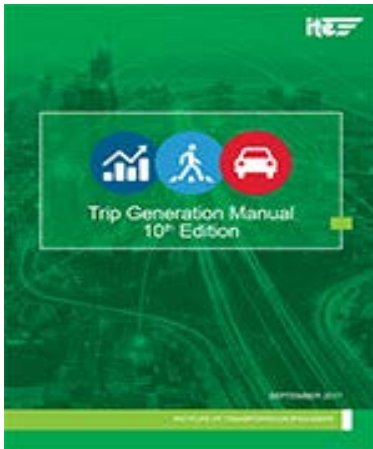


PSOMAS



TRIP GENERATION MANUAL



Changes in Residential Trip Generation and 10th Edition of ITE Trip Generation

Darlene Danehy and Alejandro Angel

Arizona ITE - November 16, 2017

Presentation Outline

- ITE Trip Generation Manual
 - History and Background
- Residential Case Study
 - Study Sites
 - Trip Generation Rates
 - Implications
- Trip Generation 10th Edition
 - Development process
 - New features (online tool, filtering, person trips)
 - Improving Trip Generation www.itedatasubmission.org
- Conclusions

ITE Trip Generation Manual

History and Background

ITE Trip Generation Manual

- 1st Edition published 1976
 - 9th Edition → published 2012
 - 10th Edition → October 2017
- Data collected throughout U.S. and Canada
- Dozens of land use types
- Variety of independent characteristics
 - Building size
 - Number of residential units
 - Students
 - Employees
 - Vehicles

ITE Trip Generation Manual

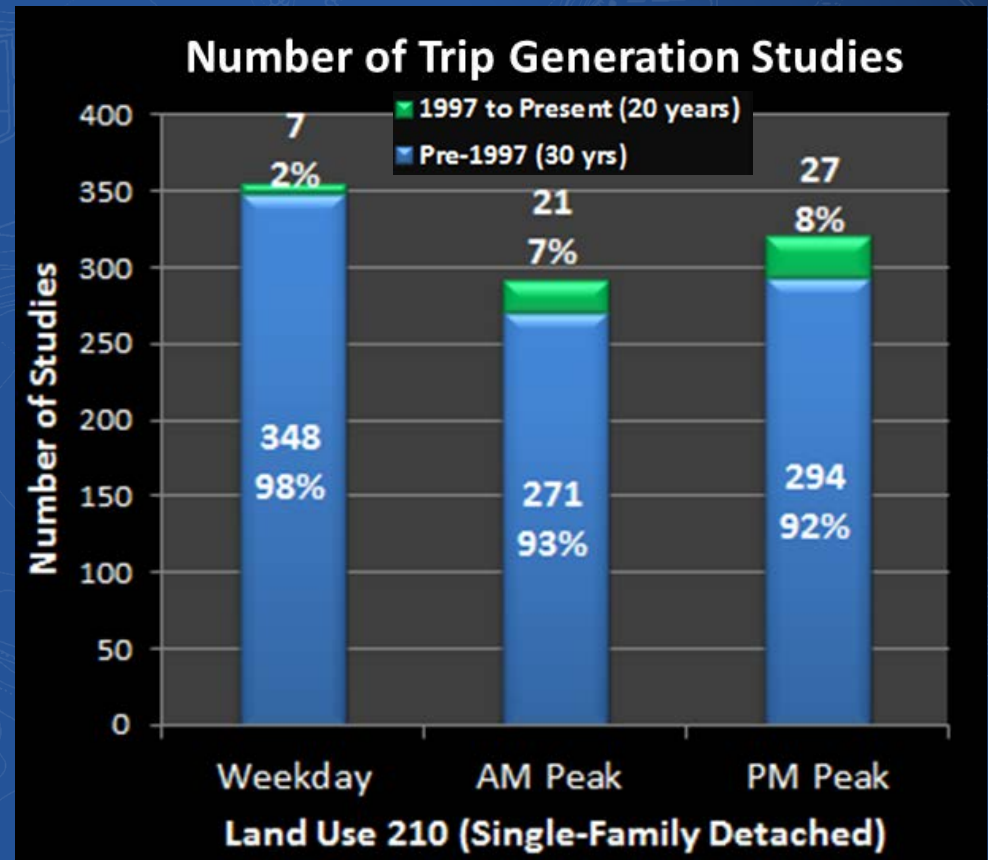
- Single Family Residential Land Uses
 - Land Use 210 – Single-Family Detached Housing
 - Detached housing
 - Typically suburban sites
 - Land Use 270 – Planned Unit Development (PUD)
 - Any combination of residential land uses
 - May include limited retail and recreational facilities



ITE Trip Generation Manual

Before 10th Edition

- Single-Family Detached Housing (Land Use Code 210)
 - Data collected between 1960s and 2000s
 - More than 300 studies

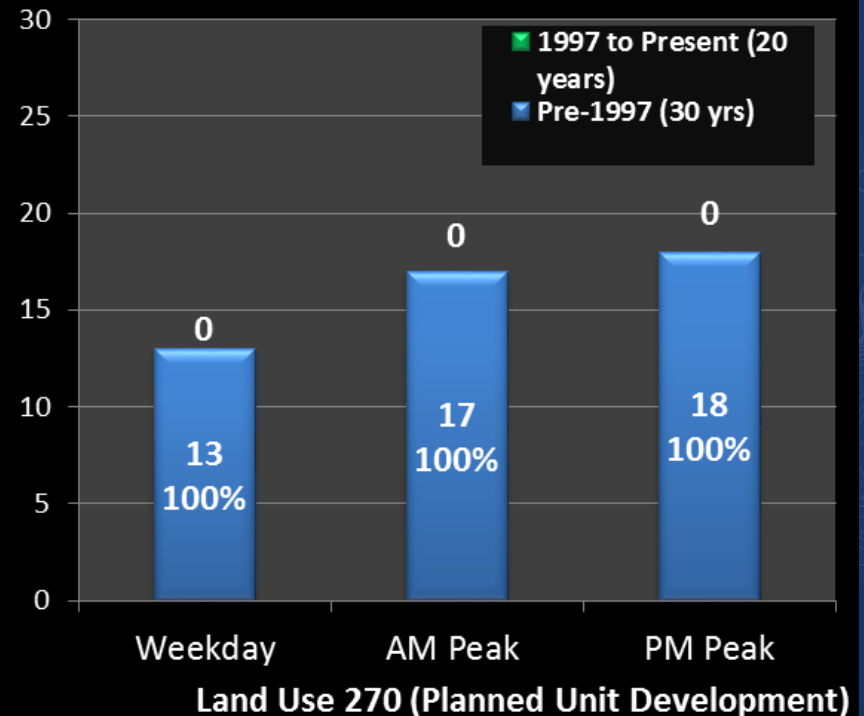


ITE Trip Generation Manual

Before 10th Edition

- Planned Unit Development (Land Use Code 270)
 - Data collected between late 1970s and mid-1990s
 - 13 weekday studies
 - 17-18 peak hour studies
 - No studies since 1997

