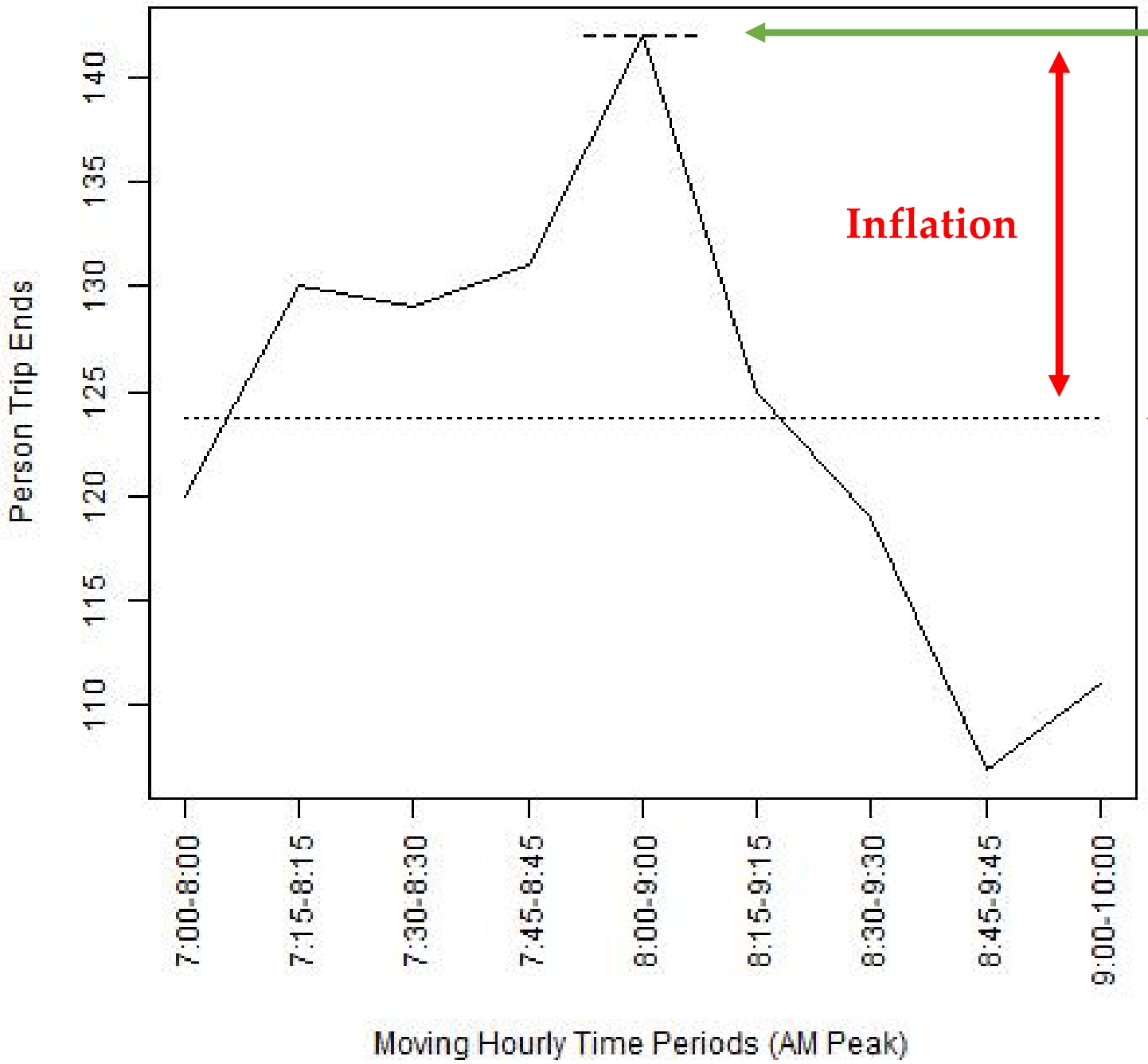
