Major Changes in Trip Generation for Large-Scale Residential Projects

ITE Western District Conference
Darlene Danehy and Alejandro Angel

June 21, 2017
Presentation Outline

- ITE Trip Generation Manual
  - History and Background
- Study Sites
- Trip Generation Rates
- Implications
  - Sample Project
- Conclusions
ITE Trip Generation Manual

History and Background
ITE Trip Generation Manual

- 1st Edition published 1976
  - Review underway for 10th Edition, expected Fall 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
• Single Family Residential Land Uses
  • Land Use 210 – Single-Family Detached Housing
    • Detached housing on individual lots
    • Typically suburban sites
    • Typically have more residents and more vehicles than other residential developments
  • Land Use 270 – Planned Unit Development (PUD)
    • Any combination of residential land uses
    • May include limited retail and recreational facilities
• Single-Family Detached Housing (Land Use Code 210)
  • Data collected between 1960s and 2000s
  • More than 300 studies
  • 2% of weekday studies and 7-8% of peak hour trip rate studies conducted since 1997 (20 years)
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\textsuperscript{1}
  - Employee population grew 1.9% from 2013 to 2014
  - Telecommute employees increased 5.6% in the same year

- Increase in cycling commuters
  - Between 2008 and 2012, 60% increase\textsuperscript{2}

- Return to downtown/urban living

- Grocery delivery and pickup

\textsuperscript{1}\url{http://globalworkplaceanalytics.com/telecommuting-statistics}
\textsuperscript{2}\url{https://www.usatoday.com/story/news/nation/2014/05/08/bike-commuting-popularity-grows/8846311/}
Comparison of 1997 and 2017

1997
- E-commerce was just beginning
  - E-Bay exploded with Beanie Babies frenzy
- 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
- 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
Study Sites

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 Manual and Field Observations
Trip Generation Rates – ITE Manual

- Single-Family Residential and PUD
  - Average Rates

<table>
<thead>
<tr>
<th>Land Use (ITE Land Use Code)</th>
<th>Trips/Unit</th>
<th>AM</th>
<th>PM</th>
<th>Daily</th>
<th>AM % in</th>
<th>PM % out</th>
<th>Daily % in</th>
<th>Daily % out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family Detached (210)</td>
<td>0.75</td>
<td>1.00</td>
<td>9.52</td>
<td>25%</td>
<td>75%</td>
<td>63%</td>
<td>37%</td>
<td></td>
</tr>
<tr>
<td>Planned Unit Development (270)</td>
<td>0.51</td>
<td>0.62</td>
<td>7.50</td>
<td>22%</td>
<td>78%</td>
<td>65%</td>
<td>35%</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 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
  - Approach counts at internal intersection in 2016
Trip Generation Rates – Field Data

- 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>AM % in</th>
<th>AM % out</th>
<th>PM % in</th>
<th>PM % out</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2016</td>
<td>0.46</td>
<td>0.51</td>
<td>6.23</td>
<td>23%</td>
<td>77%</td>
<td>70%</td>
<td>30%</td>
<td>Psomas 2016</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>2013</td>
<td>0.51</td>
<td>0.48</td>
<td>5.61</td>
<td>17%</td>
<td>83%</td>
<td>73%</td>
<td>27%</td>
<td>Psomas 2013</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>2016</td>
<td>0.51</td>
<td>0.55</td>
<td>5.71</td>
<td>16%</td>
<td>84%</td>
<td>66%</td>
<td>34%</td>
<td>Psomas 2016</td>
<td></td>
</tr>
<tr>
<td>B South*</td>
<td>2016</td>
<td>0.70</td>
<td>0.45</td>
<td>5.78</td>
<td>16%</td>
<td>84%</td>
<td>66%</td>
<td>34%</td>
<td>Pima County 2016</td>
<td></td>
</tr>
<tr>
<td>Average Rates</td>
<td>N/A</td>
<td>0.54</td>
<td>0.50</td>
<td>5.83</td>
<td>18%</td>
<td>82%</td>
<td>69%</td>
<td>31%</td>
<td>N/A</td>
<td></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
  - Highest peak hour is 12% lower for field data than PUD
  - Highest peak hour is 46% lower than single-family detached
- Daily rate is 22% lower than PUD
  - 39% lower than single-family detached
- 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></td>
<td>0.75</td>
<td>1.00</td>
<td>9.52</td>
<td>25%</td>
<td>75%</td>
<td>63%</td>
<td>37%</td>
</tr>
<tr>
<td>Planned Unit Development (ITE)</td>
<td></td>
<td>0.51</td>
<td>0.62</td>
<td>7.50</td>
<td>22%</td>
<td>78%</td>
<td>65%</td>
<td>35%</td>
</tr>
<tr>
<td>Field Data</td>
<td></td>
<td>0.54</td>
<td>0.50</td>
<td>5.83</td>
<td>18%</td>
<td>82%</td>
<td>69%</td>
<td>31%</td>
</tr>
</tbody>
</table>

Source Trips/Unit AM PM Daily % in % out % in % out
Implications

Sample Project
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>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family Detached Housing (ITE)</td>
<td>900</td>
<td>1,200</td>
<td>11,424</td>
<td></td>
</tr>
<tr>
<td>Planned Unit Development (ITE)</td>
<td>612</td>
<td>744</td>
<td>9,000</td>
<td></td>
</tr>
<tr>
<td>Field Data</td>
<td>654</td>
<td>599</td>
<td>6,999</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>AM</th>
<th>PM</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Family</td>
<td>In</td>
<td>Out</td>
<td></td>
</tr>
<tr>
<td>Detached</td>
<td>225</td>
<td>675</td>
<td>756</td>
</tr>
<tr>
<td>Housing</td>
<td></td>
<td></td>
<td>444</td>
</tr>
<tr>
<td>Planned</td>
<td>In</td>
<td>Out</td>
<td></td>
</tr>
<tr>
<td>Unit</td>
<td>135</td>
<td>477</td>
<td>484</td>
</tr>
<tr>
<td>Development</td>
<td></td>
<td></td>
<td>260</td>
</tr>
<tr>
<td>Field Data</td>
<td>In</td>
<td>Out</td>
<td></td>
</tr>
<tr>
<td></td>
<td>117</td>
<td>536</td>
<td>413</td>
</tr>
<tr>
<td></td>
<td></td>
<td></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 – COULD be widened
  - Field Data – DOES NOT need to be widened

- Beneficial to all involved
Conclusions

- More than 90% of residential data is over 20 years old
- Field data shows significantly lower peak hour and daily trip generation than ITE Manual
  - Internet shopping
  - Telecommuting
  - Flexible schedules
  - Trip chaining
- Upcoming 10th Edition
  - Vehicular and person trips (where available)
  - Different suburban and urban rates (where available)
  - Data can be filtered by various characteristics
Contact Information

Darlene Danehy, P.E., T.E., PTOE
Psomas
ddanehy@psomas.com

Alejandro Angel, Ph.D., P.E., PTOE
Psomas
aangel@psomas.com