



MEMORANDUM

TO: Feng Xie, Manager, Model Development Group, COG/TPB
FROM: Glenn Lang, Transportation Engineer, Model Development Group, COG/TPB
Ray Ngo, Transportation Engineer, Model Development Group, COG/TPB
SUBJECT: Gen3/Ver. 1.1.0 Travel Model Validation
DATE: April 6, 2026

INTRODUCTION

The activity-based, disaggregate COG/TPB Gen3 Model has been in development in three phases since late 2019. The third and final phase of development, led by COG/TPB staff, is nearing completion, with an official model release planned for the spring of this year. In 2025, TPB consultants prepared a report,¹ dated August 25, 2025, documenting the calibration and validation efforts associated with an interim version of the Gen3 Model (Gen3/Ver. 1.0.4). Subsequently, COG/TPB staff made a series of software, recalibration, performance, and correction updates to the Gen3 Model, as listed below. The resulting model was tagged as Version 1.1.0 for the upcoming official release.

Several major updates made between Gen3/Ver. 1.0.4 and Gen3/Ver. 1.1.0 included:

- Environment management: Replaced Anaconda/Miniforge3 with the uv package manager, reducing steps in the installation and accelerating environment deployment.
- Software update: Transitioned the model to work with ActivitySim 1.5.1 and utilize the new explicit chunking mechanism.
- Performance optimization: Integrated runtime improvements into the model framework, such as increased parallelization during highway assignment (increase from 16 to 32 concurrent processes).
- Bugfix: Implemented a bugfix in the transit skimming process to properly consider Park-and-Ride (PNR) parking costs.
- Model calibration: Recalibrated the transit subsidy and free parking models to local data using data from the 2019 State of Commute (SOC) survey. Subsequently, the tour and trip mode choice models were recalibrated using the 2018 calibration targets that were developed by RSG based on the Regional Travel Survey and transit on-board survey data. The recalibration of the transit subsidy and free parking models, alongside the tour and trip mode choice models, was detailed in a staff memo dated February 20, 2026.²

¹ RSG, Inc and Baseline Mobility Group, *Gen3/Ver. 1.0.4 Model Calibration and Validation Report* (Metropolitan Washington Council of Governments, August 25, 2025).

² Bahar Shahverdi, COG/TPB, *Additional Model Calibration Included in the Gen3/Version 1.1.0 Travel Model*, February 20, 2026.

This memo documents the highway and transit validation of the Gen3/Ver. 1.1.0 Model, amending Sections 3 and 4 of the August 25, 2025 model calibration and validation report³ and the corresponding sections in the February 20, 2026 model calibration memo⁴. To evaluate the updated model's goodness-of-fit, staff conducted detailed comparisons between the simulated data and established baseline datasets, specifically the 2017/2018 Regional Travel Survey (RTS), Census data, traffic counts, and transit ridership data.

HIGHWAY VALIDATION

The highway assignment validation is based on a comparison of highway assignment output from the Gen3/Ver. 1.1.0 Travel Model to observed data in the model base year of 2018. The observed data includes traffic count data collected by local jurisdictions and the Highway Performance Monitoring System (HPMS) vehicle miles of travel (VMT) data, which is developed based on data collected by the state departments of transportation (DOTs). Note that the HPMS data does not necessarily match traffic counts collected by local jurisdictions. This is evident in some of the following summaries and comparisons.

Table 1 lists the estimated to observed ratios of VMT by jurisdiction and facility type on links with counts. Note that total estimated/observed VMT is computed by aggregating VMT on individual links with observed traffic counts, and VMT on an individual link is computed as estimated/observed link volume multiplied by link distance. This table shows that most of the TPB planning area jurisdictions have estimated-to-observed ratios for VMT that are within 10%. Overall, the model estimates are only 2% higher than observed VMT. In contrast, as will be shown later in Table 5, model estimated VMT is slightly lower than the observed HPMS-based VMT.

Table 1: Estimated to Observed Ratios of VMT by Jurisdiction and Facility Type (on links with counts)

Jurisdiction	Freeway	Major Arterial	Minor Arterial	Collector	Expressway	Ramp	TOTAL*
District of Columbia	0.79	1.11	1.04	0.92	0.68	-	0.91
Montgomery County	0.96	1.11	1.13	0.75	1.57	-	1.04
Prince George's County	0.92	0.97	0.91	0.63	0.84	-	0.90
Arlington County	0.95	0.83	0.90	0.76	1.02	-	0.92
City of Alexandria	0.99	0.99	1.03	1.52	-	-	1.01
Fairfax County	0.96	0.84	0.95	0.89	0.91	-	0.93
Loudon County	0.75	1.02	1.49	0.99	0.67	-	1.16
Prince William County	1.08	1.06	0.96	0.86	1.08	-	1.02
Frederick County	1.11	1.32	1.28	0.84	1.01	-	1.14
Howard County	1.09	1.35	1.24	0.80	0.92	-	1.09
Anne Arundel County	1.05	1.03	1.04	0.88	1.05	0.79	1.04
Charles County	-	1.16	1.08	0.39	-	-	1.09
Carroll County	1.15	1.38	2.13	1.07	-	-	1.59

³ RSG, Inc and Baseline Mobility Group, *Gen3/Ver. 1.0.4 Model Calibration and Validation Report* (Metropolitan Washington Council of Governments, August 25, 2025).

