TRANSFORM 66 OUTSIDE the Beltway

VDOT | DRPT

Multimodal Solutions - 495 to Haymarket

Tier 2 Environmental Assessment
I-66 Transportation Technical Report

Appendix D

Travel Demand Model & Post Processing Methodology & Assumptions Technical Memorandum

DRAFT – MAY 12, 2015

TECHNICAL MEMORANDUM

I-66 Corridor- Interchange Justification Report

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FROM:	Steve Weller/ CH2M HILL	
DATE:	June 25, 2014	
SUBJECT:	DRAFT Travel Demand Model & Post Processing Methodology & Assumptions	

This memorandum provides a broad overview of the assumptions and procedures being used for travel demand modeling and post processing of modeling results for the I-66 Corridor Study Interchange Justification Report and serves as a point of departure for more detailed discussions.

Travel Demand Modeling Methodology and Key Assumptions

The MWCOG travel demand model will be the basis of development for travel forecasts. The I-66 study will use Version 2.3, Build 52 of the MWCOG travel demand model as the starting point for forecast development. The standard Version 2.3, Build 52 model will be strategically modified with specific alterations to improve the accuracy and reliability of multi-modal forecasts for the I-66 corridor and to preserve a level of consistency with the traffic and revenue study (OTP3) forecasting effort while maintaining the fidelity of the regional process. Specific modifications to the model will be based on analysis and validation of the model to recent data collection. Changes in the MWCOG travel demand model regional may include:

- Highway and transit network modifications to better represent study area facilities as they exist and are planned. Ramps will be micro-coded to improve forecasts and correlation to the microsimulation process.
- Traffic Analysis Zone (TAZ) splits and centroid connector location changes to improve model loading.
- Use of toll diversion methodology to forecast managed lane trips.
- Changes to external trip assumptions to improve consistency with origin-destination data and traffic and revenue evaluations.
- Changes in the time of day distribution to improve forecasting of peak period trips

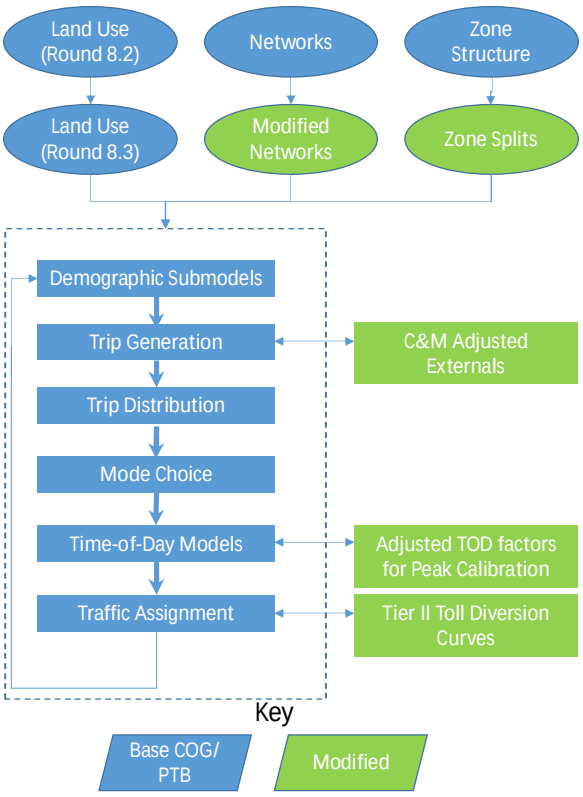
- Changes in the volume-delay function (VDF) curves, and changes in the default speed and capacity of some facility types to improve the volume and speed forecasts compares to observed data.

All changes will be made to the networks and model is a consistent manner to ensure that the changes made to improve calibration in the corridor are forecastable, not just modifications to improve calibration statistics.

Figure 1 is a flow chart summarizing the areas of changes to the travel demand forecasting process. The methodology will maintain the MWCOG model structure and will maintain the regional elements of the model. The proposed changes in the model include:

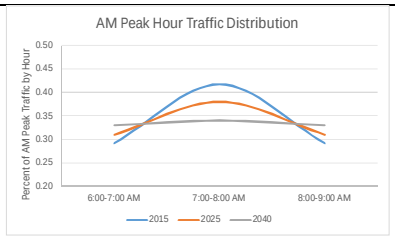
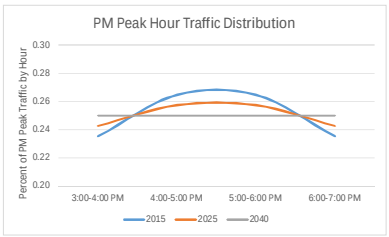
- Zone splits and network modification to improve the representation of travel in the corridor and to improve the fidelity of the output to the micro simulation process.
- Calibration and validation of the model to recently collected (2014) count data in the corridor and to available transit data in the corridor.
- Validation of the C&M Tier II Traffic and Revenue Study toll diversion curves to the I-495 HOT lanes.
- Traffic and transit ridership forecasts for a no build and two build scenarios for a 2025 opening year and a 2040 horizon year.

