Transit Modeling Update
District One Implementation & Status Report

presented to
MTF Transit & Rail Committee

presented by
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June 17, 2013

Transit Modeling Update (TMU)

Purpose and Need

- Developed by FDOT Systems Planning, in conjunction with FTA, to provide transit travel demand forecasts consistent with federal expectations.

- Incorporates state of the practice techniques
Key Features

- New Trip Generation Rates and Purposes
- Peaking Factors split into peak and off-peak periods
- Mode Choice and Destination Choice (45 markets)
- Diurnal Factors split Highway Assignment into 4 periods
- A travel time Feedback Loop is included to account for the effects of congestion on Distribution and Mode Choice

Model Flowchart
Transit Modeling Update (TMU)

**Trip Generation**

New process, 2010 Census and 5-year ACS data

**Table 1** Trip Generation Ratios

<table>
<thead>
<tr>
<th>Household Income</th>
<th>Household Auto</th>
<th>Number of Workers in Household</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;$50,000</td>
<td>$0</td>
<td>0.000</td>
</tr>
<tr>
<td>$50,000-$74,999</td>
<td>$0</td>
<td>0.000</td>
</tr>
<tr>
<td>$75,000+</td>
<td>$0</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Table 1** Trip Attraction Rates

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Household Income</th>
<th>School Employment</th>
<th>Service Employment</th>
<th>Commercial Employment</th>
<th>Household</th>
<th>School</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2** Bus/University and HB School Trip Generation Rates

<table>
<thead>
<tr>
<th>Household Income</th>
<th>Household Auto</th>
<th>Household Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Peak Factors**

Use Peak / Off-Peak processes throughout the Model

**Percent of Trips**

- HBW

![Percent of Trips Graph](image-url)
Transit Modeling Update (TMU)

Transit

Very similar to the “Tier A/B/C” methodology currently in use, but includes additional features:

- Use of REWALK for access-links
- Transit speeds are controlled by dwell at stops
- Change wait-time from ½ headway
- Use (new) recommended mode coefficients

Mode Choice and Distribution (destination choice) have been revised to reflect detailed market segmentation

Calculate probabilities for:
- HBW -- 7 markets
- HBNW -- all trips
- HBSH -- 7 markets
- HBSR -- 7 markets
- HBO -- 7 markets
- NHBO -- all trips
- HBW -- 7 markets
- HBSC -- 4 markets
- HBCU -- 4 markets

Time-Of-Day Assignment

Diurnal Factors assign trips to time period “buckets”

<table>
<thead>
<tr>
<th>TMU MODEL</th>
<th>HBW_PA</th>
<th>HBW_AP</th>
<th>NHBW_PA</th>
<th>NHBW_AP</th>
<th>NHBO_PA</th>
<th>NHBO_AP</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.524</td>
<td>0.005</td>
<td>0.015</td>
<td>0.258</td>
<td>0.119</td>
<td>0.119</td>
<td>0.015</td>
<td>6:00AM-8:59AM</td>
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<tr>
<td>0.474</td>
<td>0.169</td>
<td>0.472</td>
<td>0.466</td>
<td>0.451</td>
<td>0.451</td>
<td>0.466</td>
<td>9:00AM-2:59PM</td>
</tr>
<tr>
<td>0.039</td>
<td>0.432</td>
<td>0.678</td>
<td>0.049</td>
<td>0.381</td>
<td>0.381</td>
<td>0.049</td>
<td>3:00PM-6:59PM</td>
</tr>
<tr>
<td>0.221</td>
<td>0.136</td>
<td>0.062</td>
<td>0.000</td>
<td>0.049</td>
<td>0.049</td>
<td>0.000</td>
<td>7:00PM-5:59AM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TBRTM</th>
<th>HBW_PA</th>
<th>HBW_AP</th>
<th>NHBW_PA</th>
<th>NHBW_AP</th>
<th>NHBO_PA</th>
<th>NHBO_AP</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.491</td>
<td>0.028</td>
<td>0.336</td>
<td>0.048</td>
<td>0.177</td>
<td>0.177</td>
<td>0.028</td>
<td>6:00AM-8:59AM</td>
</tr>
<tr>
<td>0.261</td>
<td>0.327</td>
<td>0.297</td>
<td>0.328</td>
<td>0.421</td>
<td>0.421</td>
<td>0.327</td>
<td>9:00AM-2:59PM</td>
</tr>
<tr>
<td>0.030</td>
<td>0.451</td>
<td>0.262</td>
<td>0.354</td>
<td>0.323</td>
<td>0.323</td>
<td>0.262</td>
<td>3:00PM-6:59PM</td>
</tr>
<tr>
<td>0.194</td>
<td>0.228</td>
<td>0.096</td>
<td>0.279</td>
<td>0.080</td>
<td>0.080</td>
<td>0.096</td>
<td>7:00PM-5:59AM</td>
</tr>
</tbody>
</table>
Feedback Loop