⁴ Bahar Shahverdi, COG/TPB, *Additional Model Calibration Included in the Gen3/Version 1.1.0 Travel Model*, February 20, 2026.

Jurisdiction	Freeway	Major Arterial	Minor Arterial	Collector	Expressway	Ramp	TOTAL*
Calvert County	-	0.85	1.06	0.73	-	-	0.88
St. Mary's County	-	0.92	0.87	0.96	-	-	0.90
King George County	-	0.93	0.90	0.88	-	-	0.91
City of Fredericksburg	0.94	0.94	1.86	0.48	-	-	1.01
Stafford County	1.17	1.11	1.13	0.63	-	-	1.08
Spotsylvania County	0.99	0.91	0.65	0.54	-	-	0.87
Fauquier County	1.20	0.96	1.44	1.46	-	-	1.14
Clarke County	-	1.44	1.67	-	-	-	1.52
Jefferson County	1.26	1.77	2.36	1.22	-	-	1.70
TOTAL	1.01	1.06	1.12	0.80	0.91	0.79	1.02

* The Florida DOT (FDOT) standard for estimated/observed VMT areawide is ± 0.05 (acceptable) and ± 0.02 (preferable).

Table 2 lists the comparison of estimated volume to observed counts on regional screenlines, which is also shown in Figure 1. The “standard” column presents the general acceptable standard for deviation from the ideal “1.0” ratio (adopted from the Florida DOT). This deviation is ± 0.1 for screenlines within the MWCOC planning region and ± 0.2 for those outside. Over half of the screenlines are within 15% of the observed volume, and over two thirds of them are within 20% of the observed volume. The estimated traffic volume on the critical Potomac River screenline (#20) is within 10% of the observed data (E/O=0.92).

Table 2: Estimated to Observed Ratios of Traffic Volumes on Regional Screenlines by Facility Type

Screenline	Freeway	Major Arterial	Minor Arterial	Collector	Expressway	Ramp	TOTAL	Standard
1	1.19	0.63	1.02	1.03	-	-	0.98	± 0.1
2	-	1.19	1.31	1.12	0.70	-	1.12	± 0.1
3	1.07	0.96	0.86	0.69	-	-	0.98	± 0.1
4	0.00	1.33	1.14	1.09	0.70	-	1.10	± 0.1
5	0.85	1.00	1.13	0.99	-	-	0.98	± 0.1
6	0.96	1.04	0.90	0.50	0.79	-	0.92	± 0.1
7	0.88	0.97	0.97	0.62	0.87	-	0.91	± 0.1
8	0.98	1.18	0.94	0.65	1.17	-	1.03	± 0.1
9	0.97	1.52	1.02	1.01	-	-	1.10	± 0.1
10	0.99	1.14	0.96	1.49	-	-	1.14	± 0.1
11	1.05	0.87	1.15	0.88	-	-	0.97	± 0.1
12	0.95	1.28	1.44	0.80	-	-	1.10	± 0.1
13	0.95	1.26	1.60	-	-	-	1.10	± 0.1
14	0.90	1.10	0.63	0.39	-	-	0.85	± 0.1
15	0.78	0.94	0.95	0.85	-	-	0.84	± 0.1
16	0.83	1.13	0.85	0.32	-	-	0.80	± 0.1
17	0.89	0.92	0.96	0.91	-	-	0.91	± 0.1
18	1.23	0.71	1.10	1.27	0.75	-	0.98	± 0.1
19	0.95	1.08	0.99	0.75	0.73	-	0.89	± 0.1
20	1.00	1.08	-	-	0.75	-	0.92	± 0.1
22	0.94	1.09	0.95	0.57	0.99	-	0.95	± 0.1
23	1.24	1.46	0.86	0.27	-	-	1.04	± 0.2
24	0.87	0.89	0.79	0.86	-	-	0.86	± 0.1
25	1.34	-	1.61	2.07	-	-	1.42	± 0.1
26	1.23	-	1.59	3.14	1.34	-	1.38	± 0.2

Screenline	Freeway	Major Arterial	Minor Arterial	Collector	Expressway	Ramp	TOTAL	Standard
27	1.38	1.20	0.98	1.28	-	-	1.28	± 0.1
28	-	0.87	0.95	0.90	-	-	0.90	± 0.1
31	-	2.11	2.48	2.47	-	-	2.37	± 0.1
32	-	1.80	1.72	-	-	-	1.77	± 0.2
33	1.20	0.99	1.40	-	-	-	1.16	± 0.2
34	-	1.09	1.48	-	-	-	1.17	± 0.1
35	1.08	0.83	0.80	0.41	0.79	-	0.93	± 0.1
36	-	1.73	3.07	-	-	-	1.87	± 0.2
37	-	-	1.89	2.52	-	-	1.91	± 0.2
38	-	1.06	0.49	0.69	-	-	0.78	± 0.1
TOTAL	0.99	1.08	1.06	0.82	0.86	-	1.00	

