



Morgantown Monongalia MPO

MMMPO Travel Demand Model Calibration

October 18, 2021





Agenda

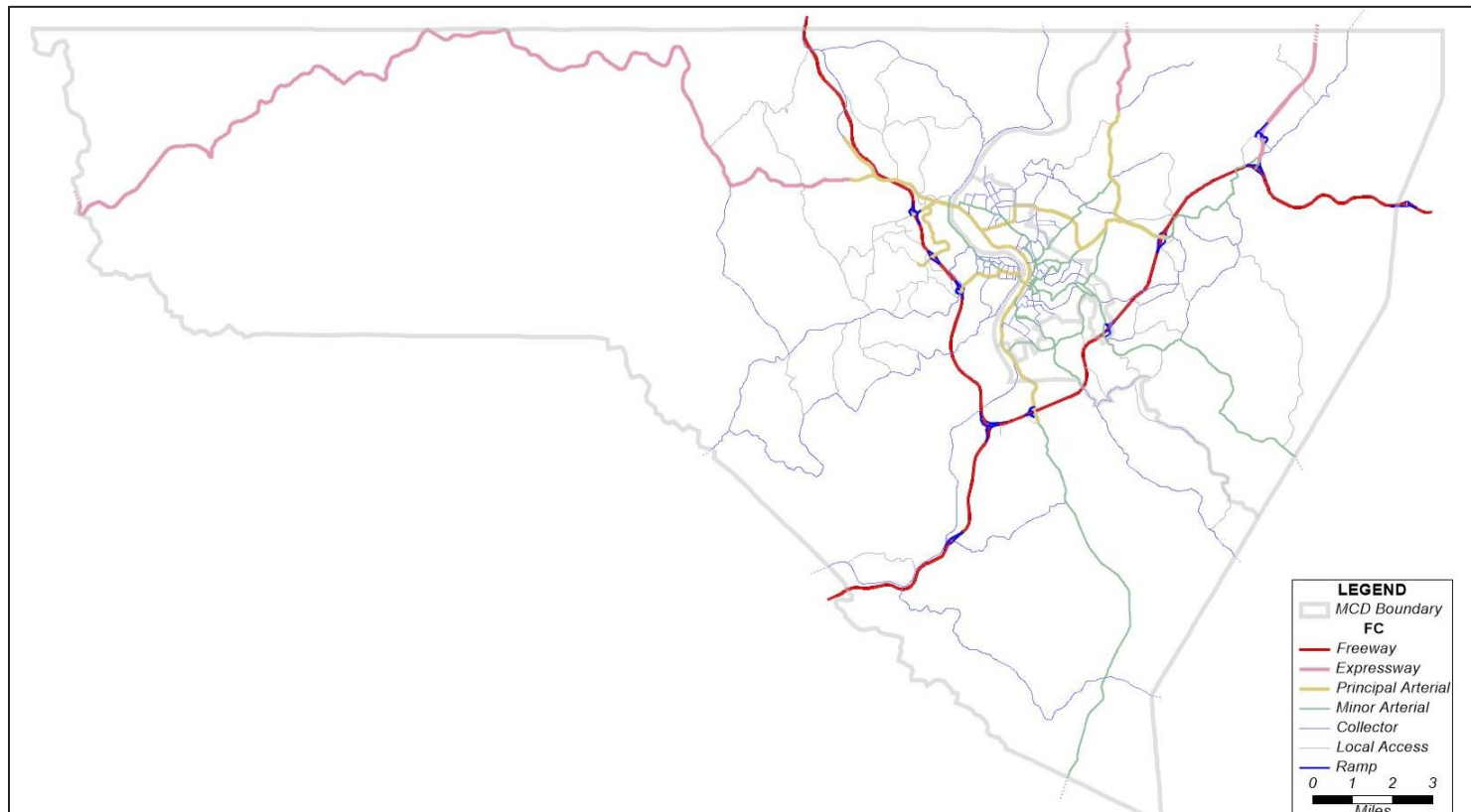
1. Objectives
2. Model Updates
3. Base Calibration Results
4. Enhanced Calibration
5. Comments and Next Steps

Model Update Objectives

- 2010 model benchmark
 - Verify Existing Model Results (TransCAD Version 7 Build 12280)
 - Likely identical results in different TransCAD versions, including Version 8, given the model simplicity
- Calibrate model to 2019 conditions:
 - 2019 demographics data
 - 2019 daily observed traffic
 - 2019 LEHD Patterns
- Model improvements:
 - Highway network enhancements – facility type & area type
 - Refinements to Trip Generation and Trip Distribution Process
 - Optional Enhanced Calibration Process