Number of Trip Generation Studies



Changes in travel patterns

- Telecommuting¹
 - Employee population grew 1.9% from 2013 to 2014
 - Telecommute employees increased 5.6% in the same year
- Flexible schedules
- Trip chaining
- Online shopping
- Increase in cycling commuters
 - Between 2008 and 2012, 60% increase²
- Return to downtown/urban living

¹<http://globalworkplaceanalytics.com/telecommuting-statistics>

²<https://www.usatoday.com/story/news/nation/2014/05/08/bike-commuting-popularity-grows/8846311/>

Comparison Between 1997 and 2017

- 1997
 - E-commerce was just beginning
 - E-Bay exploded with Beanie Babies frenzy
 - Amazon Revenue \$148M
 - People went to banks and movies
 - Gasoline - \$1.19/gallon
 - First Harry Potter book was released
- 2017
 - E-commerce has seen steady growth¹
 - 10% of total retail sales
 - 58% shop online
 - Amazon Revenue \$180B
 - Check deposit by phone and Netflix
 - Gasoline - \$2.31/gallon
 - Peak in 2008 around \$4.00/gallon
 - Harry Potter has been printed in 73 languages

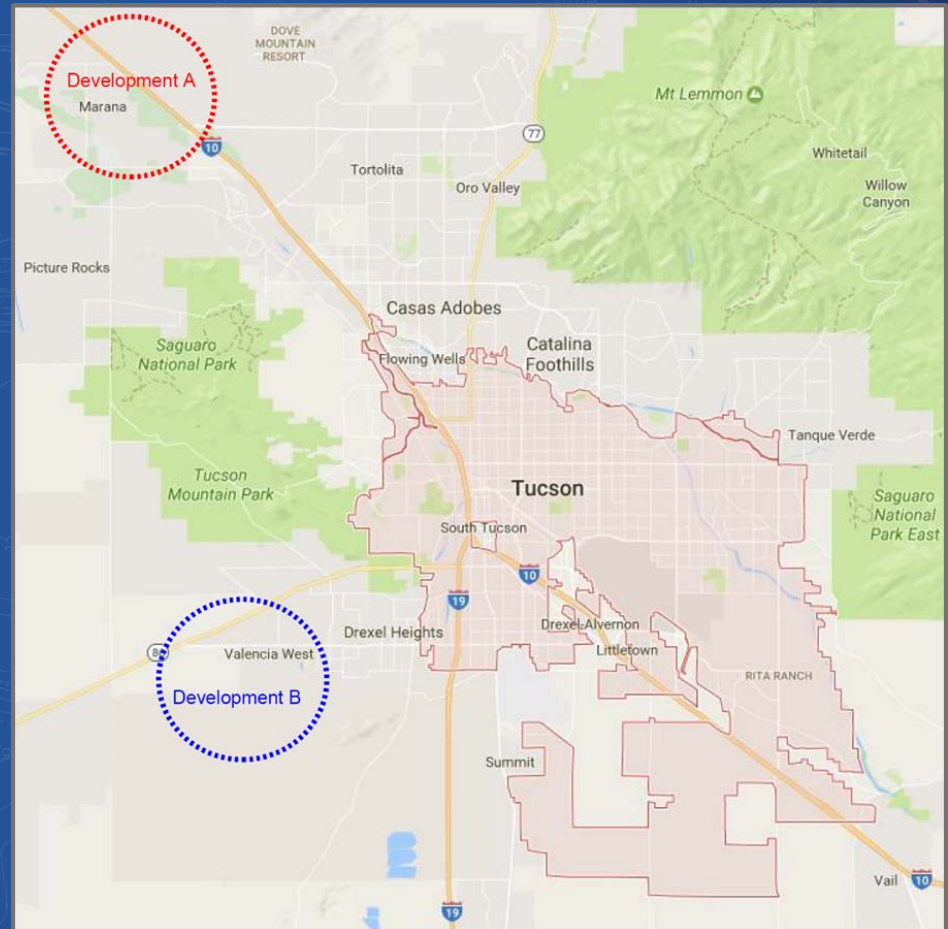
¹<https://www.iacquire.com/blog/study-online-shopping-behavior-in-the-digital-era>

Residential Case Study

Greater Tucson Area

Field Observations – Study Sites

- Two Sites on outskirts of Tucson, AZ
 - Development A
 - Marana area
 - 800 completed units
 - Development B
 - Unincorporated Pima County
 - 1,700 completed units
- Both have limited access points



Trip Generation Rates – ITE 9th Edition

- Single-Family Residential and PUD
 - Average Rates (9th Edition)

Land Use (ITE Land Use Code)	Trips/Unit			AM		PM	
	AM	PM	Daily	% in	% out	% in	% out
Single-Family Detached (210)	0.75	1.00	9.52	25%	75%	63%	37%
Planned Unit Development (270)	0.51	0.62	7.50	22%	78%	65%	35%

- PUD rates are 22-32% lower than Single Family Detached
- Ingress/Egress splits are similar

Trip Generation Rates – Field Data

- Development A
 - 24-hour tube count on one roadway in 2016
 - Only access to development
- Development B
 - 24-hour tube counts in 2013 on one roadway
 - Only one access at the time, before school was constructed
 - 24-hour tube counts on two roadways in 2016
 - Only access to development
 - Estimate school traffic for AM peak hour only
 - Pima County approach counts at internal intersection in 2016

Trip Generation Rates – Field Data

- Calculated Trip Generation Rates

Development	Year	Trips/Unit			AM		PM		Source
		AM	PM	Daily	% in	% out	% in	% out	
A	2016	0.46	0.51	6.23	23%	77%	70%	30%	Psomas 2016
B	2013	0.51	0.48	5.61	17%	83%	73%	27%	Psomas 2013
B	2016	0.51	0.55	5.71	16%	84%	66%	34%	Psomas 2016
B South*	2016	0.70	0.45	5.78	16%	84%	66%	34%	Pima County 2016
<i>Average Rates</i>	<i>N/A</i>	<i>0.54</i>	<i>0.50</i>	<i>5.83</i>	<i>18%</i>	<i>82%</i>	<i>69%</i>	<i>31%</i>	<i>N/A</i>