Screenlines - Gen3 Model / Observed

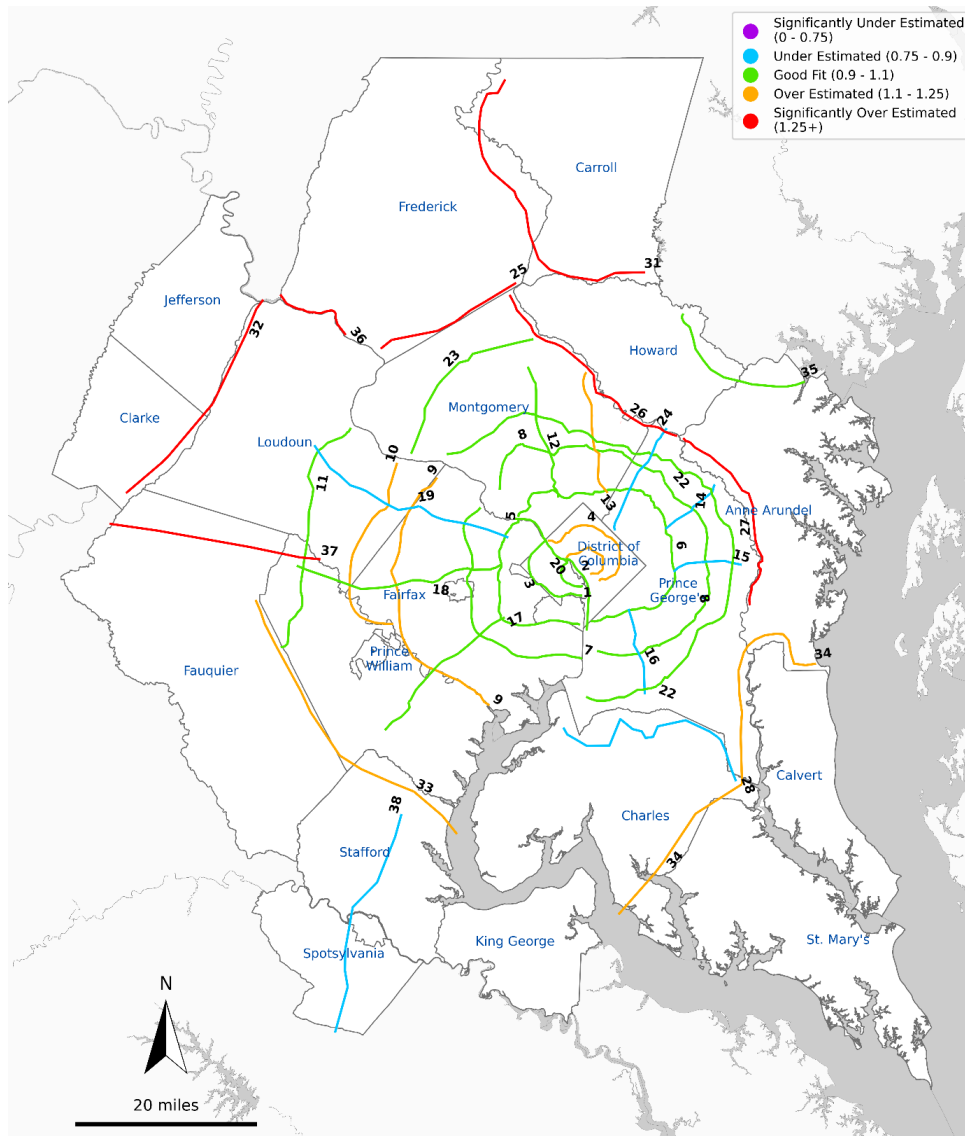


Figure 1: Estimated-to-Observed Traffic Volumes on Screenlines

Table 3 shows the estimated traffic volumes compared to the observed traffic counts by area type. The density of land activity is measured in terms of the “area type,” an index that can range from 1 to 6, where type 1 is extremely densely developed, and type 6 is very sparsely developed. As depicted, for all area types except area type 6, estimated traffic volumes are within 6% of the observed data, which is well below the preferable standard. Furthermore, though area type 6 is not within the preferable standard of 15%, it is still within the acceptable tolerance of 25%.

