PUTTING THE TRANSITION BACK IN TRANSIT

Bringing a market analysis perspective to transit planning using big data.

MNCPPC Winter Speaker Series
January 20th, 2016
Nat Bottigheimer
Transition.

Ballston, VA, in the 1970s

Ballston, VA, in 2014
Market Analysis.
Big Data.
<table>
<thead>
<tr>
<th>Data Source</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>AirSage</td>
<td></td>
</tr>
<tr>
<td>City Sourced</td>
<td></td>
</tr>
<tr>
<td>PTV/NuStats</td>
<td></td>
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<tr>
<td>ESRI</td>
<td></td>
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<tr>
<td>Miovision</td>
<td></td>
</tr>
<tr>
<td>StreetLight</td>
<td></td>
</tr>
<tr>
<td>Google</td>
<td></td>
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<tr>
<td>Mygistics</td>
<td></td>
</tr>
<tr>
<td>Tom Tom</td>
<td></td>
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<tr>
<td>INRIX</td>
<td></td>
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<tr>
<td>Here (formerly Navteq)</td>
<td></td>
</tr>
</tbody>
</table>
Identify an issue in transit planning practice

Propose an approach and general direction:
- Tailored for transit, and
- Adapted from leading-edge practice in highway and traffic analysis

Recommend ways to:
- Design transit to meet ridership and roadway performance goals
- Set performance goals to meet ridership objectives
- Use new data sources to set and measure goals
Arlington officials halt efforts on streetcars for Columbia Pike, Crystal City

The DC Streetcar Won’t Run in 2015

By Benjamin Freed | December 4, 2015

Olney looks for BRT alternatives

24 Dec 2014 | Written by Rebecca Guterman | Published in Local

Dr. Gridlock

Bus-only lanes in Crystal City, once slated to open in early 2015, now to open in the spring
Traditional Analysis

Baseline Assumptions

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ridership</td>
<td>11,000 to 16,000 (+/-) boardings per day (+/- 30% from existing auto and +/- 70% from existing bus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total travel times in minutes (northbound NB/southbound SB)</td>
<td>41 (NB) 41 (SB)</td>
<td>47 (NB) 43 (SB)</td>
<td>41 (NB) 41 (SB)</td>
<td>41 (NB) 41 (SB)</td>
</tr>
<tr>
<td>Number of stops</td>
<td>19</td>
<td>20</td>
<td>19</td>
<td>19</td>
</tr>
</tbody>
</table>

Baseline Results

- Ten (10)-minute frequencies
- Does not include special events
- Does not restructure corridor bus routes
- Streetcar in shared lane

Sensitivity Tests Conducted

- Test stop location adjustments
- Test travel time options
- Test exclusive lane operation (for Alternative 1)
- Test higher frequencies in the Central Business District

Next Steps

- Five (5) Minute Frequency (north of 5th Street SW) - 20%-25% increase
- Total Travel Time/Speed (Overall 5 minute one-way travel time reduction = 11% ridership increase)
- Minimal restructure of corridor bus routes
- Refine person throughput analysis
- Develop special events factor
- Conduct cost-benefit analysis
Traditional Analysis.

Table 5. Summary of Alternatives

<table>
<thead>
<tr>
<th>Metric</th>
<th>Dedicated BRT Alternatives</th>
<th>LRT Alternative</th>
<th>Managed Lane Alternative¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (miles)</td>
<td>A-B-C-D1-E1</td>
<td>A-B-C-D2-E1</td>
<td>A-B-C-D2-E2</td>
</tr>
<tr>
<td>Number of Stations</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>2030 Daily Ridership: Station to Station BRT²</td>
<td>8,600</td>
<td>8,800</td>
<td>8,800</td>
</tr>
<tr>
<td>2030 Daily Ridership: Total Corridor³</td>
<td>13,100</td>
<td>13,300</td>
<td>13,300</td>
</tr>
<tr>
<td>Estimated Travel Time (minutes from Union Depot to Manning Avenue)</td>
<td>30.0-30.3</td>
<td>30.2-30.5</td>
<td>29.5-30.3</td>
</tr>
<tr>
<td>Estimated Capital Cost (millions)</td>
<td>$500-505</td>
<td>$470-475</td>
<td>$460-465</td>
</tr>
</tbody>
</table>

¹ Managed Lane Alternative as defined in the AA Study
² Station to station BRT ridership represents zero express riders using the dedicated BRT.
³ Includes all corridor express riders and potential service extension through downtown Saint Paul. These and other BRT operational refinements are still under consideration but affect all BRT alternatives similarly. FTA Mobility Improvements (ridership) ratings assume an average of 2030 and “current year” ridership estimates for Mobility and Cost-Effectiveness measures.
⁴ Estimates based on 2013 Alternatives Analysis
Loaded Evaluation Terms.

