Model Task Force

Modeling Mixed-Flow Transit Travel Times in FSUTMS Voyager

presented to
MTF Transit Committee

presented by
David Schmitt & Ashutosh Kumar

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Transit Travel Time

Why is transit travel time important?
- Used to calculate the transit impedances in mode choice
- In Small/New Starts evaluation, almost all of the user benefits come from transit travel time savings

Mixed-flow transit travel time is a function of:
- Auto travel time
- Acceleration/deceleration of the transit vehicle
- Number of stops/stations
- On/off activities at stop/station
- Other elements
Review of the Existing Practice

- Used by most FSUTMS models
- Transit speeds are a piecewise linear function of the auto speeds based on:
  - Facility type
  - Area type
  - Transit mode
- Different “curves” used for various combinations of FT, AT and mode
Shortcomings

- Extremely challenging and time consuming to calibrate route travel times; near-omniscience required
  - Assessment of each route’s travel time estimation
  - Knowledge of facility/area type combinations commonly used by each route
  - Detailed understanding of curves as currently defined
  - General sense of curve adjustment impacts

- Extremely challenging to collect observed data

- Recent transit speed/delay survey indicated that the transit speed is a linear function of auto speed *

- The curves are insensitive to transit demand

*Transit Speed and Delay Report (April 2006) prepared by Kittelson & Associates for FDOT, PTO
A New Approach

- \( \text{Time}_{\text{transit}} = \text{Time}_{\text{auto}} + \text{Factor}_{\text{group}} \times \text{NumStops} \)

- \( \text{Factor}_{\text{group}} \) reflects all types of dwell and delay time incurred by transit vehicle
  - Can vary by mode, agency, geography, etc.
  - Calibrated separately for peak and off-peak periods
  - Incorporated in PT line file using “DWELL_C” sub-keyword

- Individual routes can be precisely calibrated using the TIMEFAC sub-keyword

- This approach has been implemented CFRPMv5, and a similar approach is being implemented in WCFRTM
**DWELL_C**

- NODES sub-keyword, so it is placed inside the node strings for each route
  
  **Use:** "DWELL_C = 0.50"

- For each stop, PT adds the user-specified time (in minutes) to the total travel time of the route

- DWELL_C does not vary by time period (unlike HEADWAY), so procedures are needed to avoid coding multiple transit line files
CFRPMv5 Implementation

- Create a DBF file with group code, peak and off-peak DWELL_C values
- Assign a group code to each route using USERN5
- Scripted procedures remove USERN5 keyword and insert period-specific DWELL_C value in node string (runs 2x)

**Input Transit Line File**

```
```

**Updated Transit Line File**

```
```

- Number | PKDwell | OPDwell
- 1       | 0.6     | 0.6
- 2       | 0.45    | 0.5
- 3       | 0.55    | 0.75
- 4       | 0.55    | 0.6
- 5       | 0.45    | 0.45
- 6       | 0.35    | 0.36
- 7       | 0.35    | 0.4
- 8       | 0.4     | 0.5
- 9       | 0.2     | 0.5
- 10      | 0.46    | 0.46

- Number | PKDwell | OPDwell
- 1       | 0.6     | 0.6
- 2       | 0.45    | 0.5
- 3       | 0.55    | 0.75
- 4       | 0.55    | 0.6
- 5       | 0.45    | 0.45
- 6       | 0.35    | 0.36
- 7       | 0.35    | 0.4
- 8       | 0.4     | 0.5
- 9       | 0.2     | 0.5
- 10      | 0.46    | 0.46
CFRPMv5 Calibration Process

- Gather observed transit travel times by route by using public time tables, driver run sheets or other sources
- Use 0.50 as initial DWELL_C values for both peak/off-peak periods for all groups
- Run a single PT script to get the estimated travel times
- Compare observed and estimated travel times by group
  - Investigate major differences
  - Solution may be to create new (collapse) groups or vary DWELL_C value
- Make adjustments & iterate until reasonable estimates of travel times are achieved
### Example: Peak DWELL_C Values in CFRPMv5

<table>
<thead>
<tr>
<th>Group Code</th>
<th>Agency</th>
<th>Grouping</th>
<th>Initial DWELL_C</th>
<th>Final DWELL_C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LYNX</td>
<td>Northeast</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>2</td>
<td>LYNX</td>
<td>Southeast</td>
<td>0.5</td>
<td>0.45</td>
</tr>
<tr>
<td>3</td>
<td>LYNX</td>
<td>Southwest</td>
<td>0.5</td>
<td>0.55</td>
</tr>
<tr>
<td>4</td>
<td>LYNX</td>
<td>Northwest</td>
<td>0.5</td>
<td>0.55</td>
</tr>
<tr>
<td>6</td>
<td>VOTRAN</td>
<td>Votran</td>
<td>0.5</td>
<td>0.35</td>
</tr>
<tr>
<td>7</td>
<td>SCAT</td>
<td>Titusville</td>
<td>0.5</td>
<td>0.35</td>
</tr>
<tr>
<td>8</td>
<td>SCAT</td>
<td>Melbourne</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>9</td>
<td>SunTran</td>
<td>SunTran</td>
<td>0.5</td>
<td>0.2</td>
</tr>
</tbody>
</table>
Example: CFRPMv5 Peak Calibration Results

<table>
<thead>
<tr>
<th>Agency</th>
<th>Group</th>
<th>CFRPM v4.5 (Existing Method)</th>
<th>CFRPM v5.0 (New Method)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LYNX</td>
<td>Northeast</td>
<td>7%</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Southeast</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Southwest</td>
<td>9%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>Northwest</td>
<td>11%</td>
<td>7%</td>
</tr>
<tr>
<td>VOTRAN</td>
<td>Votran</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>SCAT</td>
<td>Titusville</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Melbourne</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>SunTran</td>
<td>SunTran</td>
<td>3%</td>
<td>6%</td>
</tr>
</tbody>
</table>
Findings & Lessons Learned

- Straightforward calibration process; easy to put together a semi-automated calibration routine
- More realistic and consistent coding of stops needed
- Group codes should be defined broadly so that planned routes can use a value from the existing groups
- The ability to precisely reflect travel times on individual routes is very helpful for detailed transit studies
- Still doesn’t fully account for impacts from demand