Table 3: Estimated Vs Observed Traffic Volume by Area Type

Area Type	Observed 2018	Gen3 2018	Gen2 2018	Gen3 E/O	Gen2 E/O	Standard (Acceptable/ Preferable)
1: High mixed employment and population density	9,843,948	10,140,860	10,328,977	1.03	1.04	± 0.25/± 0.15
2: Medium/high mixed density	31,266,106	30,059,977	31,049,705	0.96	0.98	± 0.25/± 0.15
3: Medium employment density	27,384,672	26,014,014	26,166,926	0.95	0.96	± 0.25/± 0.15
4: Medium population density	17,129,636	17,242,955	17,739,028	1.01	1.03	± 0.25/± 0.15
5: Low density	19,077,729	19,569,598	19,874,883	1.03	1.04	± 0.25/± 0.15
6: Rural	10,562,619	13,188,542	12,944,715	1.25	1.23	± 0.25/± 0.15
TOTAL	115,264,710	116,215,945	118,104,234	1.01	1.02	

* Based on 7,889 directional links with daily traffic counts in 2018.

Table 4 summarizes estimated traffic volumes by facility type and compares them to observed volumes. As is shown, estimated traffic volumes on all facility types except collectors are within 9% of counts; those on collectors are 15% lower than counts.

Table 4: Estimated Vs Observed Traffic Volume by Facility Type

Facility Type	Observed 2018	Gen3 2018	Gen2 2018	Gen3 E/O	Gen2 E/O	Standard (Acceptable/ Preferable)
Freeway	39,264,889	39,147,288	41,149,106	1.00	1.04	± 0.07/± 0.15
Major Arterial	35,108,530	37,116,423	37,418,680	1.06	1.06	± 0.15/± 0.10
Minor Arterial	25,577,725	26,398,219	26,101,599	1.03	1.02	± 0.15/± 0.10
Collector	6,046,370	5,136,538	4,865,434	0.85	0.80	± 0.25/± 0.20
Expressway	9,233,286	8,390,802	8,536,418	0.91	0.92	± 0.15/± 0.10
TOTAL	115,264,710	115,264,710	118,104,234	1.01	1.02	± 0.05/± 0.02

* Based on 7,889 directional links with daily traffic counts in 2018.

A comparison of the model estimated VMT by jurisdiction to HPMS-based VMT data is shown in Table 5. Note that the estimated/observed VMT in Table 1 consider links with counts only and the observed VMT is computed using link traffic counts multiplied by link distance, while the VMT data in Table 5 includes all non-local roadway links and the observed VMT data comes from HPMS.

Compared to the Gen2 Model, the Gen3 Model performs similarly for most TPB Member jurisdictions (Montgomery County, Prince George’s County, City of Alexandria, Loudoun County, Prince William County, Frederick County, and Charles County). In the cases where the Gen2 Model performed better than the Gen3 Model, no model-related problems have been identified. In particular, the estimated VMT in DC is lower from the Gen3 Model than that from the Gen2 Model mainly because some travel was diverted from DC to address the overestimation of traffic volumes on two DC screenlines. The high E/O ratio (1.20) for the City of Alexandria is associated with the relatively small size of the jurisdiction (smaller jurisdictions usually exhibit more variations on estimated VMT, percentage wise). Outside of the TPB Planning Area, Spotsylvania County’s observed VMT includes the entire county while the estimated VMT from the Gen2 and Gen3 models includes only the northern portion of the county. The high E/O ratios in Clarke County and Jefferson County are less of a concern as the model validation is usually focused on the TPB member jurisdictions. Overall, the total estimated VMT for the TPB Planning Area matched very closely with the observed data (E/O=0.98).

Table 5: Modeled VS HPMS-Based VMT by Jurisdiction (for all links)

Jurisdiction	Observed (HPMS) VMT	Gen3 Estimated VMT	Gen2 Estimated VMT	Gen3 E/O	Gen2 E/O
District of Columbia	8,410,547	7,512,650	8,160,131	0.89	0.97
Montgomery County	20,844,658	21,063,044	20,794,264	1.01	1.00
Prince George’s County	25,320,822	23,611,922	22,659,440	0.93	0.89
Arlington County	4,115,600	3,777,512	4,109,213	0.92	1.00
City of Alexandria	1,851,663	2,224,986	2,140,651	1.20	1.16
Fairfax County	28,284,350	27,070,790	28,111,767	0.96	0.99
Loudoun County	7,342,782	8,219,080	7,449,609	1.12	1.01
Prince William County	10,300,396	10,278,447	10,162,646	1.00	0.99
Frederick County	8,391,370	9,178,742	9,066,690	1.09	1.08
Howard County	11,526,986	12,068,582	11,426,554	1.05	0.99
Anne Arundel County	16,518,082	16,078,840	16,058,595	0.97	0.97
Charles County	3,426,164	3,306,918	3,237,059	0.97	0.94
Carroll County	3,408,904	4,534,322	4,381,657	1.33	1.29
Calvert County	2,019,452	1,509,120	1,652,935	0.75	0.82
St. Mary’s County	2,367,534	1,954,106	2,134,629	0.83	0.90
King George County	932,207	826,132	835,845	0.89	0.90
City of Fredericksburg	990,749	896,715	894,269	0.91	0.90
Stafford County	4,358,421	4,305,160	4,716,562	0.99	1.08
Spotsylvania County**	3,774,287	2,424,014	2,376,420	0.64	0.63
Fauquier County	3,686,566	3,638,351	3,802,460	0.99	1.03
Clarke County	827,733	1,124,267	1,082,114	1.36	1.31
Jefferson County	1,069,310	1,521,810	1,505,290	1.42	1.41
TOTAL	169,768,582	167,125,511	166,758,800	0.98	0.98
TPB Planning Area	118,288,351	116,244,091	115,891,470	0.98	0.98
Non-TPB Member Area	51,480,231	50,881,421	50,867,330	0.99	0.99
Air Quality Nonattainment Area (8-hour Ozone)	120,307,803	117,753,211	117,544,405	0.98	0.98

