Item #2

# Version 2.3 Travel Model: Status report and use in project planning studies

Presentation
to the
TPB Travel Forecasting Subcommittee

March 23, 2012

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National Capital Region Transportation Planning Board (TPB)
Metropolitan Washington Council of Governments (MWCOG)

# Today's discussion

- Review of the upcoming AQ Conformity Schedule
- Results and findings from TPB staff's application of the Version 2.3.38 travel model for two recent project planning "studies" in northern Virginia:
  1. Metrorail parking demand at two planned Silver Line stations in Loudoun County
  2. Impacts of a Metrorail Orange Line extension on I-66 traffic inside of the Capital Beltway

# Schedule for the
# 2012 CLRP FY 2013-18 TIP
# Air Quality Conformity Assessment

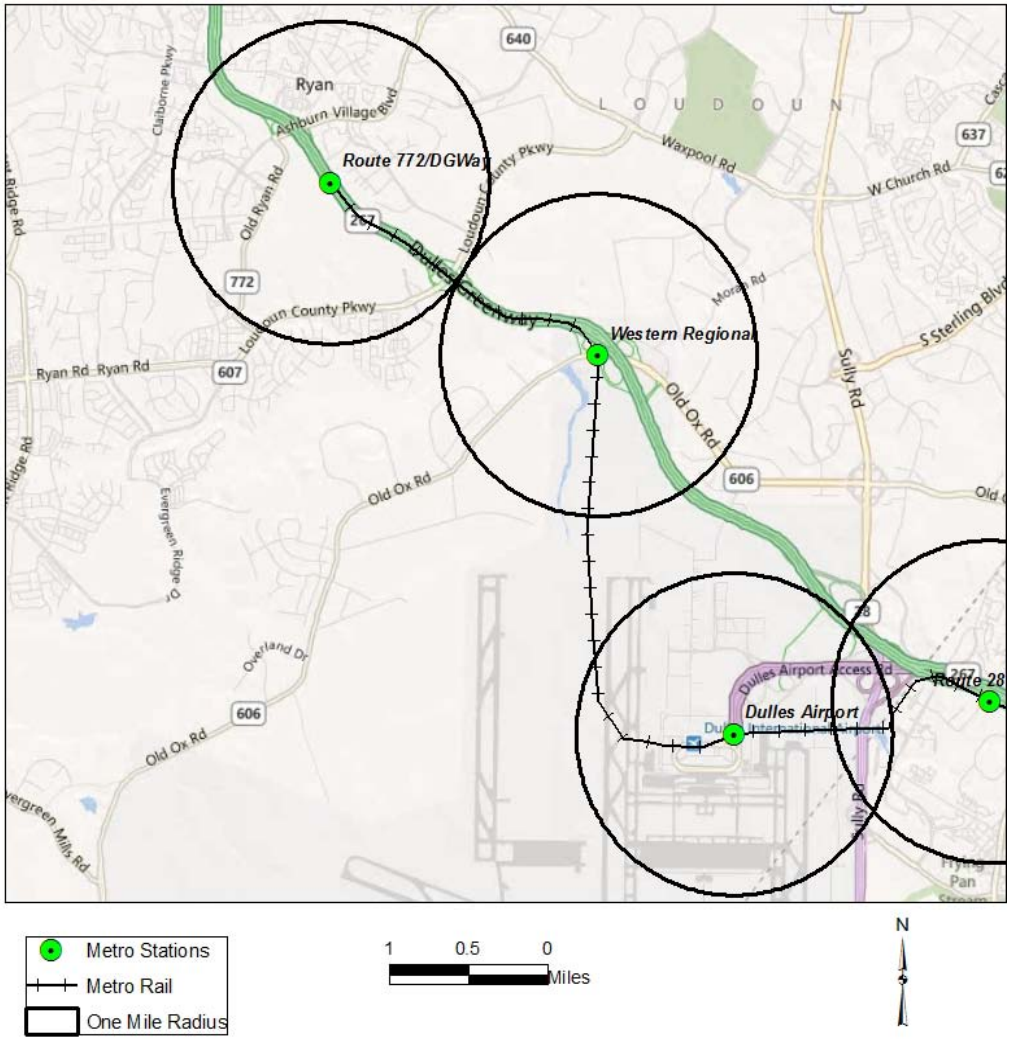
| Date | | | Event |
|---|---|---|---|
| September | 21 | | TPB briefed on Call for Projects |
| October | 19 | 2011 | Local agencies begin submitting project information |
| December | 16 | | Local agencies stop submitting project information |
| January | 6 | 2012 | TPB Tech. Committee reviews draft CLRP/TIP & work scope |
| January | 12 | | Draft CLRP/TIP project submissions and draft work scope released for public comment |
| January | 18 | | TPB is briefed on draft CLRP and TIP and work scope |
| February | 11 | | Public comment period ends |
| February | 15 | | TPB reviews public comment and and is asked to approve draft CLRP and TIP and work scope |
| March<br>April<br>May | | | Prepare modeling inputs & execute<br>travel demand & mobile emissions models<br>Analysis years: 2007, 2017, 2020, 2030, 2040 |
| June | 14 | | Draft CLRP/TIP and Conformity Assessment released for public comment at CAC |
| June | 20 | | TPB briefed on draft CLRP/TIP & Conformity Assessment |
| July | 14 | | Public comment period ends |
| July | 18 | | TPB reviews puiblic comments and responses to public comments, and is presented the draft CLRP/TIP and Conformity Assessment for adoption |