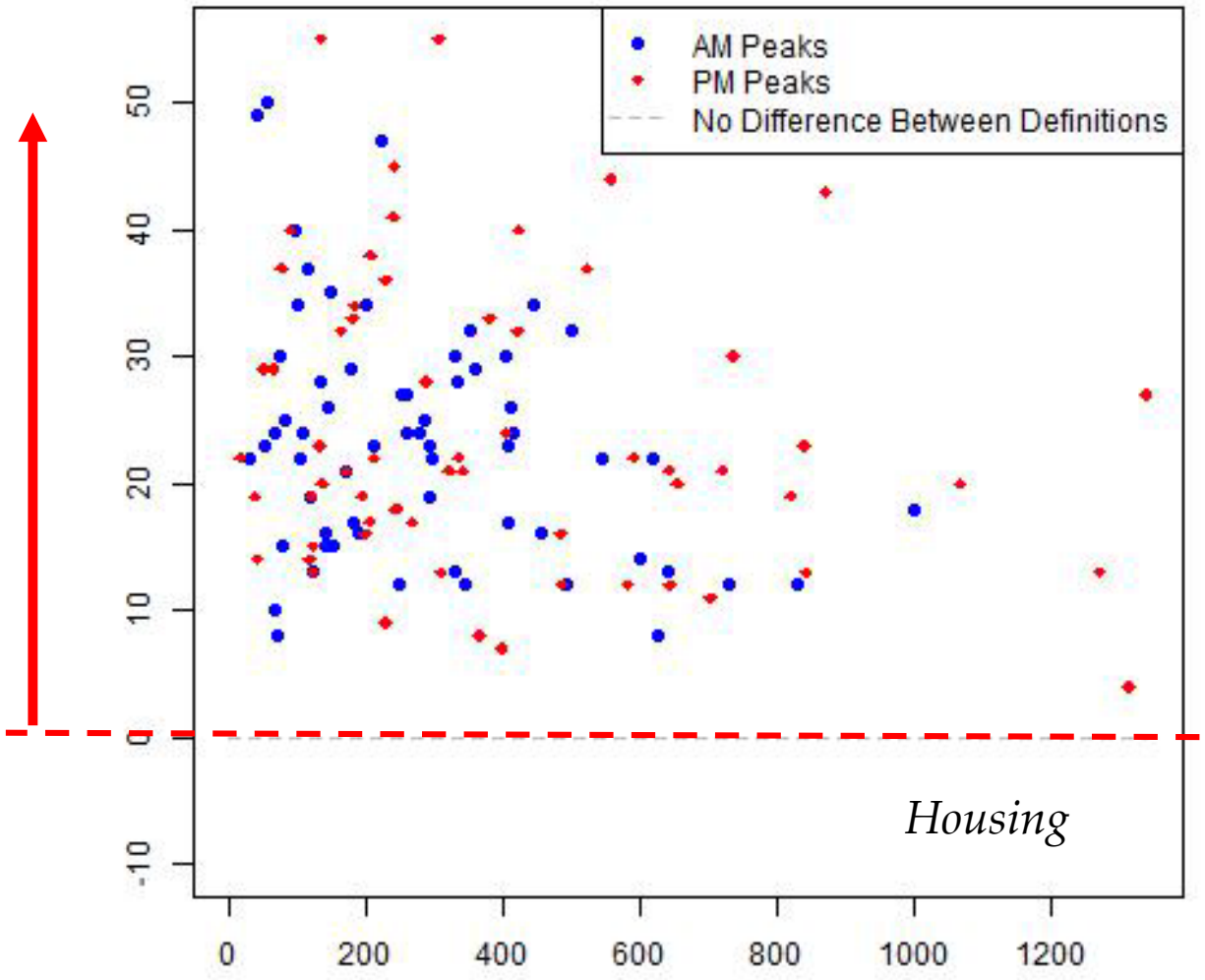