* The observed VMT data is from HPMS

** Observed VMT is for the entire Spotsylvania County while Estimated is only for the northern portion of the county.

*** TPB adopted Resolution R6-2024 that removes Fauquier County as a TPB member on February 21, 2024. Therefore, Fauquier County is not included as a TPB Member in this summary.

§ Florida DOT standard for estimated-over-observed VMT areawide is ± 0.05 (acceptable) and ± 0.02 (preferable).

§§ COG/TPB standard for estimated-over-observed VMT for DC is between 1.0 and 1.03.⁵

The percent root mean square error (RMSE) of link volumes by facility type is listed in Table 6. Since smaller values of RMSE are better, the RMSE for freeways is excellent, and the RMSE for expressways and major arterials is good. Overall, the Gen3 Model performs slightly better than the Gen2 Model in terms of RMSE (41.6% vs. 44.2%).

Table 6: Highway Assignment RMSE by Facility Type

Facility Type	# of Observed Counts	Sum of Squared Difference	Sum of Observed Counts	Gen3 Percent RMSE	Gen2 Percent RMSE*
Freeway	626	96,148,230,511	39,079,583	19.9%	24.4%
Major Arterial	2,068	84,889,117,729	35,157,742	37.7%	39.0%
Minor Arterial	3,339	48,879,192,437	25,595,667	49.9%	48.5%
Collector	1,539	13,155,067,092	6,031,195	74.6%	76.7%
Expressway	251	50,575,339,959	9,255,438	38.5%	36.1%
Ramp	2	26,484,807	33,910	21.5%	4.1%
TOTAL	7,825	293,673,432,535	115,153,535	41.6%	44.2%

* Year 2018 Validation of TPB Version 2.4 Travel Demand Forecasting Model.

The RMSE of link volumes by area type is listed in Table 7. The RMSE for area types 1-5 is good. The RMSE by jurisdiction is listed in Table 8. Many jurisdictions have good RMSE scores (below 40% RMSE).

Table 7: Highway Assignment RMSE by Area Type

Area Type	# of Observed Counts	Sum of Squared Difference	Sum of Observed Counts	Gen3 Percent RMSE	Gen2 Percent RMSE
1	753	37,342,502,169	9,854,448	53.8%	56.8%
2	1,898	86,337,767,826	31,380,356	40.8%	41.6%
3	1,262	65,976,514,577	27,539,272	33.1%	35.5%
4	1,110	35,706,801,960	17,253,985	36.5%	45.0%
5	1,230	39,635,914,777	18,561,229	37.6%	39.1%
6	1,572	28,673,931,225	10,564,245	63.6%	62.1%
TOTAL	7,825	293,673,432,535	115,153,535	41.6%	44.2%

⁵ MWCOG. Gen3 Model Development Task Order 5 Scope of Work. 7/5/2023.

Table 8: Highway Assignment RMSE by Jurisdiction

Jurisdiction	# of Observed Counts	Sum of Squared Difference	Sum of Observed Counts	Gen3 Percent RMSE	Gen2 Percent RMSE
District of Columbia	1,249	59,408,918,292	13,308,345	64.7%	64.6%
Montgomery County	837	23,157,149,803	15,020,402	29.3%	29.5%
Prince George's County	820	39,913,072,553	17,168,756	33.3%	37.9%
Arlington County	343	16,532,127,305	4,963,974	48.0%	51.3%
City of Alexandria	132	4,938,426,961	2,460,200	32.8%	33.9%
Fairfax County	1,487	56,567,542,278	23,640,692	38.8%	43.9%
Loudon County	338	9,138,490,495	3,070,888	57.2%	54.6%
Prince William County	433	11,674,104,598	6,189,150	36.3%	43.6%
Frederick County	370	8,543,421,849	3,824,960	46.5%	48.6%
Howard County	222	14,090,503,375	5,584,580	31.7%	31.8%
Anne Arundel County	453	24,942,231,107	9,982,194	33.7%	32.5%
Charles County	172	3,568,934,566	1,355,536	57.8%	60.5%
Carroll County	174	6,337,228,181	1,241,916	84.6%	80.9%
Calvert County	86	676,629,122	779,118	31.0%	22.6%
St. Mary's County	120	573,442,111	815,868	32.2%	30.7%
King George County	50	193,063,243	271,000	36.3%	31.6%
City of Fredericksburg	44	1,969,218,080	777,134	37.9%	38.5%
Stafford County	146	4,508,372,880	1,852,468	43.8%	62.1%
Spotsylvania County	96	1,717,929,984	986,600	41.2%	41.7%
Fauquier County	134	1,242,367,833	1,117,082	36.5%	34.7%
Clarke County	38	1,115,146,654	321,500	64.0%	58.4%
Jefferson County	81	2,865,111,266	421,172	114.4%	119.4%
TOTAL	7,825	293,673,432,535	115,153,535	41.6%	44.2%