Figure 1: Proposed Adjustments to the MWCOG/TPB Model Process



The tables below list key assumptions associated with the travel forecasting process.

<table>
<tr><th>Assumption</th><th>Base Case</th><th>Comments</th></tr>
<tr><td colspan="3">Model</td></tr>
<tr><td>Analysis Years:
2015 (Existing Year)
2025 (Opening Year)
2040 (Design Year)</td><td><u>TPB Model</u>
2015 (Validation year)
2025
2040</td><td>MWCOG travel demand model has model inputs at 5-year increments. Intermediate years can be developed by interpolating input data and modifying networks to represent planned conditions.</td></tr>
<tr><td>Time Periods Modeled</td><td>Three time periods representing:<table><tr><th>Period</th><th>Length</th><th>Hours</th></tr><tr><td>AM</td><td>3 hrs</td><td>6am – 9am</td></tr><tr><td>Midday</td><td>6 hrs</td><td>9am-3pm</td></tr><tr><td>PM</td><td>4 hrs</td><td>3pm – 7pm</td></tr><tr><td>Off-Peak</td><td>11 hrs</td><td>7pm- 6am</td></tr></table></td><td>Hours split based on MWCOG Household Travel Survey data (2007/08) and are consistent with the regional model.</td></tr>
<tr><td>Speeds</td><td>Consistent with current conditions in the HOV and GP lanes.</td><td>Consistent with existing conditions. Same as speed/travel time curves based on MWCOG unless validation suggests modification.</td></tr>
<tr><td>Link Capacity</td><td>Lane capacities are defined consistent with the MWCOG/TPB model approach.</td><td>Facility and area type capacity tables are used to determine link capacities. The I-66 model will use the same speed-flow curves consistent with the MWCOG/TPB model unless validation suggests modification.</td></tr>
<tr><td>Peak Spreading</td><td>Peak Period to Peak Hour factors:<table><tr><th>Period</th><th>2015</th><th>2025</th><th>2040</th></tr><tr><td>AM</td><td>0.417</td><td>0.38</td><td>0.34</td></tr><tr><td>PM</td><td>0.294</td><td>0.272</td><td>0.25</td></tr></table></td><td>Existing peak period values were derived from the 2007/2008 MWCOG Household Travel Survey. The peak hour factors decline in future years in recognition of the increased congestion expected in the region causing less peaked periods. This assumption spreads the traffic evenly over the entire peak period. This reduces the congestion in the peak periods (increases speeds in GP lanes in the peak periods)</td></tr>
</table>

	 	
Value of Time (VoT)	The VoT is based on the Tier II T&R study toll diversion curves developed for OTP3. VoT escalation assumptions will be consistent with OTP3's consultant and will be made in consultation with the OTP3's consultant and VDOT staff	Consistent with OTP3 Level 2 Traffic and Revenue study
Land Use	MWCOG Round 8.3 socioeconomic data will be used	

Assumption	Base Case	Comments
Network Assumptions		
General	MWCOG/TPB Model ver 2.3.52 with changes relating to FY2015-2020 TIP and 2014 CLRP (draft dated 4/19/2014).	The significant changes in the draft 2014 CLRP compared to the 2013 CLRP in the I-66 corridor are: VRE System plan which includes $3.2 B in capital improvements including the Gainesville to Haymarket extension; West Access to Dulles Airport from US 50 near the Loudoun County Parkway.
Project Description (I-66 Managed Lanes)	3 General Purpose and 2 Managed Lanes in each direction from US 15 in Haymarket to the Capital Beltway (I-495) in Merrifield	
Project Extent	US 15 in Haymarket to the Capital Beltway (I-495) in Merrifield	
I495 (Capital Beltway)	HOT lanes on the Beltway from 2013.	
I-95/I-395	Reversible HOT lanes on I-95 From Turkeycock Run to Massaponax. 3 Lanes	The I-95/I-295 HOT lanes will assumed to not be