*Only the southern portion of the development was used in this calculation due to data constraints

- In most cases, AM and PM rates are similar
- Development B counts in 2013 and 2016 generated similar results

Trip Generation Rates – Comparisons

- Unlike ITE Manual, field data shows AM as peak hour
- PM peak hour for single family is ½ of ITE rate
- Daily rate is 39% lower than single-family detached
 - 22% lower than PUD
- Ingress/egress are similar, though more pronounced

Source	Trips/Unit			AM		PM	
	AM	PM	Daily	% in	% out	% in	% out
Single-Family Detached Housing (ITE)	0.75	1.00	9.52	25%	75%	63%	37%
Planned Unit Development (ITE)	0.51	0.62	7.50	22%	78%	65%	35%
Field Data	0.54	0.50	5.83	18%	82%	69%	31%

Implications – Sample Project

- Residential Development
 - Single Family
 - 1,200 units
- Existing Two-Lane Roadway
 - 7,000 veh/day existing
- Trip Generation

Example Trips - 1,200 Unit Development	Trips/Unit			AM		PM	
	AM	PM	Daily	In	Out	In	Out
Single-Family Detached Housing (ITE)	900	1,200	11,424	225	675	756	444
Planned Unit Development (ITE)	612	744	9,000	135	477	484	260
Field Data	654	599	6,999	117	536	413	186

Implications – Sample Project

- Total Trips

Example Trips - 1,200 Unit Development	Daily Trips		
	Existing	Project	Total
Single-Family Detached Housing (ITE)	7,000	11,424	18,424
Planned Unit Development (ITE)	7,000	9,000	16,000
Field Data	7,000	6,999	13,999

- FDOT – Two-lane capacity is 15,600 veh/day
 - Single Family – MUST be widened
 - PUD – SHOULD be widened
 - Field Data – DOES NOT need to be widened
- Same analysis for signalization, turn lane needs, queueing
- Beneficial to all involved

ITE Trip Generation Manual – 10th Edition

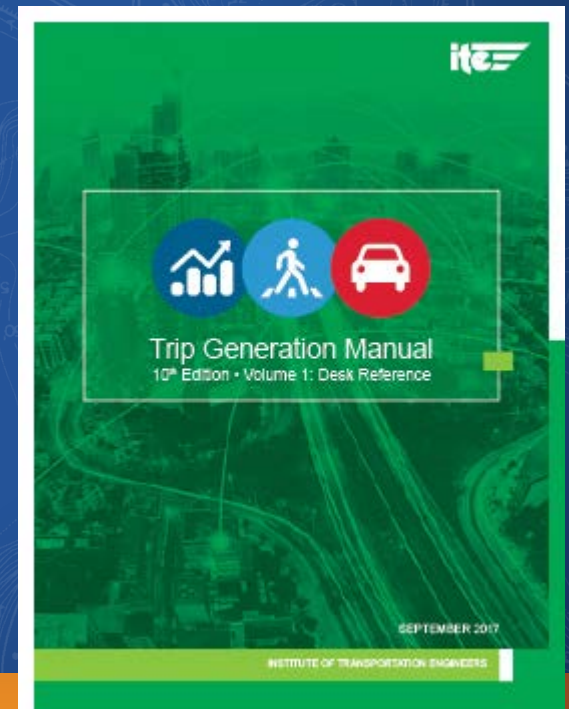


Trip Generation Manual – 10th Edition

- Manual Development Process
 - Call for volunteers – July 2016
 - Selection of 20-member review team – September 2016
 - Data review – April/May 2017
 - Each member reviewed 3 land use groups
 - Between 4 and 7 reviewers for each group
 - Review land use definitions
 - Testing of online tool

Trip Generation Manual – 10th Edition

- Features
 - Removed all data older than 1980
 - Added data from 1,700 new sites
 - Considers person trips
 - Includes online data tool
 - Facilitates querying/filtering data