# Study #1
# Metrorail parking demand in Loudoun County

# Metrorail parking demand in Loudoun County

- Client: Loudoun County, VDOT
- Consultant: Desman Associates
- Technical request: TPB staff was asked to retrieve "off-the-shelf" 2025 PNR demand estimates for the two end-of-line Silver Line stations:
  - Rte. 606/ Western Regional; and
  - Rte. 772/Dulles Gateway
    - (Phase 2 terminus, Silver Line)

# Study area: NW of Dulles Airport



# Procedure

- Staff retrieved the most recent outputs of the Version 2.3 model
  - AQC Determination/2011 CLRP, adopted 11/18/2011
  - 2025 outputs based 2020 & 2030 interpolations
- Land activity in the vicinity of both stations was reviewed
- Daily estimated 2025 boardings at all Silver Line stations were summarized and compared to FEIS boardings generated previously
- Metrorail trips summarized by access mode

# Comparison of FEIS and V2.3 2025 Metrorail Boardings for Silver Line

| Station | FEIS 2025 | V2.3 2025 | Diff. | % Diff. |
|---|---|---|---|---|
| Tysons East | 4,092 | 5,407 | 1,315 | 32.1% |
| Tysons Central RT123 | 6,067 | 10,870 | 4,803 | 79.2% |
| Tysons West | 3,838 | 3,631 | -207 | -5.4% |
| Tyson Central Rt 7 | 4,627 | 4,544 | -84 | -1.8% |
| Wiehle Ave | 6,498 | 5,997 | -502 | -7.7% |
| Reston Parkway | 4,708 | 6,739 | 2,031 | 43.1% |
| Herndon/Monroe | 8,775 | 5,056 | -3,720 | -42.4% |
| Route 28 | 1,226 | 2,630 | 1,404 | 114.5% |
| Dulles Airport | 6,200 | NA | NA | NA |
| Route 606 | 4,485 | 1,362 | -3,123 | -69.6% |
| Route 772/DGWay | 6,961 | 5,821 | -1,140 | -16.4% |
| Total | 57,477 | 52,054 | -5,423 | -9.4% |
| Total excl. Dulles Airport | 51,277 | 52,054 | 777 | 1.5% |

- Source for FEIS 2025 boardings: "Dulles Corridor Rapid Transit Project Final Environmental Impact Statement and Section 4(f) Evaluation", December 2004

- Source for TPB: Version 2.3.38 forecasts, interpolated between 2020 and 2030

Observations:

- V2.3 Model does not currently address non-resident transit travel, hence no boardings are shown at Dulles
- Considerable differences exist at station level
- Overall line boardings agree well when Dulles A.P. station is excluded

# Estimated 2025 PNR demand

| | | |
|---|---|---|
| Rte. 606: ~ | 500 | (coded lot size: 2,750) |
| Rte. 772: ~ | 4,000 | (coded lot size: 3,300) |
| Total: | 4,500 | 5,050 |

Caveats to consider:

- Above demand was developed with the Metrorail core transit constraint
- The drive access shed assumed to be 15 miles; Is this assumption appropriate?
- PNR demand & supply was not evaluated at other Silver Line stations

# Study #2
# Metrorail Orange Line extension to Centreville

# Orange Line extension to Centreville: The impact on I-66 inside the Beltway

- Client: VDOT
- Consultant: Cambridge Systematics
- Technical request: NVDOT asked TPB staff to model a nine-mile Metrorail extension on the Orange Line to assess the highway impacts on the I-66 corridor; the added stations were:
  - Fair Oaks
  - Stringfellow Road
  - Centreville

# Metrorail Orange Line extension study area

## from Vienna to Centreville

# Network coding

- Network coding was done in short order to accommodate the tight schedule
  - The alternative was coded over the existing 2011 CLRP network
  - "Interline connections" (or track sharing between Metrorail lines) were discussed but not considered
  - PNR lots were coded at the three new stations; parking rates were similar to those assumed for Silver line PNR lots
  - Bus connections at the new stations were coded with professional judgment; cutbacks in bus service were not considered

# Three modeled scenarios executed

1. Base Scenario: Standard execution of V2.3 model
   - speed feedback and;
   - no transit constraint;
   - Year 2040 (2011 CLRP) assumed
2. Alt. Scenario 1: Standard execution of V2.3 model
   - speed feedback and;
   - no transit constraint;
   - Year 2040, Orange Line ext. coded over 2011 CLRP
3. Alt. Scenario 2: Non-standard, fixed person trip table used
   - Mode Choice, TOD, and traffic assignment executed only using:
     - Final (I4) person *Base* scenario trip table
     - Base scenario highway skims
     - Alternative transit skims
     - No transit constraint

# Comparison of Base & Alt. trips by mode, VMT

**With** speed feedback

| | (1) | (2) | (2) - (1) | (2) / (1) |
|---|---|---|---|---|
| | Base Scenario | Alt 1. Scenario | Difference | Ratio |
| Travel Measure | 2040 CLRP | O.L. Ext. - W/ Feedback | | |
| Internal Auto Person Trips | 22,851,366 | 22,833,982 | -17,384 | 1.00 |
| Internal Transit Trips | 1,603,823 | 1,616,079 | 12,256 | 1.01 |
| Internal Motorized Person Trips | 24,455,189 | 24,450,061 | -5,128 | 1.00 |
| | | | | |
| Internal Auto Drivers | 15,882,036 | 15,869,922 | -12,114 | 1.00 |
| | | | | |
| Transit Percentage | 6.56% | 6.61% | 0.05% | 1.01 |
| | | | | |
| Total Vehicle Trips | 21,184,950 | 21,172,779 | -12,171 | 1.00 |
| | | | | |
| Total VMT | 217,082,216 | 217,058,538 | -23,678 | 1.00 |

- Slight drop in total person trips
- Transit trips increase with the Metrorail improvement
- Auto drivers decrease accordingly
- Minor VMT impact

**Without** speed feedback/ Fixed Person Trip Table

| | (1) | (2) | (2) - (1) | (2) / (1) |
|---|---|---|---|---|
| | Base Scenario | Alt 2. Scenario | Difference | Ratio |
| Travel Measure | 2040 CLRP | O.L. Ext. - W/O Feedback | | |
| Internal Auto Person Trips | 22,851,366 | 22,843,178 | -8,188 | 1.00 |
| Internal Transit Trips | 1,603,823 | 1,611,986 | 8,163 | 1.01 |
| Internal Motorized Person Trips | 24,455,189 | 24,455,164 | -25 | 1.00 |
| | | | | |
| Internal Auto Drivers | 15,882,036 | 15,876,378 | -5,658 | 1.00 |
| | | | | |
| Transit Percentage | 6.56% | 6.59% | 0.03% | 1.01 |
| | | | | |
| Total Vehicle Trips | 21,184,950 | 21,179,292 | -5,658 | 1.00 |
| | | | | |
| Total VMT | 217,082,216 | 216,931,232 | -150,984 | 1.00 |