ITE's Peak Hour Maximum

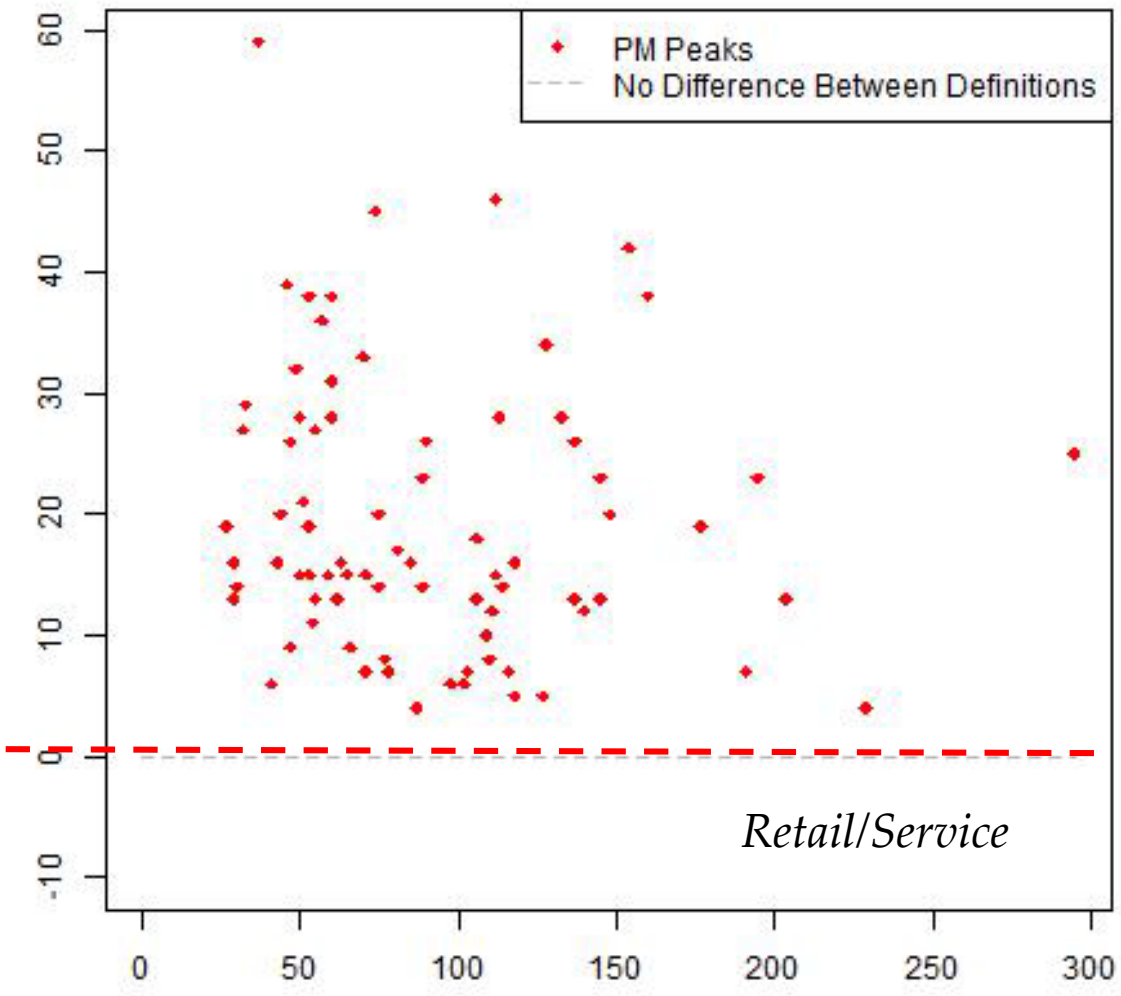
Inflation

Average Peak Hour

% Inflation

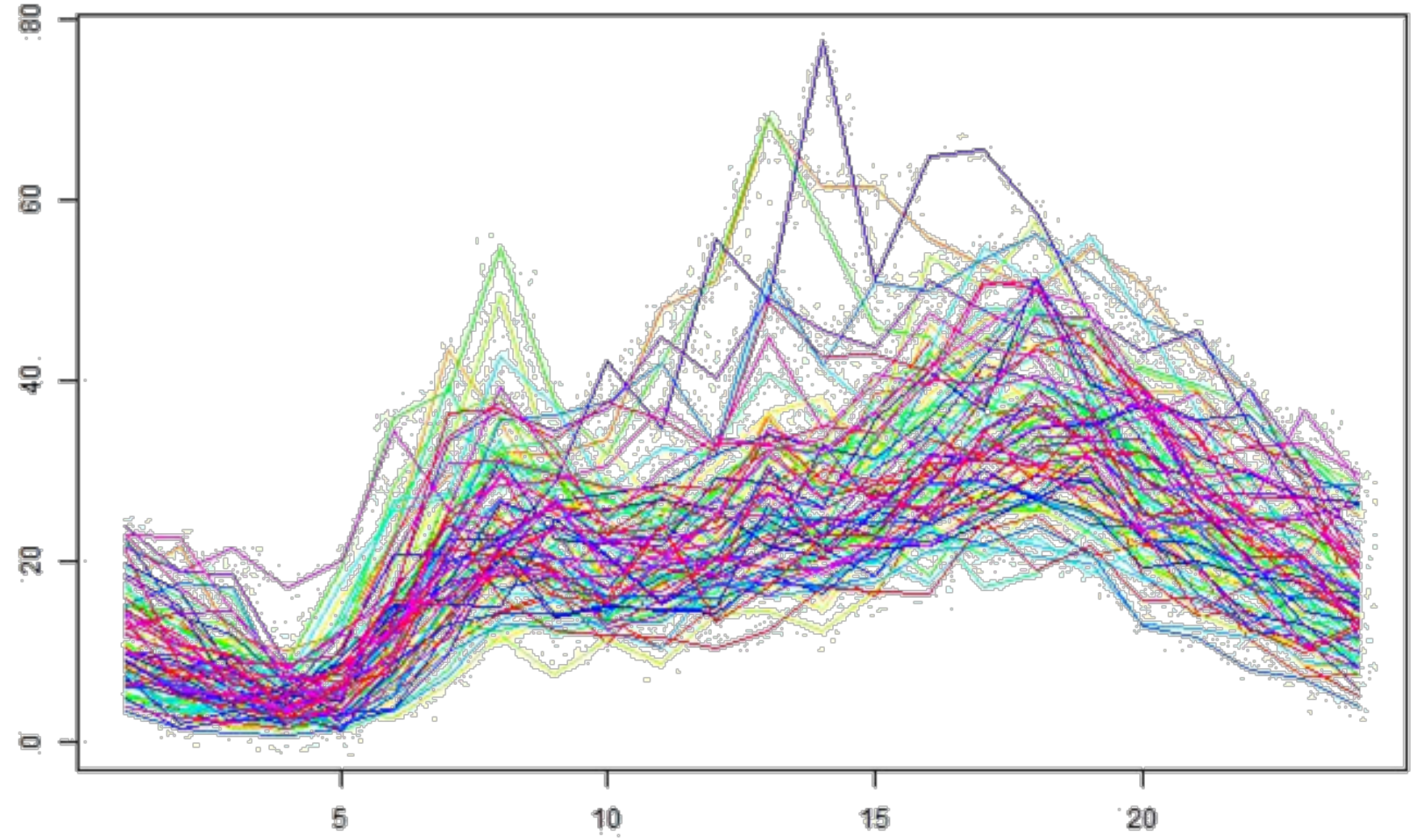