Trip Generation Manual – 10th Edition

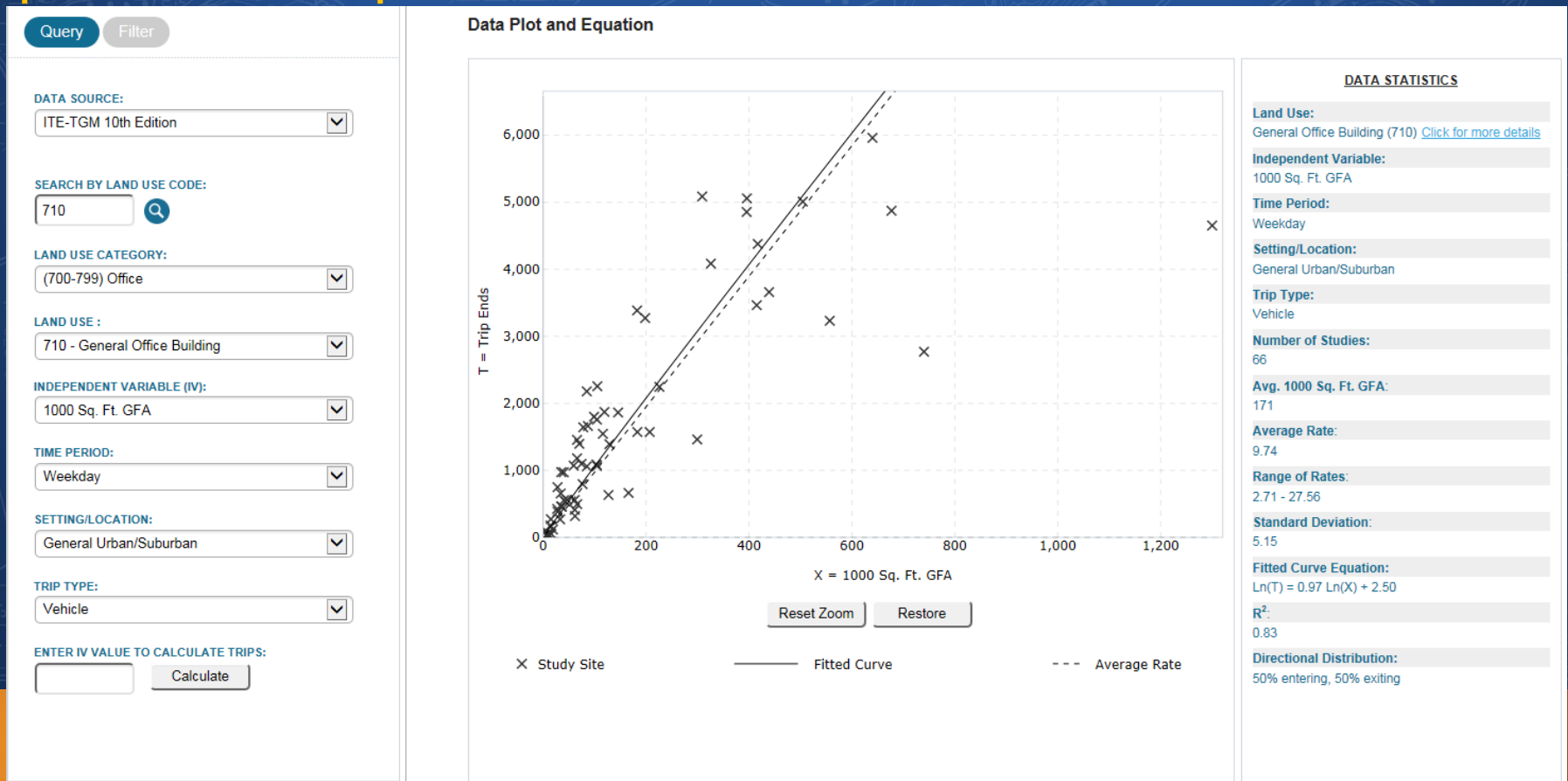
Online Tool

- Look of online tool

Filter Area

Graph / data plot

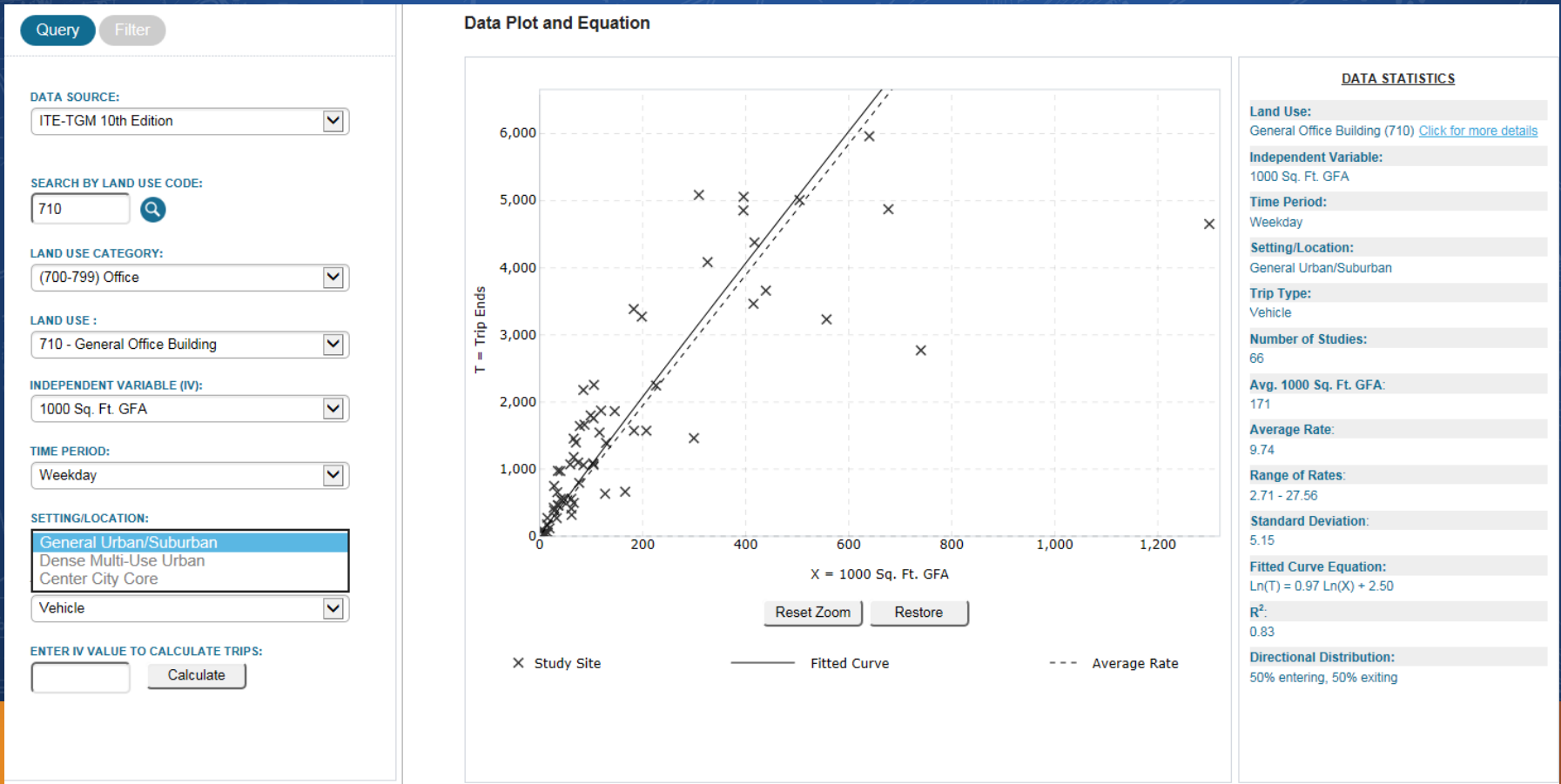
Data Summary



Trip Generation Manual – 10th Edition

Online Tool

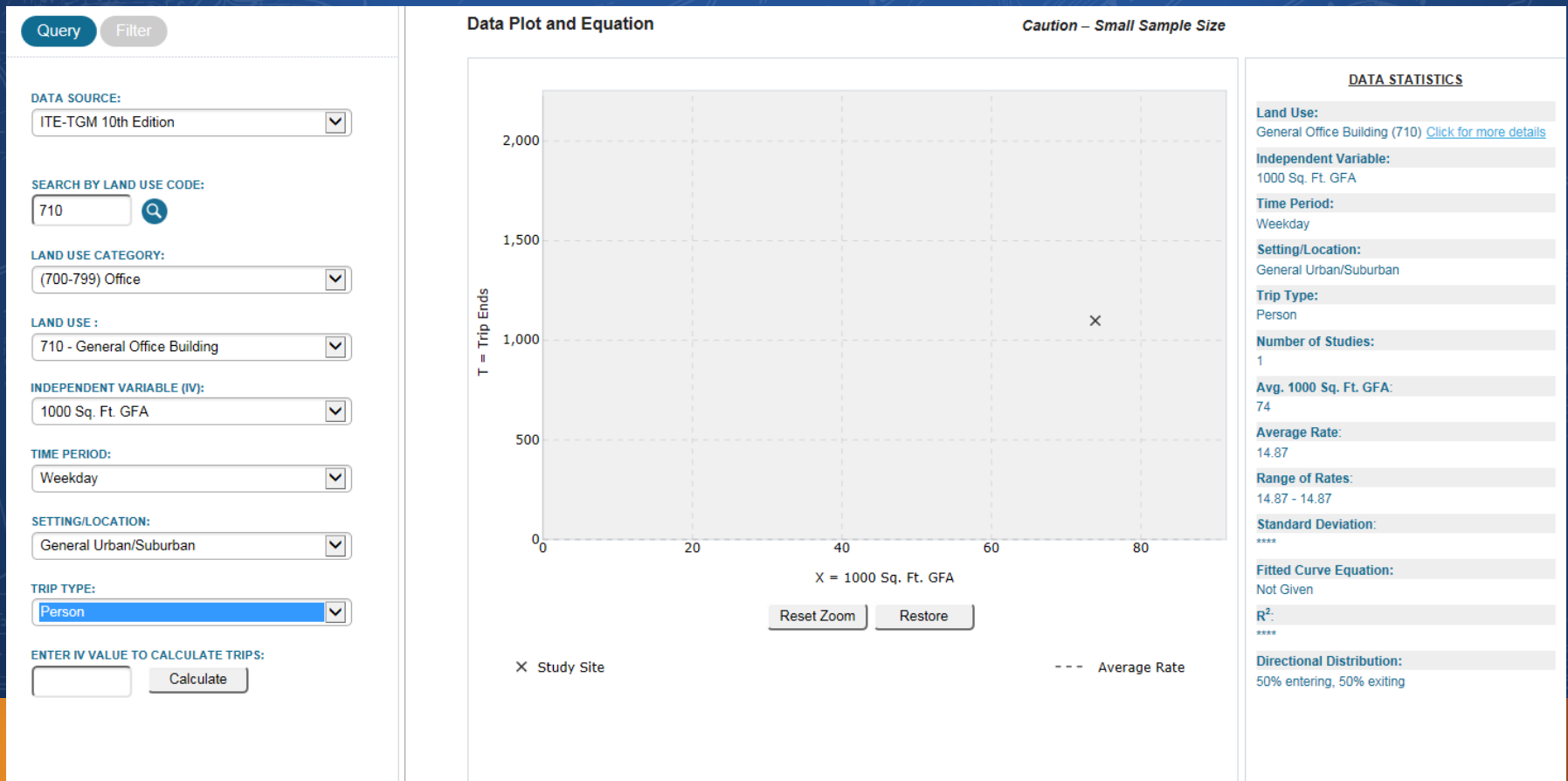