- No change in person trips
- Transit trips increase, but increase is smaller
- Auto drivers decrease but decrease is smaller
- VMT impact much larger than above

# Comparison of Base and Alt. trips by submode

**With** speed feedback

| Submode | (1) 2040_Base W/Feedback | (2) 2040_Alt W/Feedback | (2 -1) Difference | (2/1) Ratio |
|---|---|---|---|---|
| Commuter_Rail | 37,448 | 35,654 | -1,794 | 0.95 |
| All_Bus | 527,715 | 525,570 | -2,145 | 1.00 |
| Bus&Metrorail | 276,347 | 270,505 | -5,842 | 0.98 |
| Metrorail_Only | 762,314 | 784,350 | 22,036 | 1.03 |
| | 1,603,824 | 1,616,079 | 12,255 | 1.01 |

**Without** speed feedback/ Fixed Person Trip Table

| Submode | (1) 2040_Base W/Feedback | (2) 2040_Alt W/O Feedback | (2 -1) Difference | (2/1) Ratio |
|---|---|---|---|---|
| Commuter_Rail | 37,448 | 35,626 | -1,822 | 0.95 |
| All_Bus | 527,715 | 527,326 | -389 | 1.00 |
| Bus&Metrorail | 276,347 | 271,068 | -5,279 | 0.98 |
| Metrorail_Only | 762,314 | 777,966 | 15,652 | 1.02 |
| | 1,603,824 | 1,611,986 | 8,162 | 1.01 |

In both cases, transit trips are diverted to "Metro Only" submode, particularly from "Commuter Rail" and "Bus Metrorail" submodes

# Comparison of Base and Alt. I-66 segment volumes (inside Beltway)

| Section | Location | (1) Base 2040 CLRP | (2) Alternative 2040 CLRP with Orange Line Ext. W/Spd Feedback | (3) Alternative 2040 CLRP with Orange Line Ext. W/O Spd Feedback | Difference (2) - (1) | Difference (3) - (1) |
|---|---|---|---|---|---|---|
| 1 | East of Lee Highway to Theodore Roosevelt Bridge | 100,777 | 100,111 | 100,238 | -666 | -539 |
| 2 | Glebe Road to Lee Highway | 112,243 | 111,658 | 111,698 | -585 | -545 |
| 3 | North Sycamore Street to Glebe Road | 135,803 | 135,117 | 135,016 | -686 | -787 |
| 4 | Dulles Airport Road Connector to North Sycamore Street | 152,960 | 152,007 | 151,908 | -953 | -1,052 |
| 5 | Lessburg Pike (Rt. 7) to Dulles Airport Road Connector | 99,953 | 98,681 | 98,449 | -1,272 | -1,504 |
| 6 | I-495 to Lessburg Pike (Rt. 7) | 100,303 | 99,225 | 98,630 | -1,078 | -1,673 |

- The I-66 link volumes resulting from both alternative runs were quite similar

- Our conclusion was that the Orange line extension would not substantially affect volumes on I-66 inside the beltway (volume reductions were moderate)

# Observations regarding screenline analysis (next page)

- Screenline crossings in the study impact area were examined
  - A priori expectation: a radial transit improvement should result in reduced screenline crossings, particularly on North/South screenlines
- Generally, screenline crossings were not dramatically affected by the alternative
- But, screenline crossing differences were noted between “speed feedback” and “fixed trip table” simulation of the alternative:
  - Speed feedback alt: some N/S screenline crossings found to *increase* slightly (questionable)
  - Fixed trip table alt: All screenline crossings were found to decrease (reasonable)