- **Feedback Loop Number = 1**
- **START TRANSITMODEL** Thu 05/02/2013 17:06:20.97
- **START MODE CHOICE** Thu 05/02/2013 17:07:15.45
- **START DISTRIBUTION** Thu 05/02/2013 17:19:44.19
- **START HASSIGN** Thu 05/02/2013 17:49:34.07
- AM percent time change 0.49942
- AM percent volume change 0.5959
- MD percent time change 0.3764
- MD percent volume change 0.28835
- **Feedback Loop Number = 2**
- **START TRANSITMODEL** Thu 05/02/2013 17:53:40.97
- **START MODE CHOICE** Thu 05/02/2013 17:54:34.31
- **START DISTRIBUTION** Thu 05/02/2013 18:07:39.58
- **START HASSIGN** Thu 05/02/2013 18:37:18.43
- AM percent time change 0.05759
- AM percent volume change 0.12637
- MD percent time change 0.03108
- MD percent volume change 0.07725
- **Feedback Loop Number = 3**
- **START TRANSITMODEL** Thu 05/02/2013 18:41:03.19
- **START MODE CHOICE** Thu 05/02/2013 18:41:57.27
- **START DISTRIBUTION** Thu 05/02/2013 18:54:53.13
- **START HASSIGN** Thu 05/02/2013 19:24:38.26
- ... converged Thu 05/02/2013 21:52:12.48
- **START TASSIGN** Thu 05/02/2013 21:52:20.85
- **START REPORTS** Thu 05/02/2013 21:52:35.42
- End Run Thu 05/02/2013 21:52:51.83
- The model ran for a total of: 290 Minutes (4 Hr 50 Min)
Transit Modeling Update (TMU)

New Data Requirements

- Household Income
- Household Size
- Household Workers
- Auto Ownership
- University / College Students
- Peak Hour Traffic Counts
- Diurnal Factors
- Peak Hour Factors

Transit Modeling Update (TMU)

Our Experience

- Added more error checking (out of range)
- Replaced hard-coded parameters with {keys}
- Revised some matrix calculations (autos > persons)
- Improved CLUSTER functionality
- Adjusted script to prevent “out of memory” errors
- Added reporting

- Timeframe for first run: 8 weeks
"Out-of-the-Box" Summary
Reasonable Results and Run Times

C:\FSUTMS\Polk\R3\Base
VOLUME AND COUNT SUMMARY BY SCREENLINE
Total VOL= 9,552,803 CNT= 9,719,061 VOL/CNT= 0.98 N=1,083

Overall Summary
Total Number of Links: 8,132
Total Centerline Miles: 2,611.75
Total Lane Miles: 3,426.56
Total Directional Miles: 2,654.00
Total VMT using Volumes: 4,765,186 (Links With Counts)
Total VMT using Counts: 4,576,271 (Links With Counts)
Total VMT Volume over Counts: 1.04 (Links With Counts)
Total VHT using Volumes: 131,757 (Links With Counts)
Total VHT using Counts: 126,656 (Links With Counts)
Total VHT Volume over Counts: 1.04 (Links With Counts)
Total Volumes All Links: 53,000,190
Total VMT All Links: 17,818,308
Total VHT All Links: 517,371
Original Speed (MPH): 35.49
Congested Speed (MPH): 33.85

================================================================
End Run Tue 04/30/2013 17:02:51.03
The model ran for a total of: 354 Minutes (5 Hr 54 Min)

Potential Model Enhancements

- External Trips
  - Identify by trip type and occupancy
  - Split by trip purpose and trip length

- Special Trips
  - Airports
  - Theme Parks
  - Trucks

- Calibration Procedures
  - Mode Choice
  - Destination Choice
Managed Lanes Implementation

Incorporating the Phase 1 congestion pricing toll procedure in the Polk TMU

Preliminary results are encouraging

D1RPM Implementation

Scalability?
- Long Run Times (7 days)
- Optimization
  - Procedures
  - Cluster Utilization
- Hybrid Model Testing
Transit Modeling Update (TMU)

TMU Project Documents

- Trip Distribution Review and Recommended Improvements
- Trip Generation Review and Recommended Improvements
- Time of Day Stratification Review
- Mode Choice Review and Recommended Improvements
- Travel Time Feedback Review
- Reporting Functionality Recommendations
- Principles of Model Calibration & Validation
- User Benefit Guidelines and Procedures
- Quality Control Guidelines

Available for Download at FSUTMSONLINE.NET

Transit Modeling Update (TMU)