The Root Mean Square Error comparison by volume group is shown in Table 9. The RMSE for the Gen2 and Gen3 models are very similar.

Table 9: Volume Group RMSE Comparison

Volume Group	# of Observed Counts	Gen3 Percent RMSE	Gen2 Percent RMSE	Standard
< 5,000	2,454	114.3%	112.7%	100%
5,000 – 9,999	1,936	54.2%	58.3%	45%
10,000 – 14,999	1,162	41.2%	42.3%	35%
15,000 – 19,999	721	33.5%	33.5%	30%
20,000 – 29,999	716	29.4%	31.1%	27%
30,000 – 49,999	391	27.0%	27.9%	25%
50,000 – 59,999	116	23.9%	22.7%	20%
60,000 +	329	18.5%	21.3%	19%
TOTAL	7,825	41.6%	44.2%	

TRANSIT VALIDATION

The transit validation is based on observed transit boarding count data from the transit providers (WMATA, MARC, VRE), and the Federal Transit Administration’s National Transit Data. A summary of the transit ridership validation by transit mode is listed Table 10. All of the major modes – Metrorail, commuter rail, and bus (All Bus in the table) are within 3% and overall transit is underestimated by 1%. In general, the transit validation statistics from the Gen3 Model have improved relative to the Gen2 Model, mainly because the Gen3 Model, which was estimated and calibrated to more recent conditions, can better capture the recent trend of transit ridership in the region. Please note that, for the Gen2 Model, the 2014 transit validation results are the focus of this comparison, since the 2014 transit validation of the Gen2 Model performed better than the 2018 validation.

Table 10: Estimated and Observed Transit Loading Summary

Transit Mode	Model Estimate	Observed Ridership	Gen3 (2018) E/O	Gen2 (2014) E/O	Gen2 (2018) E/O	Standard (Acceptable ⁶ / Preferable)
Metrorail	622,284	641,227	0.97	1.01	1.3	± 0.09/± 0.03
Commuter Rail	56,192	56,580	0.99	0.76	0.76	± 0.09/± 0.03
MARC	14,870	38,249	1.08	0.86	0.97	± 0.09/± 0.03
VRE	41,322	18,331	0.81	0.64	0.54	± 0.09/± 0.03
All Bus	582,353	575,642	1.01	1.09	1.2	± 0.09/± 0.03
Metrobus Total	313,281	360,000	0.87			± 0.09/± 0.03
Other Bus in WMATA Area	166,387	141,390	1.18			± 0.09/± 0.03
Other Bus not in WMATA Area	102,685	74,252	1.38			± 0.09/± 0.03
Total Transit⁷	1,260,829	1,273,449	0.99	1.04	1.24	± 0.09/± 0.03

* Source: RSG. Gen3 Data Development. Washington, D.C.: Metropolitan Washington Council of Governments, National Capital Region Transportation Planning Board, December 29, 2021, Table 3-11, https://www.mwcog.org/assets/1/6/Gen3_Phase_1_Data_Development_Report_Final.pdf

** Source: Meseret Seifu and Sanghyeon Ko, “Year-2018 Validation of TPB Version 2.4 Travel Model”, COG/TPB Memorandum, August 17, 2021. Note that the observed bus ridership data includes I-X and X-I bus trips made by residents/non-residents of the TPB modeled area while the Ver. 2.4 Model simulates only resident I-I trips. However, the I-X and X-I bus trips which likely use commuter buses, accounted for only a very small fraction of total bus ridership (0.63 %). The Gen3 Model similarly models only resident I-I trips but does include visitor and I-X and X-I transit trips. Again, this is a small fraction of bus ridership, but a slightly larger fraction of commuter rail ridership (about 1%).

Table 11 lists the station group ridership for Metrorail. Most station groups are within 20% of the observed data. See Figure 2 for a map of the station groups.

⁶ Cambridge Systematics. FSUTMS-Cube Framework Phase II Model Calibration and Validation Standards. 10/2/2008.