Highway Network

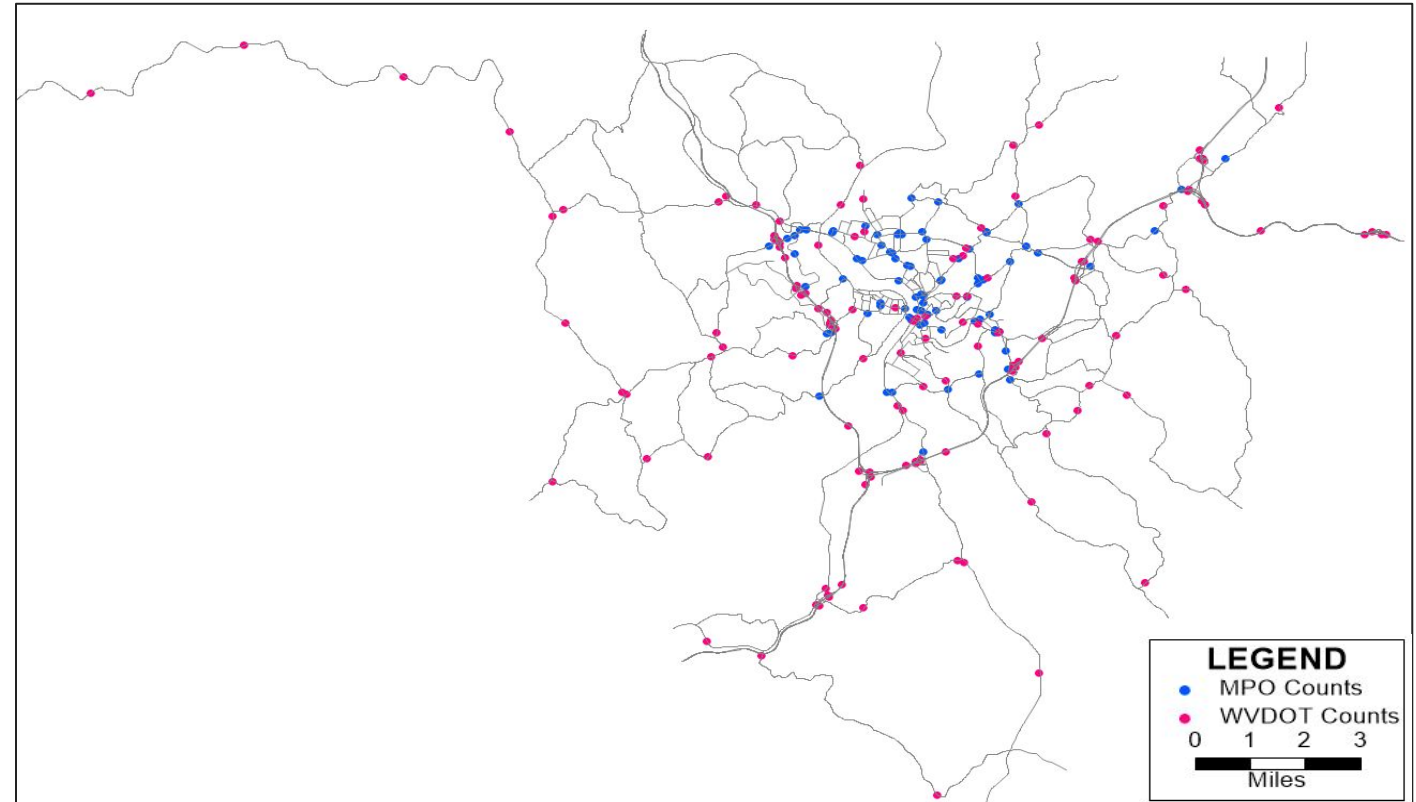
- Network was debugged using our in-house Network Diagnostic Tool
- Functional class and area type was added to the links (Source: WVDOT Open Data Portal)
- Capacities and speeds were reviewed and adjusted as necessary.