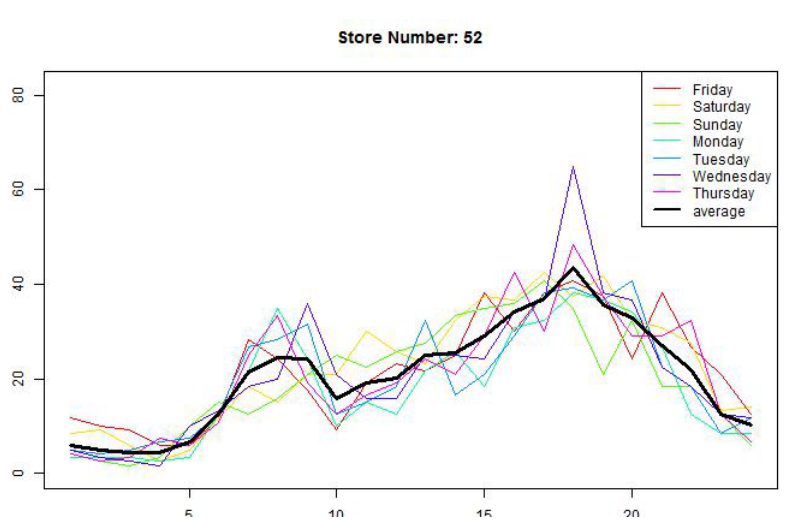
Trips by ITE's Definition

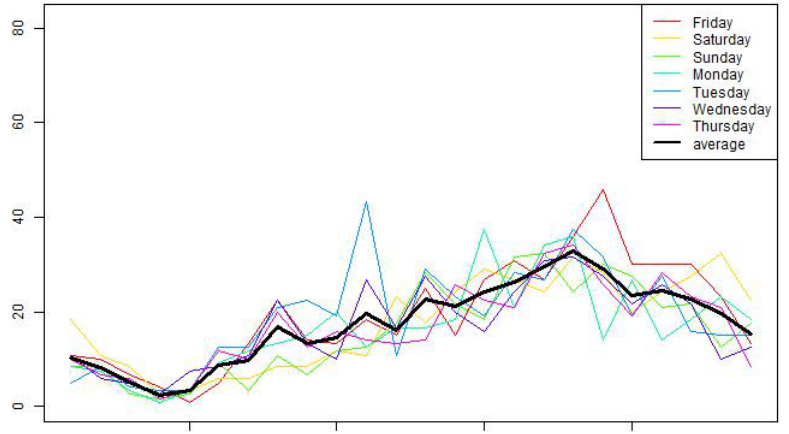


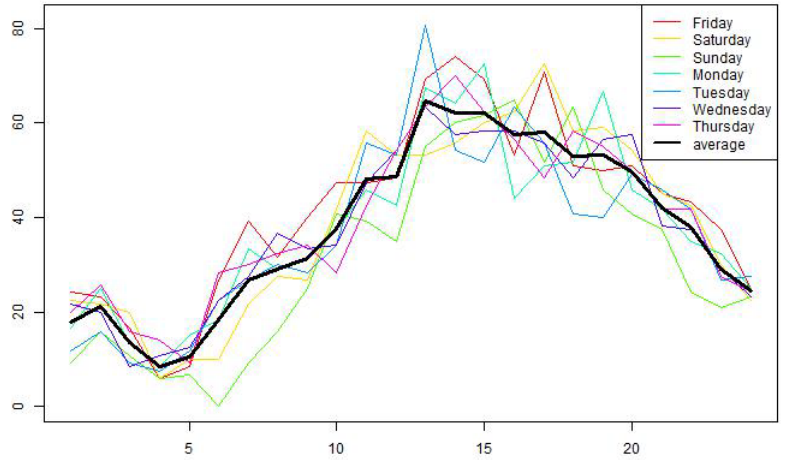