  Staff investigated the trip tables to gain more insight

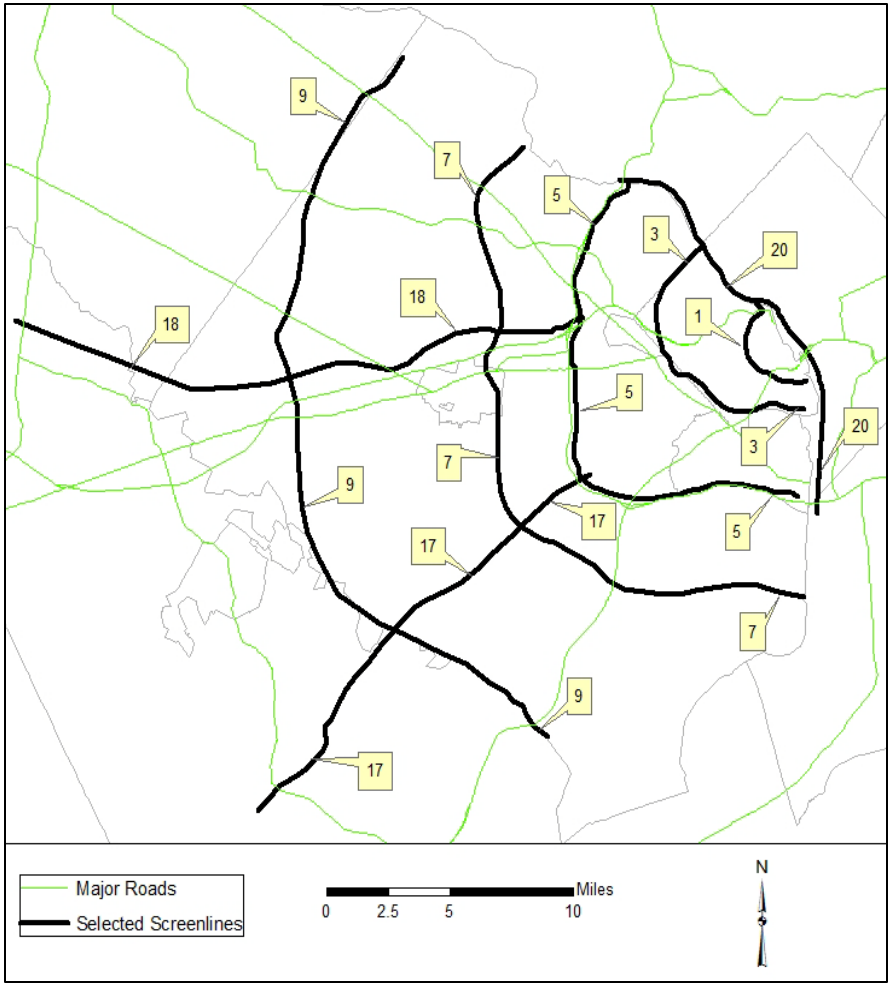
# Daily Base and Alt. screenline crossings in the expected highway impact area

**With** speed feedback

| Screenline No. | (1) 2040_Base W/Feedback | (2) 2040_Alt W/Feedback | (2 -1) Difference | % Diff |
|---|---|---|---|---|
| | (a) | (b) | (d) | (e) |
| 1 | 907,800 | 908,200 | 400 | 0.04% |
| 3 | 1,032,400 | 1,032,500 | 100 | 0.01% |
| 5 | 1,331,000 | 1,330,800 | -200 | -0.02% |
| 7 | 1,439,900 | 1,439,300 | -600 | -0.04% |
| 9 | 1,292,400 | 1,295,200 | 2,800 | 0.22% |
| 17 | 678,100 | 675,800 | -2,300 | -0.34% |
| 18 | 970,800 | 969,600 | -1,200 | -0.12% |
| 20 | 1,373,700 | 1,375,500 | 1,800 | 0.13% |

