Shortcomings of Conventional Methods:
Shortcomings of Conventional Methods:

**Single-Family Detached Housing (210)**

<table>
<thead>
<tr>
<th>Average Vehicle Trip Ends vs:</th>
<th>Dwelling/Units</th>
<th>On:</th>
<th>Weekday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Studies:</td>
<td>350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. Number of Dwelling Units:</td>
<td>197</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directional Distribution:</td>
<td>50% entering, 50% exiting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Trip Generation per Dwelling Unit**

<table>
<thead>
<tr>
<th>Average Rate</th>
<th>Range of Rates</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.57</td>
<td>4.91 - 21.85</td>
<td>3.69</td>
</tr>
</tbody>
</table>

**Data Plot and Equation**

Fitted Curve Equation: \( T = 0.80 \ln(X) + 2.71 \)

\( R^2 = 0.96 \)

---

**Shopping Center (820)**

<table>
<thead>
<tr>
<th>Average Vehicle Trip Ends vs:</th>
<th>1000 Sq. Feet Gross Leasable Area</th>
<th>Weekday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Studies:</td>
<td>302</td>
<td></td>
</tr>
<tr>
<td>Average 1000 Sq. Feet GLA:</td>
<td>328</td>
<td></td>
</tr>
<tr>
<td>Directional Distribution:</td>
<td>50% entering, 50% exiting</td>
<td></td>
</tr>
</tbody>
</table>

**Trip Generation per 1000 Sq. Feet Gross Leasable Area**

<table>
<thead>
<tr>
<th>Average Rate</th>
<th>Range of Rates</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.84</td>
<td>12.50 - 275.00</td>
<td>31.36</td>
</tr>
</tbody>
</table>

**Data Plot and Equation**

Fitted Curve Equation: \( T = 0.65 \ln(X) + 5.68 \)

\( R^2 = 0.78 \)

---

**General Office Building (710)**

<table>
<thead>
<tr>
<th>Average Vehicle Trip Ends vs:</th>
<th>1000 Sq. Feet Gross Floor Area</th>
<th>On:</th>
<th>Weekday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Studies:</td>
<td>78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average 1000 Sq. Feet GFA:</td>
<td>199</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Directional Distribution:</td>
<td>50% entering, 50% exiting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Trip Generation per 1000 Sq. Feet Gross Floor Area**

<table>
<thead>
<tr>
<th>Average Rate</th>
<th>Range of Rates</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.91</td>
<td>3.55 - 28.80</td>
<td>6.13</td>
</tr>
</tbody>
</table>

**Data Plot and Equation**

Fitted Curve Equation: \( T = 0.77 \ln(X) + 3.65 \)

\( R^2 = 0.80 \)
Shortcomings of Conventional Methods:

Northeast Leg
Prepared for Widening

Southwest Leg
Widened Substantially

West & East Legs
Increased in Width
Benefits of Mixed-Use Trip Generation

ITE

PM Peak Hour

ITE Handbook

MXD

MXD+

Counts

49% over estimate

18% over estimate

8% over estimate

14% over estimate
Shortcomings of Conventional Methods:

- Unaccounted Variability: 4% vs. 11%
- Average Model Error: 2% vs. 16%
Validation:

15 California sites
6 Florida sites
2 sites in Texas
2 in Georgia
2 in S Carolina
2 sites in Utah

Gateway Oaks
Sacramento

River Place
Portland
7D Factors That Influence Trip Generation

- Density
- Diversity
- Design
- Destinations
- Distance to Transit
- Development Scale
- Demographics
Examples
Traditional vs. MXD+ and Big Data

One variable

Seven variables
Big Data Examples
Density and Demographics: US Census Explorer

http://www.census.gov/censusexplorer/censusexplorer-popest.html
Big Data Examples
EPA Smart Location Database
Street intersection density:
(Intersections per square mile. An indicator of street connectivity from the perspective of pedestrian and bicycle travel. 3-way intersections are given reduced weight. Highways and high-speed arterials are given zero weight.)

218.02

Zoom to
Big Data Examples
EPA Smart Location Database for Destination Accessibility
San Joaquin Valley Model Improvement Program
Origins & Destinations

Filters:
- All Periods
- All Traveler Types
- Early AM
- AM Peak
- Mid-Day
- PM Peak
- Late PM
- Home Workers
- Inbound Commuters
- Long Term Visitors
- Outbound Commuters
- Resident Workers
- Short Term Visitors

Trips TO Tulare County

Trips FROM Tulare County
### Action: Modify MXD Model Inputs

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Scenario Name</th>
<th>Surrounding Area</th>
<th>Site Demographics</th>
<th>Auto Trip Length</th>
<th>Proximity Table</th>
<th>Advanced Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dennis_1204</td>
<td>Existing</td>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Surrounding Area
- **Surrounding Household Size**: 2.2
- **Source**: Census 2000 - All Housing Types
- **Model**: CensusTracts

**Options for Source**:
- Census 2000 - All Housing Types
- Census 2010 - All Housing Types
- ACS 2012 (5-year) - All Housing Types custom

**Options for Model**:
- CensusTracts

**Settings**:
- **Save Inputs and Run Model**
Mode Share Validation - California Household Survey Data

Vehicle Miles Traveled - VMT

<table>
<thead>
<tr>
<th>Total Per Capita per Household</th>
<th>City</th>
<th>County</th>
<th>MPO</th>
<th>Statewide</th>
<th>Project</th>
<th>Alt 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40</td>
<td>45</td>
<td>45</td>
<td>55</td>
<td>60,000</td>
<td>90,000</td>
</tr>
</tbody>
</table>

Source: Placeholder based on the UC Davis VMT Impact tool.
Example Outputs

Person Mode Share

AM Peak Hour

- 51% drive-alone + truck
- 12% rideshare
- 33% transit/shuttle
- 4% active