Does the Difference Method Always Work for Travel Demand Forecasting?

ITE 2017 Western District Annual Meeting
Made Possible Using Data Courtesy of NDOT
Topics Covered

- What is the difference method?
- Our previous experience with that model
- Case Study
- Model Adjustments
- Conclusion
What is the difference method?
Two Common Methods in Difference Method

NCHRP 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design

- Difference Method (Delta)
- Ratio Method
Example #1: Model represents existing well

Where:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Count</td>
<td>1,000</td>
</tr>
<tr>
<td>Base Year Model Volume</td>
<td>800</td>
</tr>
<tr>
<td>Future Year Model Volume</td>
<td>2,800</td>
</tr>
<tr>
<td>Delta</td>
<td>2,000</td>
</tr>
</tbody>
</table>

Model-to-Count Ratio = 0.80  
Ratio = 3.5

Forecasts = 3,000 or 3,500

Ratio vs. Delta = 500 or 1.07
Example #2: Model represents existing poorly

Where:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Count</td>
<td>1,000</td>
</tr>
<tr>
<td>Base Year Model Volume</td>
<td>200</td>
</tr>
<tr>
<td>Future Year Model Volume</td>
<td>2,200</td>
</tr>
<tr>
<td>Delta</td>
<td>2,000</td>
</tr>
</tbody>
</table>

Model-to-Count Ratio = 0.20
Ratio = 11.0

Forecasts = 3,000 or 11,000

Ratio vs. Delta = 8,000 or 3.67
Our previous experience with that model
Previous Project Locations

Previous experience

Recent experience

(Formerly Parsons Brinckerhoff)
Recent Experience (Unadjusted)

**AM Peak Period**

- **Model/Count Ratio**: 0.79
- **PRMSE**: 33%
- **R²**: 0.87
- **Correlation Coefficient**: 0.93

**PM Peak Period**

- **Model/Count Ratio**: 0.80
- **PRMSE**: 30%
- **R²**: 0.88
- **Correlation Coefficient**: 0.94
Project Location: Challenges

Too many path with grid system

Models tend to be bad in edge of model
Project Location: Challenges

Less than 90 degree freeway system: Cut-through
Case Study (Unadjusted): All Locations

**AM Peak Period**

- **Model/Count Ratio**: 0.42
- **PRMSE**: 80%
- **$R^2$**: 0.72
- **Correlation Coefficient**: 0.85

**PM Peak Period**

- **Model/Count Ratio**: 0.55
- **PRMSE**: 66%
- **$R^2$**: 0.73
- **Correlation Coefficient**: 0.85
Case Study (Unadjusted): CC-215 Only

**AM Peak Period**

- **Model/Count Ratio**: 0.14
- **PRMSE**: 103%
- **R²**: 0.81
- **Correlation Coefficient**: 0.90

**PM Peak Period**

- **Model/Count Ratio**: 0.20
- **PRMSE**: 97%
- **R²**: 0.65
- **Correlation Coefficient**: 0.81

The graphs show traffic count data for AM and PM peak periods, categorized as over-estimates and under-estimates. The data includes traffic volumes for other surface streets, CC-215, Lamb Blvd, and I-15 Mainline.

(Formerly Parsons Brinckerhoff)
Example #2: Model represents existing poorly

Where:

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<td>Future Year Model Volume</td>
<td>2,200</td>
</tr>
<tr>
<td>Delta</td>
<td>2,000</td>
</tr>
</tbody>
</table>

**Model-to-Count Ratio = 0.20**

**Ratio vs. Delta = 8,000 or 3.67**

- **Ratio = 11.0**

Forecasts = 3,000 or 11,000
Model Adjustments
Corrected Network and Land Use

- First, corrected typical stuff
  - Land Use
  - Network

- But…
OD-based Adjustments

LEGEND

xxx: Inbound Trips in AM Period
yyy: Outbound Trips in PM Period

Origins

500 (350)

350 (250)

600 (700)
Before and After (AM Peak Period): All

**Statistics**

<table>
<thead>
<tr>
<th>Before</th>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>0.42</td>
<td>Model/Count Ratio</td>
<td>0.88</td>
</tr>
<tr>
<td>80%</td>
<td>PRMSE</td>
<td>26%</td>
</tr>
<tr>
<td>0.72</td>
<td>$R^2$</td>
<td>0.96</td>
</tr>
<tr>
<td>0.85</td>
<td>Correlation Coefficient</td>
<td>0.98</td>
</tr>
</tbody>
</table>

**Before**

- Over-estimates
- Under-estimates

**After**

- Over-estimates
- Under-estimates
Before and After (PM Peak Period): All

**Before**

**Statistics**

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</tr>
</thead>
<tbody>
<tr>
<td>0.55</td>
<td>Model/Count Ratio</td>
<td>1.01</td>
</tr>
<tr>
<td>66%</td>
<td>PRMSE</td>
<td>20%</td>
</tr>
<tr>
<td>0.73</td>
<td>$R^2$</td>
<td>0.95</td>
</tr>
<tr>
<td>0.85</td>
<td>Correlation Coefficient</td>
<td>0.98</td>
</tr>
</tbody>
</table>

**After**

- Model Volumes
- PM Period Traffic Count
- Other Surface Streets
- CC-215
- Lamb Blvd
- I-15 Mainline

(Formerly Parsons Brinckerhoff)
Before and After (AM Peak Period): CC-215 Only

Before

Statistics

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<tr>
<td>0.14</td>
<td>Model/Count Ratio</td>
<td>0.95</td>
</tr>
<tr>
<td>103%</td>
<td>PRMSE</td>
<td>19%</td>
</tr>
<tr>
<td>0.81</td>
<td>$R^2$</td>
<td>0.96</td>
</tr>
<tr>
<td>0.90</td>
<td>Correlation Coefficient</td>
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After

(Formerly Parsons Brinckerhoff)
Before and After (PM Peak Period): CC-215 Only

Before

Statistics

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</thead>
<tbody>
<tr>
<td>0.20</td>
<td>Model/Count Ratio</td>
<td>1.06</td>
</tr>
<tr>
<td>97%</td>
<td>PRMSE</td>
<td>27%</td>
</tr>
<tr>
<td>0.65</td>
<td>$R^2$</td>
<td>0.86</td>
</tr>
<tr>
<td>0.81</td>
<td>Correlation Coefficient</td>
<td>0.93</td>
</tr>
</tbody>
</table>

After
Conclusion

- Model calibrated well in several areas does not mean it will in elsewhere.
  - Compare the model versus traffic counts,
  - Especially towards the edges
- Models may over-estimate the attractiveness of cut-through routes
- When model-to-count ratio is poor, use Delta method
Questions?

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