**Without** speed feedback

| Screenline No. | (1) 2040_Base W/Feedback | (2) 2040_Alt W/O Feedback | (2 -1) Difference | % Diff |
|---|---|---|---|---|
| | (a) | (b) | (d) | (e) |
| 1 | 907,800 | 906,100 | -1,700 | -0.19% |
| 3 | 1,032,400 | 1,029,200 | -3,200 | -0.31% |
| 5 | 1,331,000 | 1,327,800 | -3,200 | -0.24% |
| 7 | 1,439,900 | 1,435,000 | -4,900 | -0.34% |
| 9 | 1,292,400 | 1,289,400 | -3,000 | -0.23% |
| 17 | 678,100 | 676,600 | -1,500 | -0.22% |
| 18 | 970,800 | 968,900 | -1,900 | -0.20% |
| 20 | 1,373,700 | 1,371,500 | -2,200 | -0.16% |



# Auto driver trip table differences (Alt. – Base)

Table A: 2040Base vs. 2040 Alt w/ Speed Feedback

| | DESTINATION | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORIGIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | . . . | TOTAL |
| 1 DC CR | -83 | -6 | 45 | -14 | 1 | 9 | 10 | -14 | 5 | 10 | 1 | 0 | 2 | 6 | | **-33** |
| 2 DC NC | -43 | -136 | 25 | 11 | -9 | 8 | 11 | 161 | 51 | 6 | 0 | -1 | 11 | 33 | | **108** |
| 3 MTG | -132 | -114 | -1067 | 70 | 5 | 25 | 63 | 601 | 85 | 87 | -15 | -3 | 113 | 71 | | **-223** |
| 4 PG | -148 | -16 | -135 | 43 | -41 | -74 | 46 | 535 | 41 | 33 | -1 | -1 | 14 | 253 | | **493** |
| 5 ARLCR | 4 | 0 | 2 | 2 | -18 | -10 | 3 | -21 | -1 | 6 | 0 | 0 | 0 | 1 | | **-34** |
| 6 ARNCR | 39 | 5 | 38 | 1 | -20 | -161 | 1 | -11 | 36 | 66 | 0 | 0 | 0 | 2 | | **-25** |
| 7 ALX | 52 | 16 | 28 | -22 | 5 | 259 | -18 | 130 | 27 | 20 | 0 | 0 | 0 | 0 | | **478** |
| 8 FFX | -1686 | -581 | 219 | -195 | -297 | -883 | -365 | -7551 | 110 | 1922 | -1 | 0 | 2 | -9 | | **-9702** |
| 9 LDN | -126 | 29 | 139 | 25 | -30 | -49 | -3 | -395 | 120 | 549 | -24 | -1 | -7 | -6 | | **250** |
| 10 PW | 188 | 316 | 463 | -10 | 76 | 284 | 77 | 2804 | -1347 | -6193 | -10 | 0 | -7 | -20 | | **-4191** |
| 11 FRD | -27 | 2 | 199 | 33 | -1 | 15 | 16 | 148 | 253 | 66 | -24 | 54 | -522 | -319 | | **-101** |
| 12 CAR | -15 | -10 | 31 | -12 | -2 | -3 | 2 | 29 | 42 | 8 | -37 | -46 | 34 | 0 | | **23** |
| 13 HOW | -33 | -61 | -201 | -107 | 0 | 1 | 5 | 45 | 11 | 10 | 4 | -50 | 176 | 164 | | **-35** |
| 14 AAR | -66 | 14 | -9 | 89 | -12 | -30 | 7 | 88 | 14 | 13 | -3 | -4 | 115 | -291 | | **-83** |
| . | | | | | | | | | | | | | | | | |
| . | | | | | | | | | | | | | | | | |
| . | | | | | | | | | | | | | | | | |
| **TOTAL** | **-2205** | **-612** | **-245** | **-33** | **-374** | **-698** | **-146** | **-5156** | **-380** | **-915** | **-128** | **-52** | **-79** | **-117** | | **-12114** |