	reversible lanes between Turkeycock Run and Prince William Parkway, 2 reversible lanes from Prince William Parkway to Garrisonville Rd (Phase I) and 2 reversible lanes from Garrisonville Rd to Massaponax. Phase I opening in 2015 and Phase II 2025.	open in the "Existing Conditions run for 2015 even though Phase I of the HOT lanes are scheduled to open in 2015. The I-95 and I-395 lanes Phase I and Phase II HOT lanes will be assumed to be open in the I-66 opening year 2025 and horizon year 2040.
Springfield Interchange	Springfield Interchange Phase VIII complete. HOT access allowed from I95 and I395 to/from HOT lanes on Capital Beltway via directional ramps.	
HOV	All HOV facilities in the network are assumed to become HOV3+ after 2020.	Consistent with VDOT plans.
Toll Assumptions		
Tolling Methodology	The I-66 Model will apply Toll Diversion Curves (TDC) for trips in the I-66 corridor and the Beltway.	OTP3 Tier 2 T&R study applied the TDC to trips in I-66. Study team will look to expand the TDC application to include the Beltway and I-95/395 HOT lanes to adequately capture network effects of the managed lane system.
Toll Approach	Variable toll rates by roadway segment, based on maintaining managed lane speed goal of 55 mph.	Adopted to account for varying demand levels along the length of the project.
Tolls	Toll rates will be set to maintain speeds on the managed lanes and will be consistent with OTP3's consultant	
Assumption	Base Case	Comments
Mode Assumptions		
Vehicle Class	HOV3+: Free Other Cars & Medium Trucks: Tolled Heavy Trucks: Banned	On I-66 Managed Lanes.
HOV Vehicles	Modeled using the TPB Model HOV module. Starting in 2020, all HOV facilities in Northern Virginia area will be HOV-3+	The HOV estimates provided are an output of the *mode choice* and *carpool occupancy* models developed by MWCOG.
Hybrid/Violators	Modeled as a single class	Based on discussions with VDOT (progressive

	Details to be determined in coordination with VDOT, OTP3, and OTP3's consultant	technological advancement and improved enforcement over years).
Buses and Heavy Trucks	Buses will be pre-assigned to the model highway network in the I66 Corridor with a PCE factor of 2.5.	PCEs are not currently used in the MWCOG/TPB model. We will look to utilize truck and bus PCEs as part of the I-66 calibration effort.
Park and Ride Access	Assigned to highway network as specified in the MWCOG model	PNR and KNR are not assigned to the network. Will investigate adding the capability to assign PNR and KNR trips to the highway network.
Transit Capacity Constraint	Constrained to 2020 levels consistent with MWCOG methodology	

Methodology and Key Assumptions for Post Processing of Modeling Results

Post processing of travel demand model output is necessary in order to analyze traffic operations during peak hour conditions using peak period model output. Post processing will follow NCHRP 255 guidelines for estimating balanced existing, no-build, and build peak hour volumes.

Extensive data collection occurred in early June 2014. This included:

- 24 hour traffic counts with vehicle classifications at all ramp locations within study area and along the mainline of I-66 and I-495 between Rt7 and Gallows Rd.
- AM and PM peak period turn movement traffic counts. Counts generally occurred between 6:00 AM and 8:30 AM for the morning peak period and between 4:30 PM and 6:30 PM for the evening peak period.
- Travel time runs along the entire corridor for the AM and PM peak periods. This information along with additional travel time data yet to be procured will be used to identify where ramp counts may be constrained due to mainline congestion.

The following table outlines proposed steps for estimating existing, no-build, and build, peak hour volumes.

Step	Description
Existing Peak Hour Volumes	
1	Collect and review raw count information (ramps, mainline, and intersections).
2	Check for suspect / bad count data.
3	Calculate system peak hours.
4	Review volume-time profile to check for congestion-constrained locations.
5	Use demand smoothing adjustments.
6	Balance adjustments.
7	Produce final rounded and balanced 2014 peak-hour volumes.
No-Build Peak Hour Volumes	
1	Apply peak period-to-peak hour factors to forecasted link demand from the travel model (base year and "no-build" future year)
2	Estimate future year peak-hour turn movement demand at intersections that are present in both base year model and future year "no-build" model using existing peak-hour turn movement counts and NCHRP 255 procedures
3	Balance between intersections where possible.
4	Produce final rounded and balanced 2025 and 2040 peak-hour "no-build" volumes.
Build Peak Hour Volumes	
1	Apply peak period-to-peak hour factors to forecasted "build" link demand from the travel model
2	Compute change between future year "no-build" and future year "build" link volumes.
3	Add computed change to "no-build" final rounded link volumes.
4	Adjust future year peak-hour turn movement demand at intersections in response to changes
5	Balance between intersections where possible.
6	Produce final rounded and balanced 2025 and 2040 "build" peak-hour volumes.

The following table summarizes proposed assumptions to be used in post processing.

Elements	Assumption
System-wide peak hour for developing balanced existing peak hour volumes	To be determined by traffic count analysis
Peak period to peak hour factors	2025 No-Build and Build: 38% AM; 33% PM 2040 No-Build and Build: 27% AM; 25% PM
Ramp capacity	1,600 vehicles per lane per hour
HOV / HOT lane capacity	1,800 vehicles per lane per hour
Vehicle classifications	Existing classification data will be used for link specific vehicle classifications