⁷ Metrorail + Commuter Rail + All Bus; note that Metrobus Total + Other Bus in WMATA Area + Other Bus not in WMATA Area = All Bus

Table 11: Metrorail Station Group Boarding Comparison

Station Group	Station Group Name	Model Estimate	Observed Ridership	Gen3 (2018) E/O	Gen2 (2014) E/O	Gen2 (2018) E/O	Standard (Acceptable / Preferable)
1	Red Line - "A" route MD outside Beltway	20,372	28,038	0.73	1.05	1.46	± 0.2/± 0.15
2	Red Line - "A" route MD inside Beltway	21,872	22,663	0.97	1.23	1.57	± 0.2/± 0.15
3	Red Line - "A" route DC non-core	25,069	22,157	1.13	0.99	1.27	± 0.2/± 0.15
4	Red Line - DC core	132,594	134,602	0.99	0.74	0.93	± 0.2/± 0.15
5	Red Line - "B" route DC non-core	25,679	24,075	1.07	1.37	1.58	± 0.2/± 0.15
6	Red Line - "B" route MD	21,042	22,873	0.92	0.89	1.62	± 0.2/± 0.15
7	Green Line - "E" route MD	11,115	17,003	0.65	0.98	1.26	± 0.25/± 0.2
8	Green Line - "E" route DC non-core	17,109	22,469	0.76	0.78	1.32	± 0.2/± 0.15
9	Green Line - DC core	40,277	38,192	1.05	1.15	1.33	± 0.2/± 0.15
10	Green Line - "F" route DC non-core	23,926	21,253	1.13	1.13	1.42	± 0.2/± 0.15
11	Green Line - "F" route MD	12,927	17,359	0.74	0.86	1.33	± 0.25/± 0.2
12	Blue/Yellow Line - VA Fairfax	14,124	16,027	0.88	1.04	1.51	± 0.25/± 0.2
13	Blue/Yellow Line - VA Alexandria	11,513	13,536	0.85	0.86	1.32	± 0.25/± 0.2
14	Blue/Yellow Line - VA Core	32,068	45,438	0.71	1.14	1.04	± 0.2/± 0.15
15	Orange Line - VA Fairfax	8,818	15,724	0.56	0.51	1.44	± 0.25/± 0.2
16	Orange Line - VA Arlington non-core	33,334	28,802	1.16	1.88	1.91	± 0.2/± 0.15
17	Orange/Blue Line - VA/DC core	104,921	95,840	1.09	0.93	1.31	± 0.2/± 0.15
18	Orange/Blue Line - DC non-core	15,145	11,628	1.3	0.96	1.49	± 0.25/± 0.2
19	Orange Line - DC/MD	13,584	13,401	1.01	0.88	1.22	± 0.25/± 0.2
20	Blue Line - DC/MD	17,550	13,680	1.28	1.13	1.47	± 0.25/± 0.2
21	Silver Line - Phase I & Phase 2	19,243	16,466	1.17	2.29	1.73	± 0.25/± 0.2
	Total for Red Line Station Groups	246,629	254,408	0.97	0.91	1.19	± 0.2/± 0.15
	Total for Green Line Station Groups	105,355	116,276	0.91	1.00	1.33	± 0.2/± 0.15
	Total for Blue/Yellow Line Station Groups	57,705	75,001	0.77	1.07	1.19	± 0.2/± 0.15
	Total for Orange/Blue Line Station Groups	193,352	179,075	1.08	1.02	1.43	± 0.2/± 0.15
	Total for Silver Line Station Groups	19,243	16,466	1.17	2.29	1.73	± 0.2/± 0.15
	Grand TOTAL	622,284	641,226	0.97	1.01	1.3	± 0.09/± 0.03

* FDOT standard for transit ridership > 20,000 passengers per day is ± 0.2 (acceptable) and ± 0.15 (preferable) and is ± 0.25 (acceptable) and ± 0.2 (preferable) for 10k - 20k per day.