Trips by ITE's Definition

How do they vary in time?







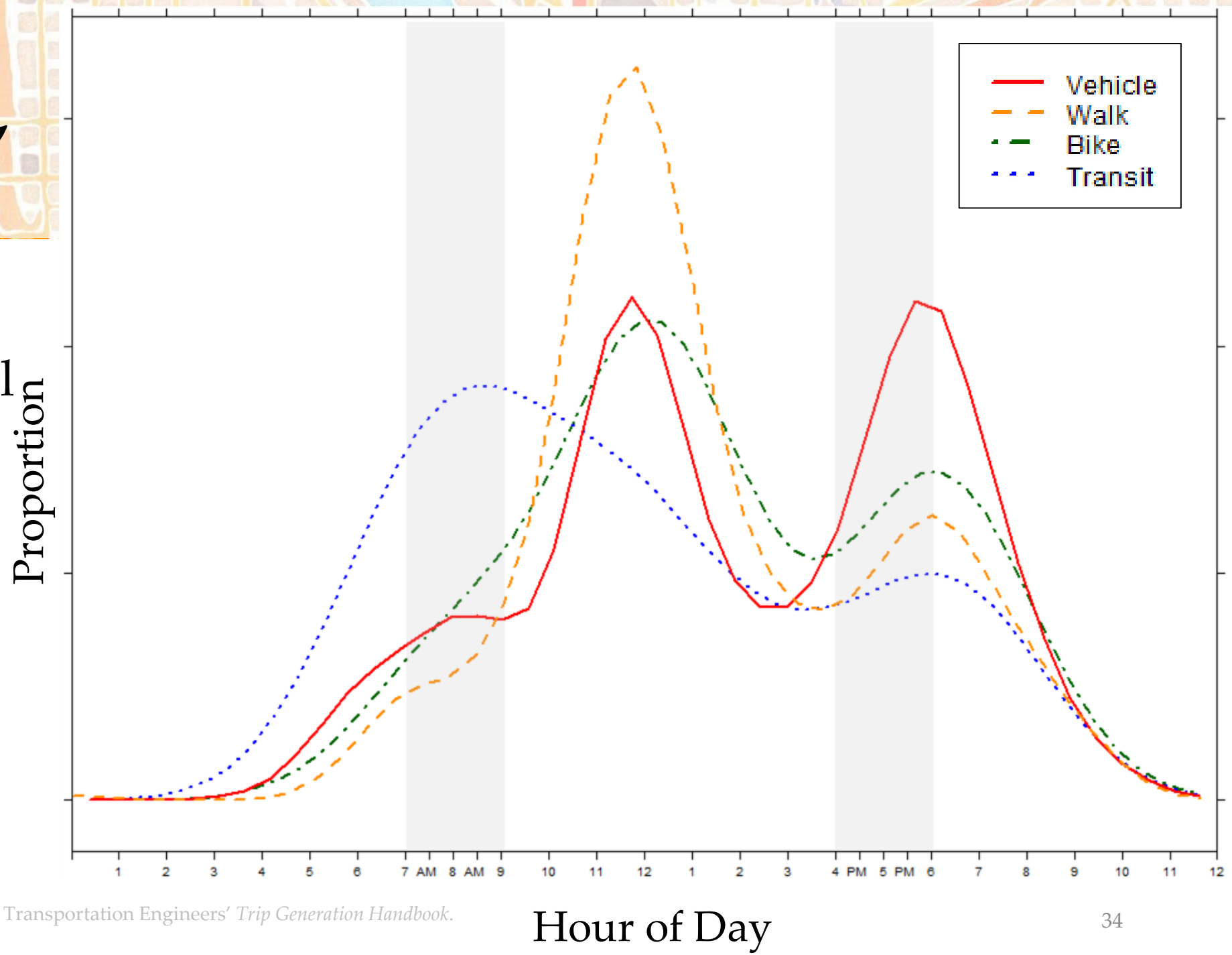


Modal "Peak Hour"