- Ability to filter by area type, but limited data
 - >90% of offices are General Urban/Suburban



Trip Generation Manual – 10th Edition

Online Tool

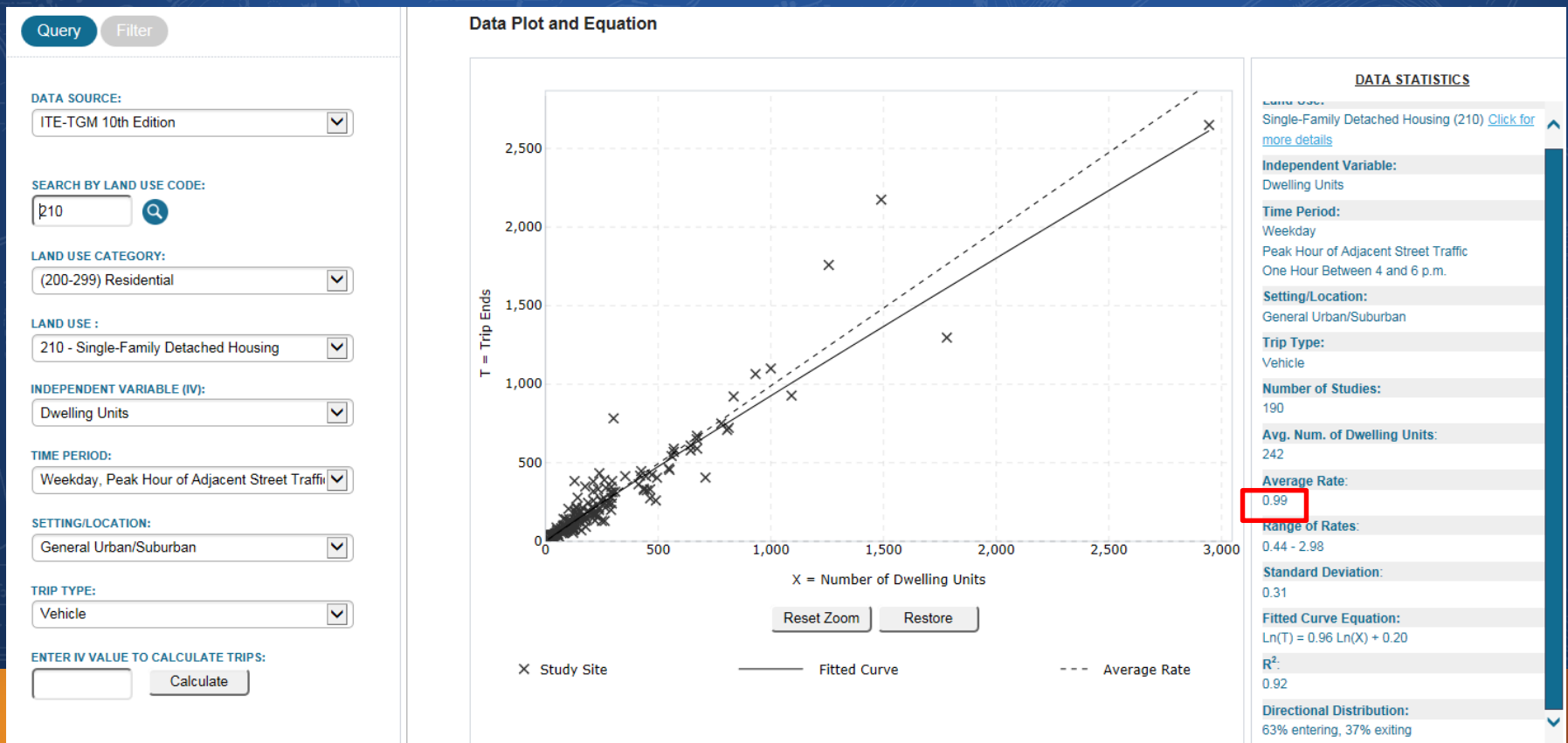
- Person trip data
 - 1 study for office, none for residential