Highway Network

- Traffic Counts obtained from MPO and WVDOT website
- Based on the MPO counts, changes in traffic are:
 - From 2017 to 2018: 0.45% reduction
 - From 2018 to 2019: 3.7% reduction
- Number of observations by Facility type and area type:

Facility Type	Number of Observations		
	Area Type		
	Urban	Rural	Total
Freeway	8	4	12
Expressway	0	8	8
Principal Arterial	30	0	30
Minor Arterial	45	8	53
Collector	26	21	47
Local Access	9	3	12
Ramp	37	5	42
Total	155	49	204

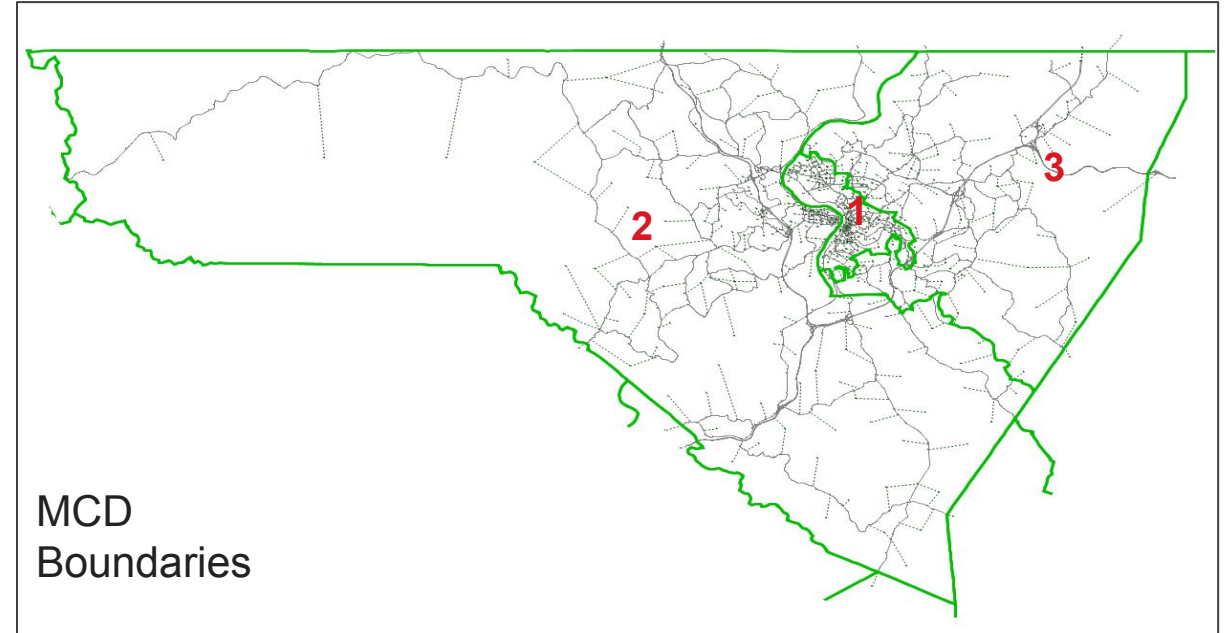


- Observed traffic covers all freeway segments and ramps

Socio-Economic Data

- **Socio-Economic Trends:**

- Household Growth CAGR is 1.2%
- Employment growth CAGR is 0.8%



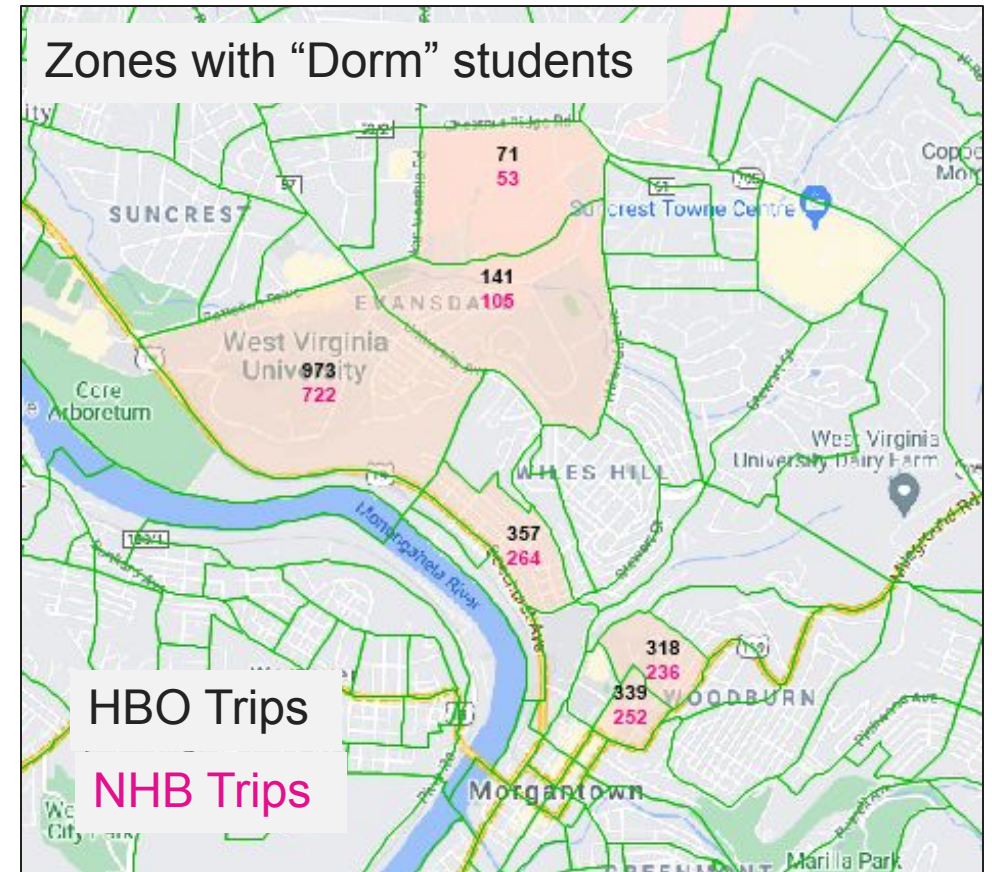
Socio-Economic Data Summary														
ID	MCD	No of Zones	2010				2019				% Difference			
			Households	Employment			Households	Employment			Households	Employment		
				Retail	Non-Retail	Total		Retail	Non-Retail	Total		Retail	Non-Retail	Total