- Puget Sound Regional Council Household Travel Survey

- Dining Out

N	
Bike	20
Transit	54
Vehicle	3,228
Walk	533



Clifton, Currans, & Muhs. Evolving the Institute of Transportation Engineers' *Trip Generation Handbook.* http://trrjournalonline.trb.org/doi/10.3141/2344-12

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Predictions Distributions

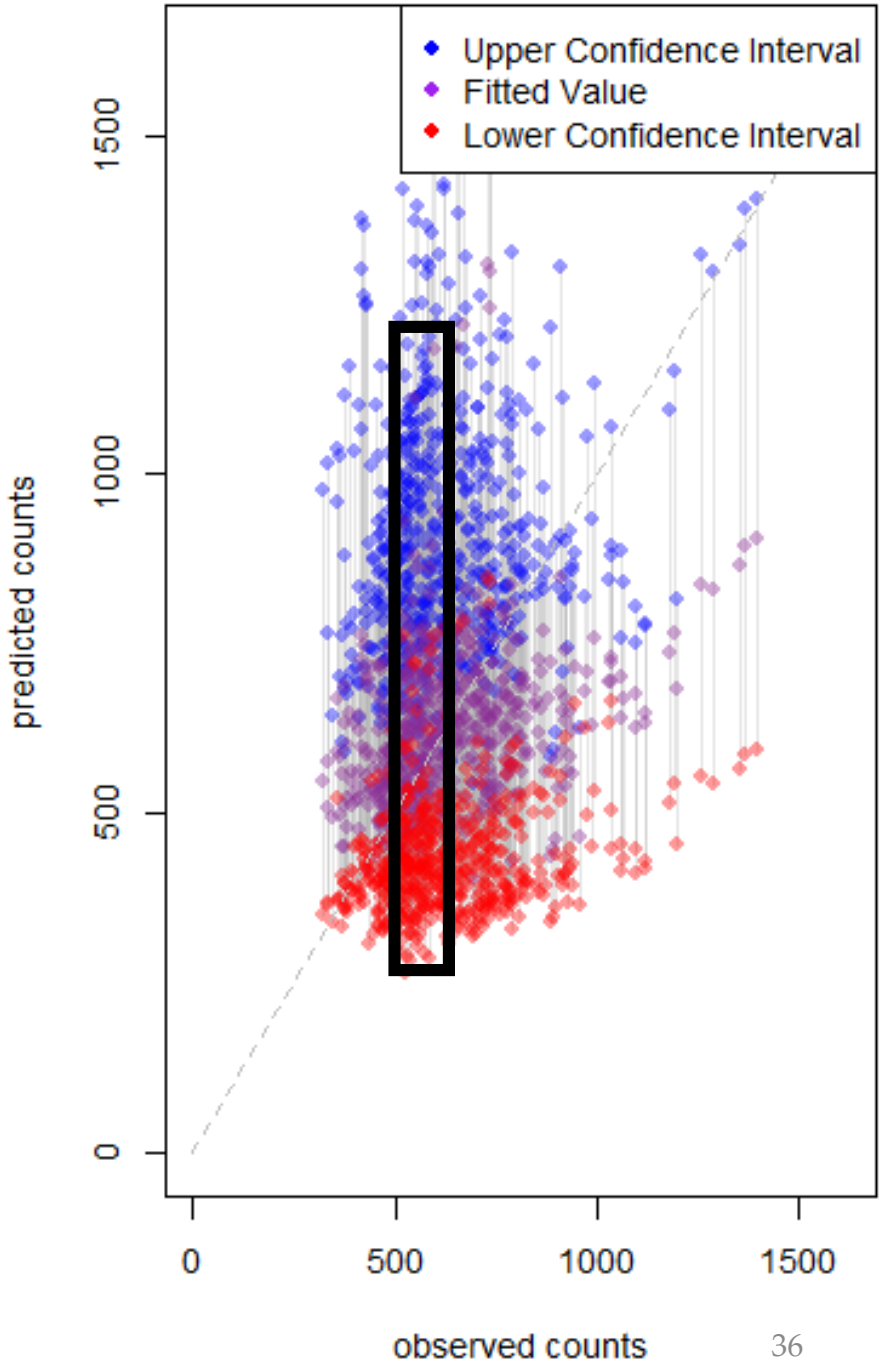
A single prediction may derive an average estimate of **550 counts** with a 95% confidence interval of **350 to 1250 counts**.