Station Groups - Gen3 Model / Observed

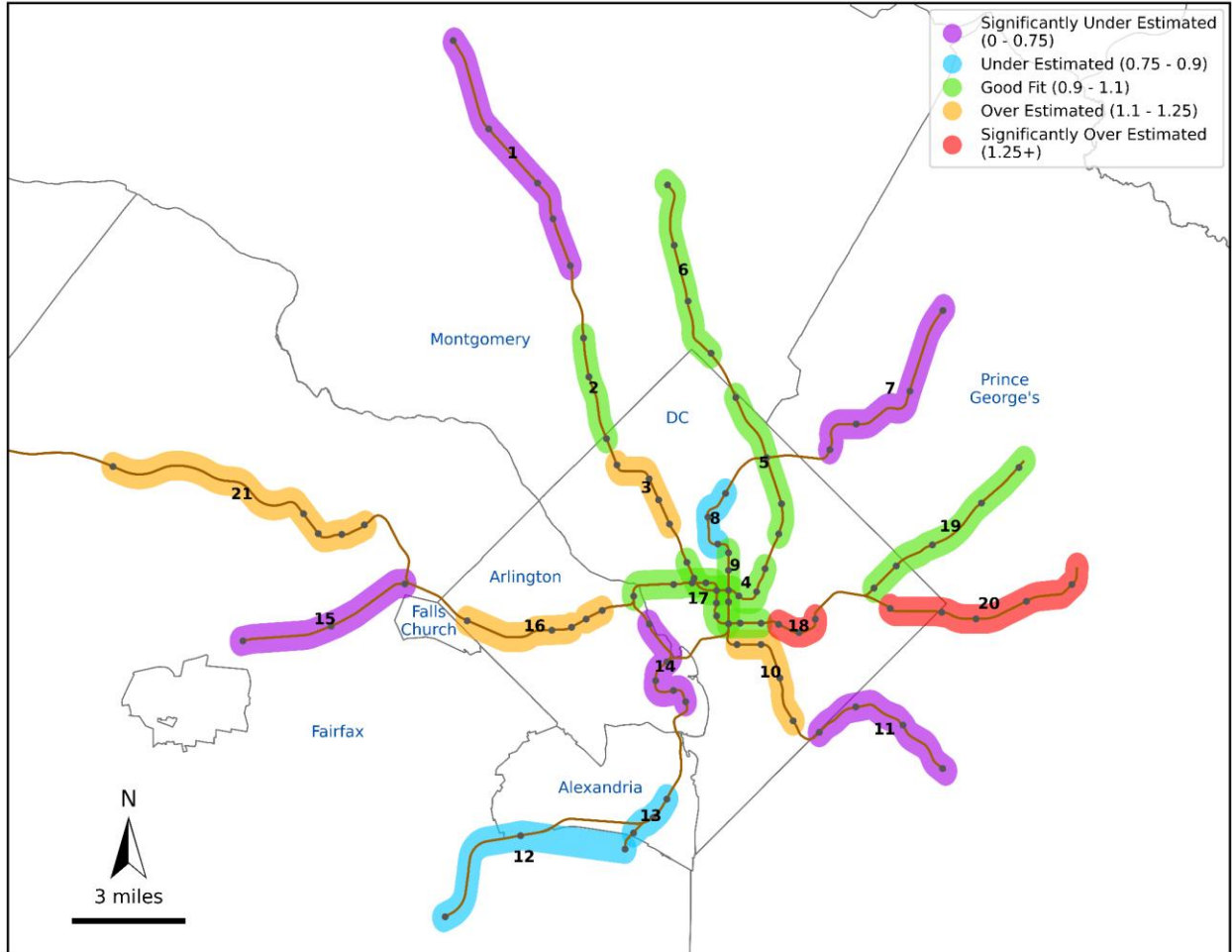


Figure 2: Metrorail Station Group E/O Comparison

CONCLUSIONS

Consistent with previous findings, the highway and transit validation results confirm that the Gen3/Ver. 1.1.0 Model is ready for production-use modeling work in support of TPB's regional transportation planning processes, such as the update of the next Long-Range Transportation Plan and the air quality conformity analysis, project planning studies, and other exploratory analyses. The model validation metrics generally meet the federal and state benchmarking standards. Compared to the Gen2 Model, the current, trip-based, production-use model, the highway validation performance of the Gen3 Model is largely comparable. Regarding the transit validation performance, the Gen3 Model shows a strong improvement for Commuter Rail and All Bus, while the validation of Metrorail ridership stays consistent.

In addition to the highway and transit validation reported on in this memo, the Gen3 Model has undergone five sensitivity tests during Phase 2 development and four during Phase 3, which are listed below. Furthermore, COG/TPB staff performed a usability test by applying the Gen3 Model in the performance analysis of Visualize 2050 and comparing its results to those of the Gen2 Model. The results of these tests have been documented in a separate report⁸ and various memos.⁹ In a broader sense, those sensitivity tests and performance analysis should also be considered as part of the model validation effort that demonstrated the reasonableness of model sensitivities and showcased the unique capabilities associated with the disaggregate data generated by the Gen3 Model.

Phase 2:

- Auto operating cost increase
- Bridge closure
- Doubling the frequency of high-capacity transit
- Increased telecommuting to DC
- Hypothetical AV ownership in the horizon year

Phase 3:

- Capacity expansion on I-95
- Congestion pricing in the DC Central Business District
- Increased telecommuting to the TPB Planning Area
- Extension of the Red line

Overall, COG/TPB staff are satisfied with the validation performance of the Gen3/Ver. 1.1.0 Travel Model and recommend the model for production use.

⁸ RSG, Baseline Mobility Group, and Metropolitan Washington Council of Governments. *Gen3 Model Phase 2 Sensitivity Testing Results*, February 12, 2024.

⁹ Meseret Seifu, COG/TPB. *A sensitivity test of capacity expansion on I-95 between the Baltimore and Washington, D.C. beltways using the Gen2/Version 2.4.6 Travel Model and the Gen3/Version 1.0.3 Travel Model*, March 12, 2025.

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