Trip Generation Manual – 10th Edition

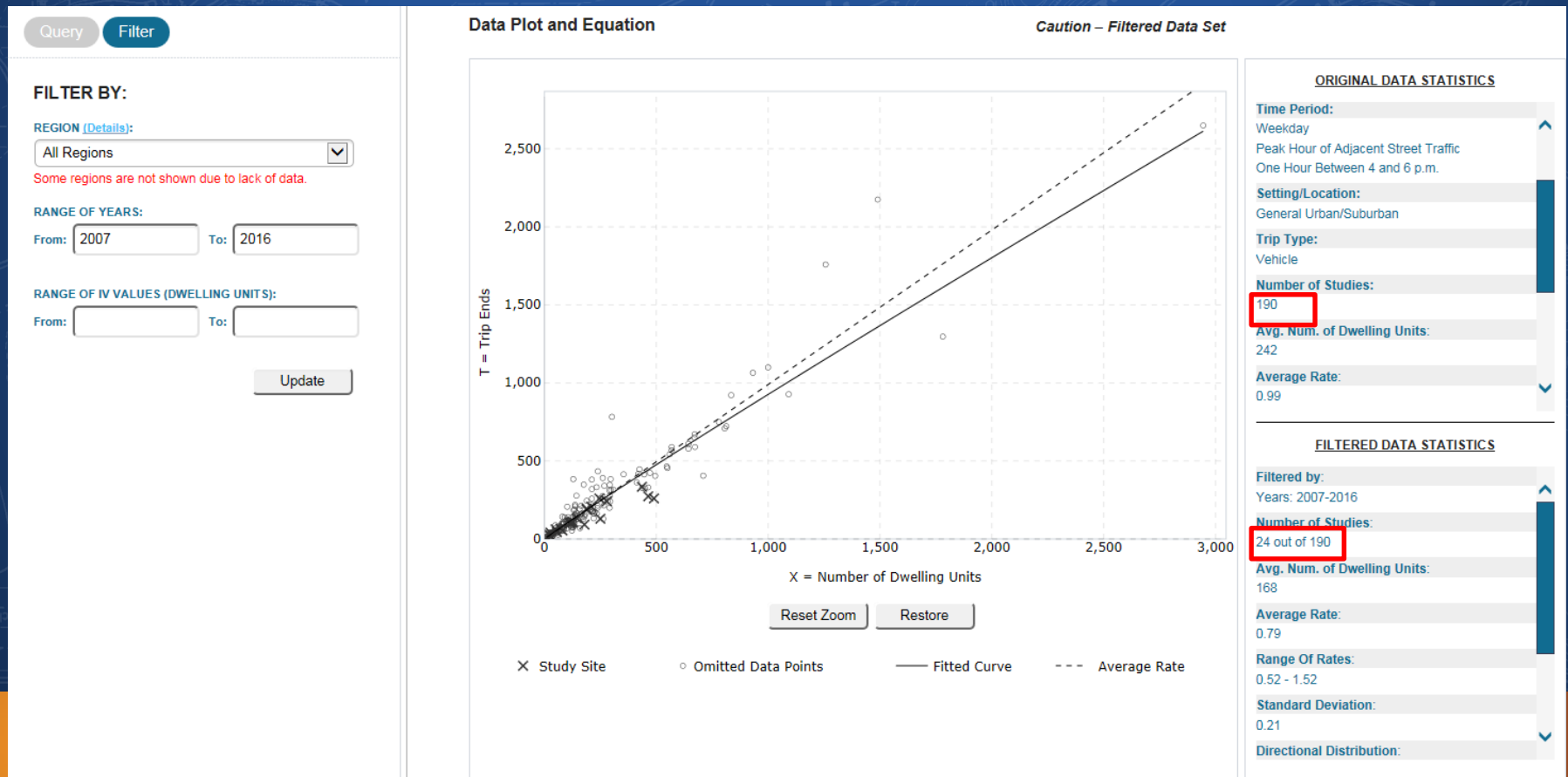
Online Tool

- Residential data (LU 210)
 - Removed over 150 pre-1980 studies



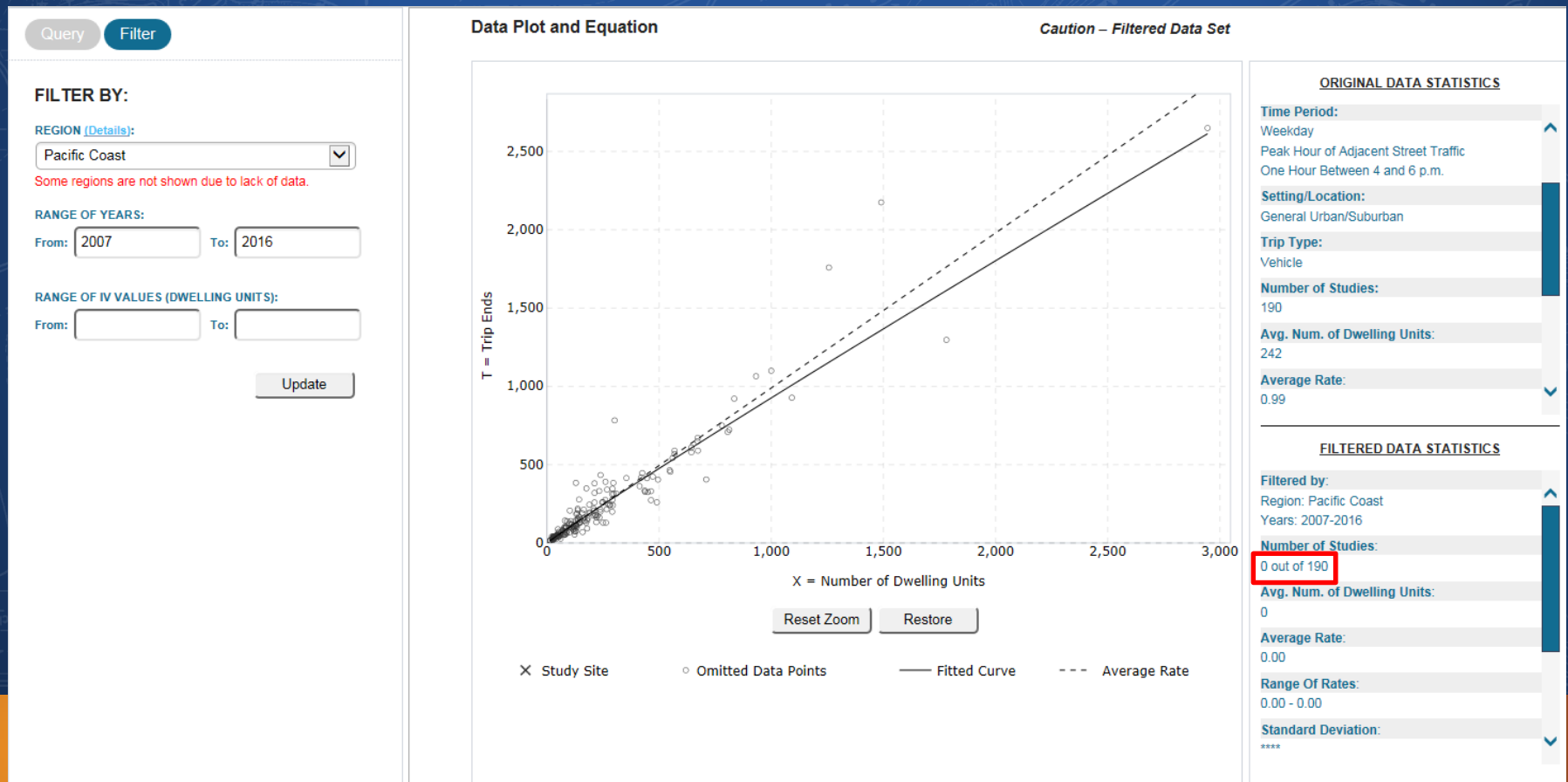
Trip Generation Manual – 10th Edition Online Tool

- Residential data (LU 210) - Filtering Tool
 - 24 out of 190 studies (13%) are from last 10 years



Trip Generation Manual – 10th Edition Online Tool