Table B: 2040Base vs. 2040 Alt w/o Speed Feedback

| | DESTINATION | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORIGIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | . . . | TOTAL |
| 1 DC CR | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | | **29** |
| 2 DC NC | 6 | 0 | 1 | 1 | 1 | 2 | 0 | 9 | 0 | -1 | 0 | 0 | 0 | 0 | | **18** |
| 3 MTG | 14 | 6 | 3 | 2 | 2 | 6 | 0 | -15 | 0 | 0 | 0 | 0 | 0 | 0 | | **17** |
| 4 PG | 44 | 17 | 6 | 14 | 8 | 14 | 2 | -10 | 0 | 0 | 0 | 0 | 0 | 0 | | **95** |
| 5 ARLCR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | | **5** |
| 6 ARNCR | 6 | 2 | 0 | 0 | 7 | 95 | 2 | -4 | 0 | 0 | 0 | 0 | 0 | 0 | | **108** |
| 7 ALX | 5 | 3 | 0 | 0 | 7 | 275 | 79 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | | **390** |
| 8 FFX | -1544 | -488 | -289 | -46 | -289 | -722 | -120 | -1186 | -9 | -16 | 0 | 0 | 0 | 0 | | **-4710** |
| 9 LDN | -192 | -83 | -42 | -5 | -50 | -126 | -19 | -32 | 0 | 0 | 0 | 0 | 0 | 0 | | **-550** |
| 10 PW | -346 | -77 | -48 | -6 | -71 | -187 | -9 | -304 | -2 | 0 | 0 | 0 | 0 | 0 | | **-1050** |
| 11 FRD | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -6 | 0 | 0 | 0 | 0 | 0 | 0 | | **-5** |
| 12 CAR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | **0** |
| 13 HOW | 3 | 2 | -1 | 1 | 0 | 1 | 0 | -3 | 0 | 0 | 0 | 0 | 0 | 0 | | **3** |
| 14 AAR | 11 | 1 | 0 | 0 | 1 | 3 | 0 | -2 | 0 | 0 | 0 | 0 | 0 | 0 | | **13** |
| . | | | | | | | | | | | | | | | | |
| . | | | | | | | | | | | | | | | | |
| . | | | | | | | | | | | | | | | | |
| **TOTAL** | **-1995** | **-617** | **-370** | **-37** | **-384** | **-637** | **-64** | **-1526** | **-12** | **-17** | **0** | **0** | **0** | **0** | | **-5658** |

Shaded area indicates cells where auto drivers should decrease (i.e., where transit service increases)

Table A also shows the expected decrease in auto driver trips in the shaded area, but also shows the increase in auto drivers from DC & MD to VA that are induced by the added capacity afforded by the transit improvement (the purpose of speed feedback).

Table B shows a distinct pattern- Auto driver trips change, for the most part, in cells impacted by transit improvement

# Conclusions

- The Orange Line extension will not impact I-66 traffic substantially
- The Orange Line extension analysis proved useful in demonstrating *differences* in findings between approaches

  – The fixed person trip table approach ensured that the transit improvement reduced auto travel strictly within the area affected by the alternative. The approach resulted in expected reductions in N/S screenline crossings, and resulted in substantially decreased VMT, relative to the SF approach

  – The speed feedback approach reflected the impact of the alternative (more transit trips, less auto trips) as well as trip distribution changes resulting from added highway capacity (i.e., more river crossings). The subsequent redistribution of person/auto driver travel offset some of the benefits indicated by the fixed trip table approach (i.e., reduced screenline crossings and reduced VMT)

# Final Comments

- The Version 2.3 travel model has been applied by TPB staff, and will continue to be tested
- The Loudoun County study has indicated that initial Metrorail boardings compare reasonably with prior forecasts at the line level, and the need for refinement when the regional model is used for station level analysis
- Orange line extension study has indicated that the model responds reasonably to coded transit improvements
- When interpreting "standard/speed feedback" model results (screenline crossings in particular), the analyst must be mindful of:
  - The transit improvement, as a first-order effect
  - The consequent change in accessibility and trip distribution (accounted for by the speed feedback loop), as a second-order effect