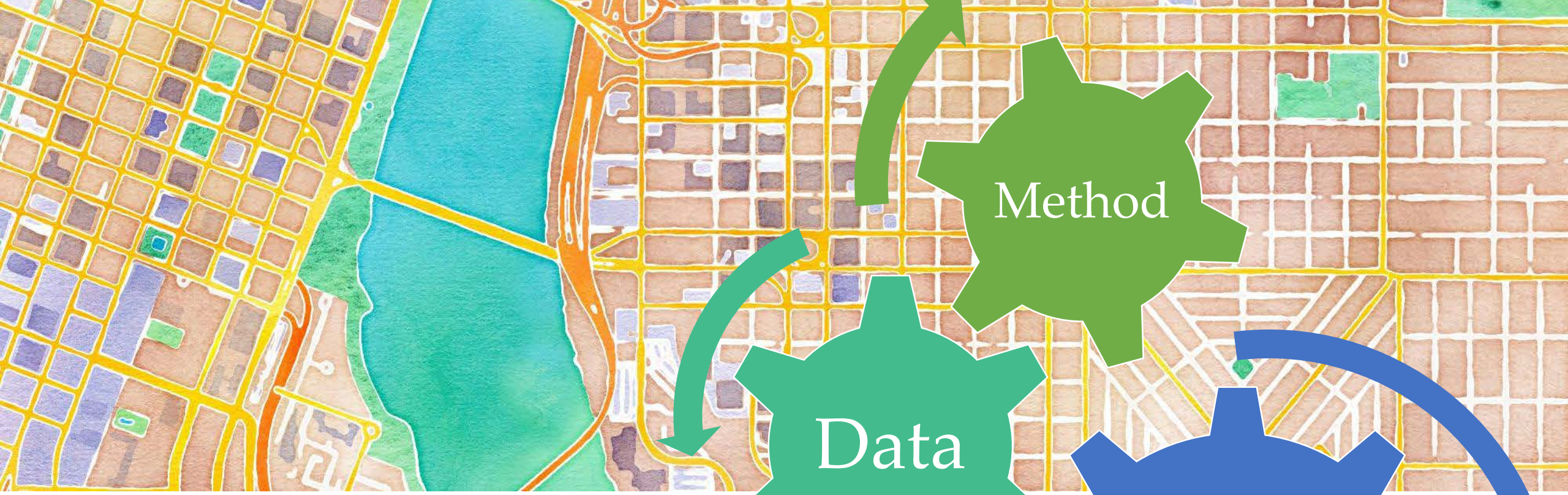
If 550 counts just barely warrants that adjacent street must be widened, that implies that approximately 50% of the time the warrant would apply (and 50% it wouldn't).

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?