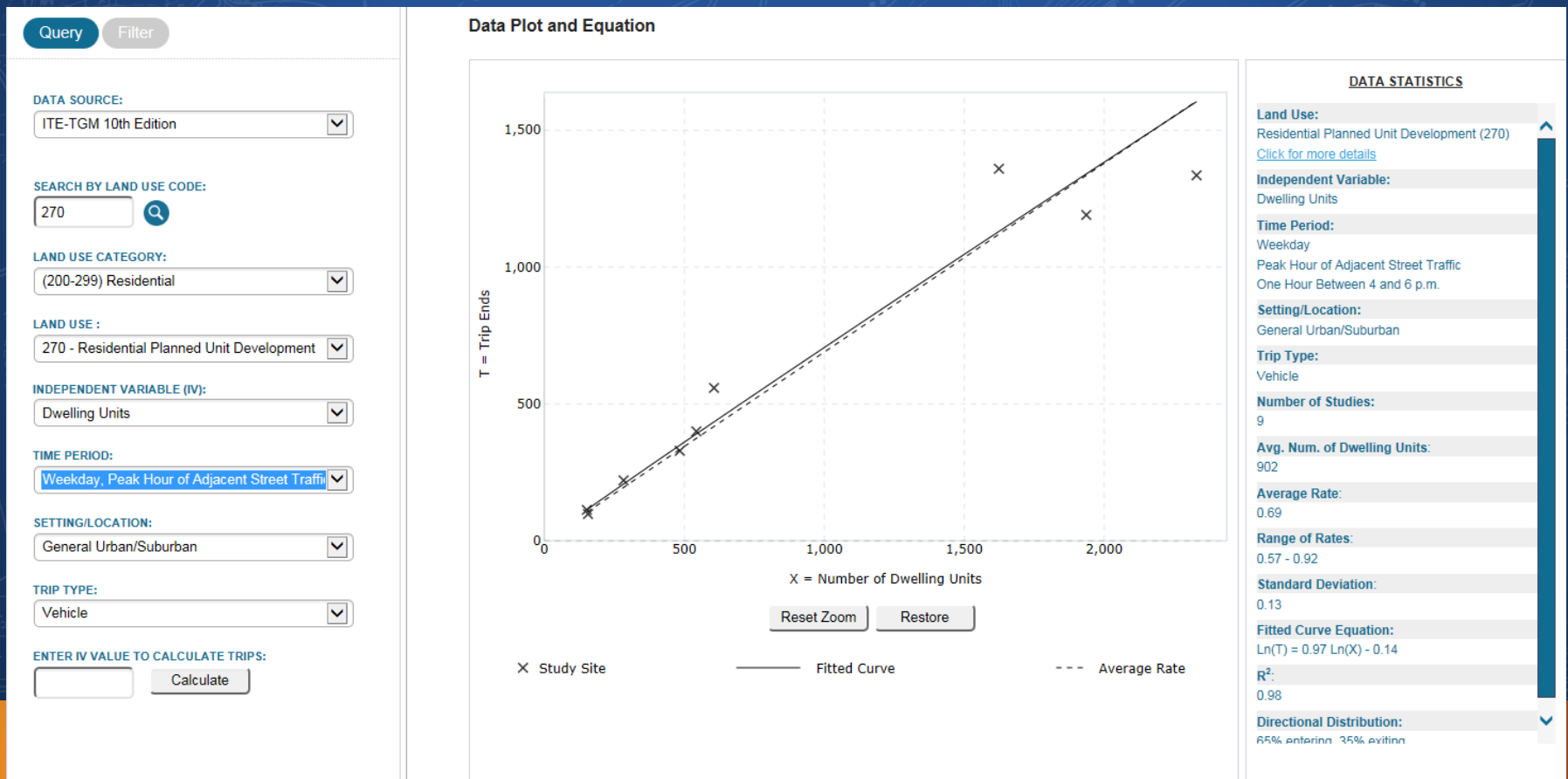
- Residential data (LU 210) - Filtering Tool
 - 0 for Pacific Coast, 0 for Rockies and Great Plains



Trip Generation Manual – 10th Edition

Online Tool

- Residential PUD (LU 270)
 - 9 studies – none after 1995



Trip Generation Manual – 10th Edition

- Improving the data
- www.itedatasubmission.org
- Trip gen data form - <http://library.ite.org/pub/e278c427-2354-d714-5104-02d600087399>

