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

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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
  - 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
Before 10<sup>th</sup> Edition

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

- Telecommuting\(^1\)
  - 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% increase\(^2\)
- 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 growth\(^1\)
- 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)

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

• 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
### Calculated Trip Generation Rates

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

*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

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

*Source*
Implications – Sample Project

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

<table>
<thead>
<tr>
<th>Example Trips - 1,200 Unit Development</th>
<th>Trips/Unit</th>
<th>AM</th>
<th>PM</th>
<th>Daily</th>
<th>AM</th>
<th>PM</th>
<th>AM</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family Detached Housing (ITE)</td>
<td></td>
<td>900</td>
<td>1,200</td>
<td>11,424</td>
<td>225</td>
<td>675</td>
<td>756</td>
<td>444</td>
</tr>
<tr>
<td>Planned Unit Development (ITE)</td>
<td></td>
<td>612</td>
<td>744</td>
<td>9,000</td>
<td>135</td>
<td>477</td>
<td>484</td>
<td>260</td>
</tr>
<tr>
<td>Field Data</td>
<td></td>
<td>654</td>
<td>599</td>
<td>6,999</td>
<td>117</td>
<td>536</td>
<td>413</td>
<td>186</td>
</tr>
</tbody>
</table>
Implications – Sample Project

- Total Trips

<table>
<thead>
<tr>
<th>Example Trips - 1,200 Unit Development</th>
<th>Daily Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing</td>
</tr>
<tr>
<td>Single-Family Detached Housing (ITE)</td>
<td>7,000</td>
</tr>
<tr>
<td>Planned Unit Development (ITE)</td>
<td>7,000</td>
</tr>
<tr>
<td>Field Data</td>
<td>7,000</td>
</tr>
</tbody>
</table>

- 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
• 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

• 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
• Look of online tool

**Filter Area**

**Graph / data plot**

**Data Summary**

*Data Plot and Equation*

**DATA SOURCE:**
ITE-TGM 10th Edition

**SEARCH BY LAND USE CODE:**
710

**LAND USE CATEGORY:**
(700-799) Office

**LAND USE:**
710 - General Office Building

**INDEPENDENT VARIABLE (IV):**
1000 Sq. Ft. GFA

**TIME PERIOD:**
Weekday

**SETTING/LOCATION:**
General Urban/Suburban

**TRIP TYPE:**
Vehicle

**ENTER IV VALUE TO CALCULATE TRIPS:**

---

**DATA STATISTICS**

**Land Use:**
General Office Building (710) Click for more details

**Independent Variable:**
1000 Sq. Ft. GFA

**Time Period:**
Weekday

**Setting/Location:**
General Urban/Suburban

**Trip Type:**
Vehicle

**Number of Studies:**
66

**Avg. 1000 Sq. Ft. GFA:**
171

**Average Rate:**
9.74

**Range of Rates:**
2.71 - 27.56

**Standard Deviation:**
5.15

**Fitted Curve Equation:**
\( \ln(\text{Trip}) = 0.97 \ln(\text{GFA}) + 2.50 \)

**R^2:**
0.93

**Directional Distribution:**
50% entering, 50% exiting

Online Tool

- Ability to filter by area type, but limited data
- >90% of offices are General Urban/Suburban
• Person trip data
  • 1 study for office, none for residential
• Residential data (LU 210)
  • Removed over 150 pre-1980 studies
• Residential data (LU 210) - Filtering Tool
  • 24 out of 190 studies (13%) are from last 10 years
Residential data (LU 210) - Filtering Tool

- 0 for Pacific Coast, 0 for Rockies and Great Plains
• Residential PUD (LU 270)
  • 9 studies – none after 1995
- Improving the data
- [www.itedatasubmission.org](http://www.itedatasubmission.org)
- Trip gen data form - [http://library.ite.org/pub/e278c427-2354-d714-5104-02d600087399](http://library.ite.org/pub/e278c427-2354-d714-5104-02d600087399)
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
Contact Information

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