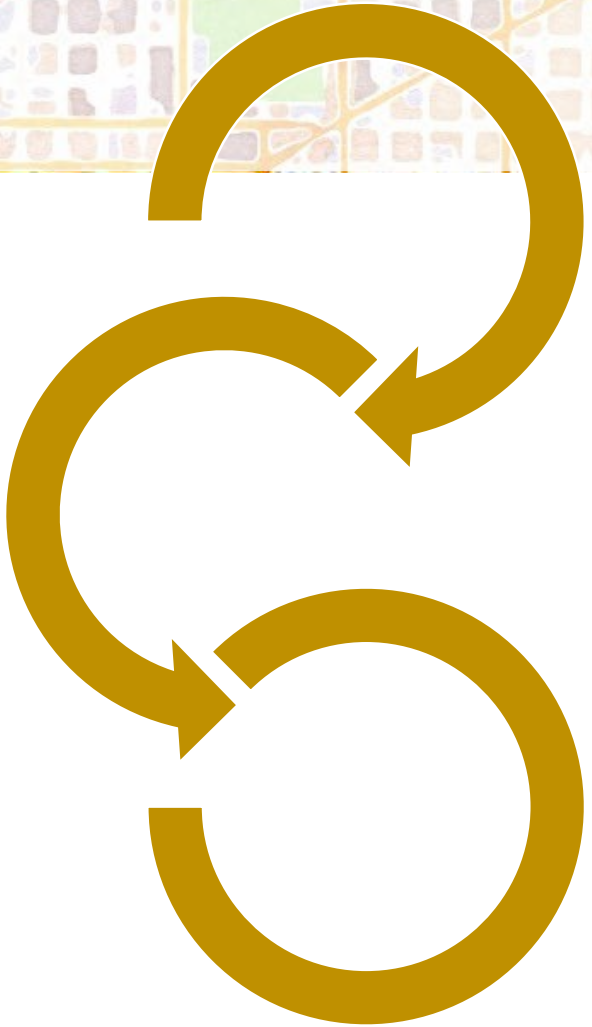


Mechanisms for Change

Conclusions

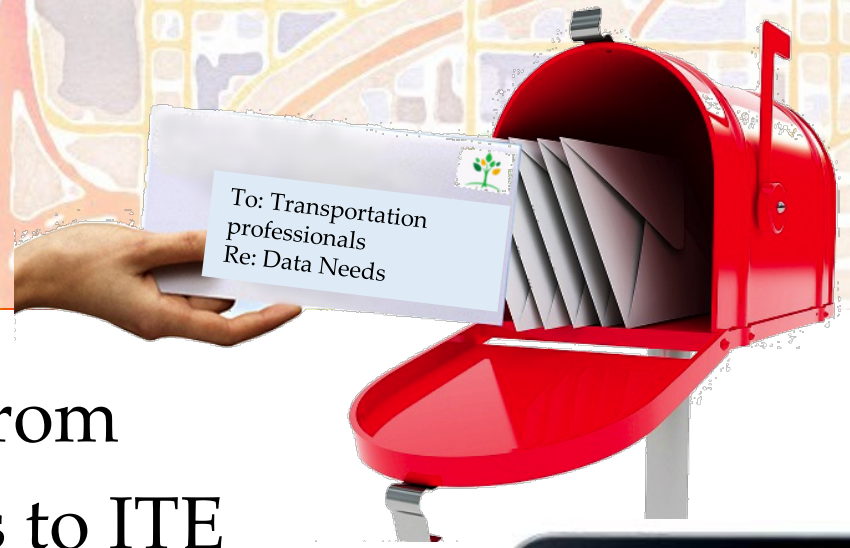
Relationships

- 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?



Bochner, Brian S.; Currans, Kristina M.; Dock, Stephanie P. et al. Advances in Urban Trip Generation Estimation. Institute of Transportation Engineer's Journal, (2016).

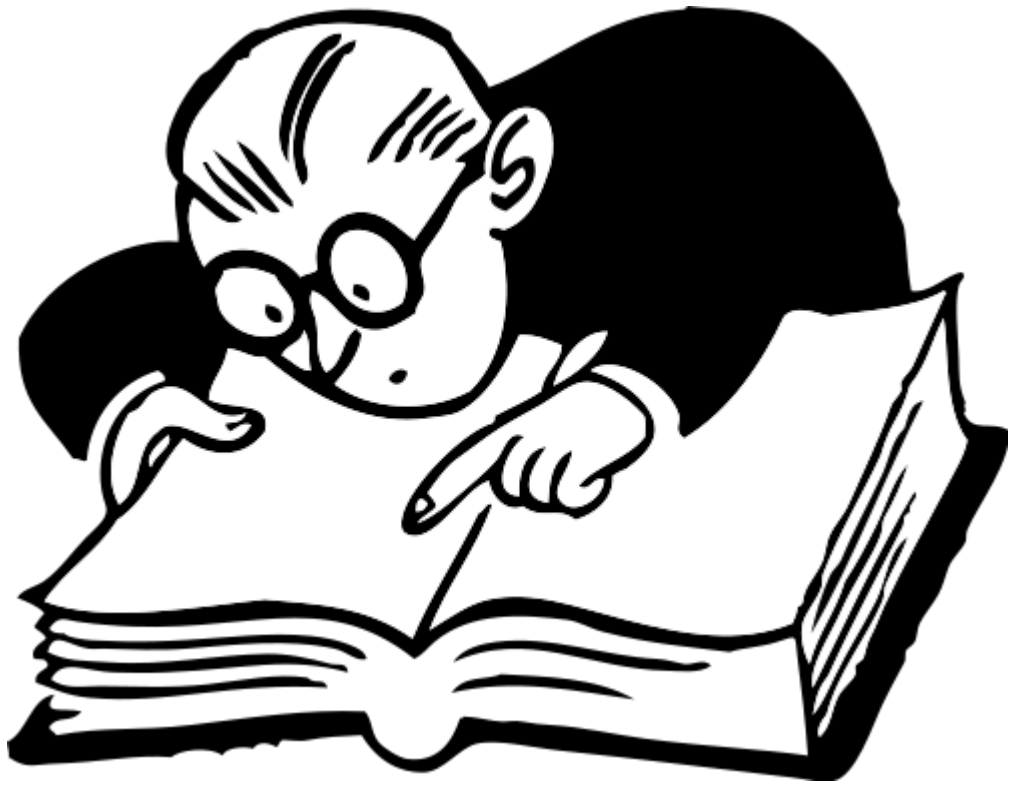
Invest in the data you use



- 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

Institute of Transportation Engineer's Expert Panel on Urban Trip Generation. Urban and Person Trip Generation. White Paper published by Institute of Transportation Engineers, (forthcoming, 2016).

Continue to Study the Data We Have/Use



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