 Institute of Transportation Engineers Trip Generation Data Form (Part 1)																																																																						
Land Use/Building Type: ¹			ITE Land Use Code:																																																																			
Source:			Source No. (ITE use only):																																																																			
Name of Development:			Day of the Week:																																																																			
City:	State/Province:	Zip/Postal Code:	Day:	Month:	Year:																																																																	
Country:			Metropolitan Area:																																																																			
1. For fast-food land use, please specify if hamburger- or nonhamburger-based.																																																																						
Location Within Area: ☐ (1) CBD ☐ (3) Suburban (Non-CBD) ☐ (5) Rural ☐ (2) Urban (Non-CBD) ☐ (4) Suburban CBD ☐ (6) Freeway Interchange Area (Rural) ☐ (7) Not Given					Detailed Description of Development: ²																																																																	
Independent Variable: (include data for as many as possible) ² <table border="1"> <thead> <tr> <th></th> <th>Actual</th> <th>Estimated</th> <th></th> <th>Actual</th> <th>Estimated</th> </tr> </thead> <tbody> <tr> <td>(1) Employees (#)</td> <td>☐</td> <td>☐</td> <td>(9) Parking Spaces (% occupied: _____)</td> <td>☐</td> <td>☐</td> </tr> <tr> <td>(2) Persons (#)</td> <td>☐</td> <td>☐</td> <td>(10) Beds (% occupied: _____)</td> <td>☐</td> <td>☐</td> </tr> <tr> <td>(3) Total Units (#) (indicate unit: _____)</td> <td>☐</td> <td>☐</td> <td>(11) Seats (#)</td> <td>☐</td> <td>☐</td> </tr> <tr> <td>(4) Occupied Units (#) (indicate unit: _____)</td> <td>☐</td> <td>☐</td> <td>(12) Servicing Positions/Vehicle Fueling Positions</td> <td>☐</td> <td>☐</td> </tr> <tr> <td>(5) Gross Floor Area (gross sq. ft.)</td> <td>☐</td> <td>☐</td> <td>(13) Shopping Center % Out-parcels/pads</td> <td>☐</td> <td>☐</td> </tr> <tr> <td>(% of development occupied _____)</td> <td>☐</td> <td>☐</td> <td>(14) A.M. Peak Hour Volume of Adjacent Street Traffic</td> <td>☐</td> <td>☐</td> </tr> <tr> <td>(6) Net Rentable Area (sq. ft.)</td> <td>☐</td> <td>☐</td> <td>(15) P.M. Peak Hour Volume of Adjacent Street Traffic</td> <td>☐</td> <td>☐</td> </tr> <tr> <td>(7) Gross Leasable Area (sq. ft.)</td> <td>☐</td> <td>☐</td> <td>(16) Other _____</td> <td>☐</td> <td>☐</td> </tr> <tr> <td>(% of development occupied _____)</td> <td>☐</td> <td>☐</td> <td>(17) Other _____</td> <td>☐</td> <td>☐</td> </tr> <tr> <td>(8) Total Acres (% developed: _____)</td> <td>☐</td> <td>☐</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>							Actual	Estimated		Actual	Estimated	(1) Employees (#)	☐	☐	(9) Parking Spaces (% occupied: _____)	☐	☐	(2) Persons (#)	☐	☐	(10) Beds (% occupied: _____)	☐	☐	(3) Total Units (#) (indicate unit: _____)	☐	☐	(11) Seats (#)	☐	☐	(4) Occupied Units (#) (indicate unit: _____)	☐	☐	(12) Servicing Positions/Vehicle Fueling Positions	☐	☐	(5) Gross Floor Area (gross sq. ft.)	☐	☐	(13) Shopping Center % Out-parcels/pads	☐	☐	(% of development occupied _____)	☐	☐	(14) A.M. Peak Hour Volume of Adjacent Street Traffic	☐	☐	(6) Net Rentable Area (sq. ft.)	☐	☐	(15) P.M. Peak Hour Volume of Adjacent Street Traffic	☐	☐	(7) Gross Leasable Area (sq. ft.)	☐	☐	(16) Other _____	☐	☐	(% of development occupied _____)	☐	☐	(17) Other _____	☐	☐	(8) Total Acres (% developed: _____)	☐	☐		
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2. Definitions for several independent variables can be found in the Trip Generation, Second Edition, User's Guide Glossary.																																																																						
3. Please provide all pertinent information to describe the subject project, including the presence of bicycle/pedestrian facilities. To report bicycle/pedestrian volumes, please refer to Part 4 of this data form.																																																																						
Other Data: Vehicle Occupancy (#): A.M. _____ P.M. _____ 24-hour % Percent by Transit: A.M. % _____ P.M. % _____ 24-hour % Percent by Carpool/Vanpool: A.M. % _____ P.M. % _____ 24-hour %			Transportation Demand Management (TDM) Information: At the time of this study, was there a TDM program (that may have impacted the trip generation characteristics of this site) underway? ☐ No ☐ Yes (If yes, please check appropriate box(es), describe the nature of the TDM program(s) and provide a source for any studies that may help quantify this impact. Attach additional sheets if necessary.)																																																																			
Employees by Shift: First Shift: Start Time _____ End Time _____ Employees (#) _____ Second Shift: Start Time _____ End Time _____ Employees (#) _____ Third Shift: Start Time _____ End Time _____ Employees (#) _____			☐ (1) Transit Service ☐ (5) Employer Support Measures ☐ (9) Tolls and Congestion Pricing ☐ (2) Carpool Programs ☐ (6) Preferential HOV Treatments ☐ (10) Variable Work Hours/Compressed Work Weeks ☐ (3) Vanpool Programs ☐ (7) Transit and Ridesharing Incentives ☐ (11) Telecommuting ☐ (4) Bicycle/Pedestrian Facilities and Site Improvements ☐ (8) Parking Supply and Pricing Management ☐ (12) Other _____																																																																			
Parking Cost on Site: Hourly _____ Daily _____																																																																						

Please Complete Form on Other Side

Conclusions

- Most ITE data is old but used to forecast traffic well into the future!
- Field data shows significantly lower peak hour and daily trip generation than ITE Manual
 - Internet shopping
 - Telecommuting
 - Flexible schedules
 - Trip chaining
- 10th Edition
 - Updated data
 - Online tool with useful filters
 - Step towards multimodal → Person trips!
 - More data is needed

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