Level of Service (LOS) Overview

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
</tr>
<tr>
<td>B</td>
<td>Good</td>
</tr>
<tr>
<td>C</td>
<td>Average</td>
</tr>
<tr>
<td>D</td>
<td>Acceptable</td>
</tr>
<tr>
<td>E</td>
<td>Congested</td>
</tr>
<tr>
<td>F</td>
<td>Severely Congested</td>
</tr>
</tbody>
</table>
Impacts Identification

FORECASTED TRAFFIC CHANGES
- Largest decrease in traffic volume occurs on Georgia Avenue NW (nearly 50% reduction in some cases)
- Largest increase in traffic volume occurs on facilities parallel to Georgia Avenue NW, particularly 13th Street NW, 5th Street NW, and North Capitol Street.
- Forecasted traffic volumes are important, but not the only elements in understanding impacts to the street network. Additional factors such as system capacity, person throughput, and local street impacts will be evaluated in future phases of study.

POTENTIAL LANE REMOVAL OPTIONS*

*For the purposes of this evaluation, a dedicated curb lane was not included because it does not require the removal of a travel lane.

PEAK HOUR TRAFFIC (VEHICLES PER HOUR)

Decreased Traffic
- 0 - 35
- 35 - 75
- > 75

Increased Traffic
- 0 - 35
- 35 - 50
- 50 - 75
- > 75

Lane removed (Georgia Avenue NW) or 5th Street NW (dotted line)

Dedicated Station

Metro Rail Line
Big Data Helps: Highway Example.

- Faster calibration and validation of meso- & micro-scale models
- Increased confidence
- More alternatives analyzed in less time
- Quick acceptance of results by stakeholders and public
- Investment targeted to correct interchange
Big Data Helps: Highway Example.

Example: Big Data in Transit Plans.

Map zone-to-zone trips to find hotspots
Identify hotspots with low transit use
Map transit travel times
Improvements for zones with high potential & poor service
Example of Forecasted Demand.

Model Outputs: Internal Trips (2040)

The highest number of trips occur within zones; however, some noteworthy internal trips are:

- Approximately **18,500** trips per day flow between White Oak and ICC area

- Approximately **14,000** trips per day flow between Silver Spring and White Oak

Source: 2040 forecasts developed using MWCOCG regional travel demand model
Travel Markets: External Trips (2040)

Noteworthy are trips that flow to/from Washington D.C. from the Study Area.

Approximately 83,000 trips per day flow between the Study Area and Washington DC.

Source: 2040 forecasts developed using MWCOG regional travel demand model
Zone to Zone Travel.
## Zone to Zone Travel

<table>
<thead>
<tr>
<th>Destinations</th>
<th>Trips to Red Line Stations</th>
<th>External Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Day</td>
<td>AM Peak</td>
</tr>
<tr>
<td><strong>Origins</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAZ 604 (North Hill Sligo Park)</td>
<td>18%</td>
<td>24%</td>
</tr>
<tr>
<td>TAZ 596 (South of MD 650)</td>
<td>10%</td>
<td>11%</td>
</tr>
<tr>
<td>TAZ 591 (North of MD 650)</td>
<td>9%</td>
<td>18%</td>
</tr>
<tr>
<td>TAZ 589 (Tech Road Vicinity)</td>
<td>4%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Measuring Transit Accessibility.

Places you can get to by transit:
- Within 30 min
- Within 45 min
- Within 60 min
- Within 75 min
Future of Transit Accessibility.
General Approach – Market Definition.

**STEP 1**: Define Zones For Analysis

**STEP 2**: Measure Zone-to-Zone Trip Making (%)

**STEP 3**: Identify TAZ-Based Trip Generation

**STEP 4**: Measure Zone-to-Zone Trip Making

**STEP 5**: Calculate Current Transit Trip Making

**STEP 6**: Calculate Potentially Servable Transit Market Share

**STEP 7**: Present Transit Market Share
Other Tools Needed

Travel Time Reliability
  • Transit
  • Cars

Traffic Simulation
Travel Time Reliability: Roads

INRIX HTF Profile Statistics
I-10 from I-405 to I-110

Typical Traffic: Monday

![INRIX HTF Profile Statistics Table and Map](image-url)
Bus Performance Data.
Transit Reliability Analysis

5 Fulton Reliability
PM period (4 PM to 7 PM)
Source: SFMTA bus AVL data from May 2012. GIS analysis tool developed by Fehr & Peers
Transit Reliability Analysis