Q & A
## Transit Ridership

### ESTIMATE OF AVERAGE WEEKDAY RIDERSHIP for 2007 BY ROUTE

<table>
<thead>
<tr>
<th>#</th>
<th>Route/Route Name</th>
<th>Ridership</th>
<th>TMU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 Shuttle</td>
<td>117</td>
<td>431.7</td>
</tr>
<tr>
<td>2</td>
<td>11 S. Main/Grillatee</td>
<td>256</td>
<td>462.8</td>
</tr>
<tr>
<td>3</td>
<td>12 Lakeland/Winterhaven</td>
<td>247</td>
<td>305.6</td>
</tr>
<tr>
<td>4</td>
<td>20 Grove Park/Crystal Lake</td>
<td>256</td>
<td>430.0</td>
</tr>
<tr>
<td>5</td>
<td>21 Bivens Rd</td>
<td>106</td>
<td>742.1</td>
</tr>
<tr>
<td>6</td>
<td>201 Bartram Exp to Lakeland</td>
<td>285</td>
<td>494.6</td>
</tr>
<tr>
<td>7</td>
<td>30 Cleveland Heights</td>
<td>81</td>
<td>825.1</td>
</tr>
<tr>
<td>8</td>
<td>31 S Florida Ave</td>
<td>544</td>
<td>2035.7</td>
</tr>
<tr>
<td>9</td>
<td>32 Maldita Loop</td>
<td>16</td>
<td>155.0</td>
</tr>
<tr>
<td>10</td>
<td>37 Sault</td>
<td>27</td>
<td>95.1</td>
</tr>
<tr>
<td>11</td>
<td>40 Avionics/Beacon</td>
<td>88</td>
<td>581.2</td>
</tr>
<tr>
<td>12</td>
<td>41 Central Ave</td>
<td>200</td>
<td>352.7</td>
</tr>
<tr>
<td>13</td>
<td>42 L M Streets</td>
<td>144</td>
<td>1036.4</td>
</tr>
<tr>
<td>14</td>
<td>50 Killbuck/Providencia</td>
<td>180</td>
<td>1160.4</td>
</tr>
<tr>
<td>15</td>
<td>51 L12/DUP CITY</td>
<td>590</td>
<td>1530.9</td>
</tr>
<tr>
<td>16</td>
<td>52 N Florida Ave</td>
<td>513</td>
<td>771.8</td>
</tr>
<tr>
<td>17</td>
<td>53 Lakeland Village</td>
<td>37</td>
<td>410.4</td>
</tr>
<tr>
<td>18</td>
<td>56 Killbuck/Mall Hill Rd</td>
<td>170</td>
<td>334.1</td>
</tr>
<tr>
<td>19</td>
<td>57 Southwest/Highline</td>
<td>86</td>
<td>203.1</td>
</tr>
</tbody>
</table>

Subtotal | 4,270 | Subtotal | 13,378 |

### WHAT

<table>
<thead>
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<th>Ridership</th>
<th>TMU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 Southside</td>
<td>232</td>
<td>88.6</td>
</tr>
<tr>
<td>2</td>
<td>12 Lakeland/Winterhaven</td>
<td>265</td>
<td>305.6</td>
</tr>
<tr>
<td>3</td>
<td>15 Harvard City</td>
<td>105</td>
<td>352.0</td>
</tr>
<tr>
<td>4</td>
<td>20 Palm Harbor</td>
<td>37</td>
<td>230.2</td>
</tr>
<tr>
<td>5</td>
<td>226 Bartram Exp to Winter Haven</td>
<td>170</td>
<td>197.7</td>
</tr>
<tr>
<td>6</td>
<td>30 Eagle Ridge/Winter Haven</td>
<td>305</td>
<td>895.8</td>
</tr>
<tr>
<td>7</td>
<td>40 Southside</td>
<td>179</td>
<td>738.7</td>
</tr>
<tr>
<td>8</td>
<td>44 Southwest</td>
<td>167</td>
<td>161.3</td>
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<tr>
<td>9</td>
<td>50 Westside</td>
<td>110</td>
<td>286.6</td>
</tr>
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</table>

Subtotal | 1,998 | Subtotal | 5,918 |

### Polk County

<table>
<thead>
<tr>
<th>#</th>
<th>Route/Route Name</th>
<th>Ridership</th>
<th>TMU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20 Winter Haven</td>
<td>81</td>
<td>233.3</td>
</tr>
<tr>
<td>2</td>
<td>36 Prosper in Eagle Ridge Mall</td>
<td>111</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Subtotal | 192 | Subtotal | 60 |

Total | 6,061 | Total | 16,355 |

## Run Optimization

**Distribute MULTI step HASSIGN example**

**Distribute INTRA step HASSIGN example**

- **Parallel Processing**
- **Automatically Scales for # of Cores**
- **10% time savings**
- **Cannot be used for summary stats**

### Key

- **Parallel Processing**
- **Automatically Scales for # of Cores**
- **10% time savings**
- **Cannot be used for summary stats**