<table>
<thead>
<tr>
<th>Westbound</th>
<th>Fulton St</th>
<th>McAllister St</th>
<th>Market St</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening Night</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Speed</th>
<th>Fulton St</th>
<th>McAllister St</th>
<th>Market St</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>21 25 20 22 22 18 21 18 15 11 20 14 12 11</td>
<td>12 11 10 13 11 7 8</td>
<td>8 8 6</td>
</tr>
<tr>
<td>Midday</td>
<td>20 22 19 21 19 16 18 16 12 9 18 12 11 9</td>
<td>11 10 9 13 10 6 7</td>
<td>7 7 6</td>
</tr>
<tr>
<td>School</td>
<td>21 20 18 21 18 14 16 15 11 8 17 12 11 9</td>
<td>11 9 9 13 9 6 6</td>
<td>7 7 6</td>
</tr>
<tr>
<td>PM</td>
<td>18 20 18 20 17 14 15 15 12 9 16 12 11 10</td>
<td>11 9 9 12 9 6 7</td>
<td>7 6 5</td>
</tr>
<tr>
<td>Evening</td>
<td>26 27 24 25 23 19 22 20 18 12 20 14 15 12</td>
<td>13 11 12 16 12 8 7</td>
<td>8 7 6</td>
</tr>
<tr>
<td>Night</td>
<td>24 23 22 23 21 18 20 17 17 11 19 14 13 11</td>
<td>13 10 11 15 11 8 8</td>
<td>10 9 7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reliability</th>
<th>Fulton St</th>
<th>McAllister St</th>
<th>Market St</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>0.3 0.3 0.4 0.3 0.4 0.3 0.4 0.3 0.3 0.3 0.4 0.3 0.4 0.3</td>
<td>0.2 0.2 0.2 0.2 0.3 0.3 0.4 0.2 0.2</td>
<td>0.4 0.3 1.0</td>
</tr>
<tr>
<td>Midday</td>
<td>0.7 0.4 0.5 0.3 0.4 0.4 0.4 0.3 0.3 0.3 0.4 0.3 0.3 0.4</td>
<td>0.3 0.2 0.3 0.3 0.3 0.2 0.2</td>
<td>0.3 1.5 0.3</td>
</tr>
<tr>
<td>School</td>
<td>0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.2 0.3 0.3 0.3 0.3 0.4</td>
<td>0.3 0.2 0.3 0.3 0.3 0.3 0.3</td>
<td>0.3 0.7 0.3</td>
</tr>
<tr>
<td>PM</td>
<td>0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3</td>
<td>0.2 0.2 0.2 0.3 0.3 0.3 0.3</td>
<td>0.6 1.9 0.5</td>
</tr>
<tr>
<td>Evening</td>
<td>0.5 0.4 0.4 0.4 0.4 0.4 0.4 0.6 0.4 0.4 0.5 0.3 0.4 0.3</td>
<td>0.3 0.3 0.3 0.3 0.3 0.4 0.6</td>
<td>0.3 1.6 0.9</td>
</tr>
<tr>
<td>Night</td>
<td>0.3 0.3 0.4 0.4 0.3 0.3 0.4 0.3 0.3 0.3 0.3 0.3 0.3 0.3</td>
<td>0.2 0.2 0.2 0.2 0.3 0.3 0.6</td>
<td>0.4 1.0 0.2</td>
</tr>
</tbody>
</table>
Technical Questions.

Route taken versus trip origin
- Study purpose (funding responsibility? Making a physical improvement? Measuring VMT/GHG?)
- Cell phone (towers) versus GPS

Sizes of grids that generate data
- How precisely do you need to know origins and destinations? Elementary school? HS? Arena?

Figuring out which mode is generating data
- Speed and route characteristics

Imputing trip purpose
- Commuting to work or going home to sleep?
- Work-arounds, post-processing often needed
Pros and Cons of Big Data.

Traditional data is Irregularly Available, Expensive, and Often Sampled

Big Data is fast, frequent, and relatively cheap
  • But sometimes not exactly what you want
  • Work-arounds, post-processing, “key assumptions” often required

Comprehensiveness of big data can buttress sampled data that may be discounted in public mind
Better Framed Debates.

Less Debate about Forecast Transit Ridership

• Tighter relationship between ridership and travel patterns already in place

More Emphasis on Details of Transit Experience

• Less “faith-based ridership” bus versus rail
• Mode neutral
Concluding Thoughts.

Target real issues, not concerns

Quantified performance goals and public-private partnerships

“Outpatient procedures” versus radical surgery

More Research

- Effect of Travel Time and Reliability on Transit Ridership
- Forecasting Transit and Roadway Reliability

Begin adapting and refining tools
Thank you for your time.

For more information, please contact:

**Nat Bottigheimer**
Fehr & Peers DC, Senior Market Lead
n.bottigheimer@fehrandpeersdc.com

@FehrAndPeersDC