1	Morgantown	86	12,472	4,532	19,697	24,229	13,543	1,438	22,856	24,294	9%	-68%	16%	0%
2	Western	143	12,303	2,730	6,786	9,516	13,524	2,460	9,741	12,201	10%	-10%	44%	28%
3	Eastern	113	19,109	2,823	13,794	16,617	21,868	1,908	15,490	17,398	14%	-32%	12%	5%
Entire Region		342	43,884	10,085	40,277	50,362	48,935	5,806	48,087	53,893	12%	-42%	19%	7%

Trip Generation

- Non-retail employment disaggregated into:
 - “Basic”: construction, manufacturing, wholesale, etc.
 - “Service”: finance, administrative, technical services
- Trip attraction rate updates:
 - HBW, HBO, NHB purposes were revised to provide consistency with expected rates
 - Off-Campus HBU trip rates were scaled down to account for the reduction in university enrollment (8%) and 2,900 additional beds on-campus

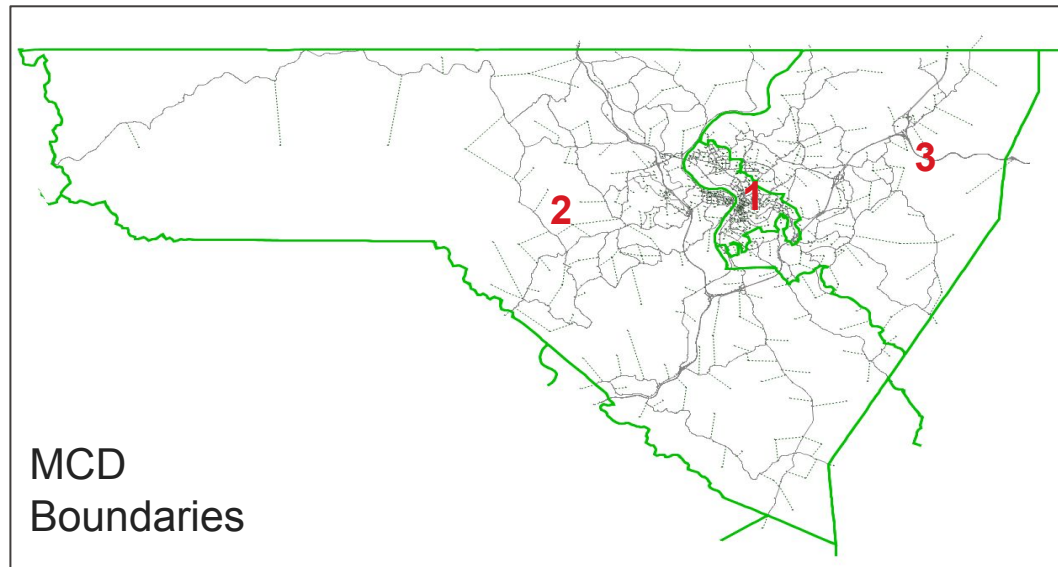
Trip Generation – Special Generators

- Special Generators
 - Ruby Memorial Hospital and Mon Health Medical Center
 - Trips were estimated using ITE trip generation rates
- Dorm Students
 - 2010 trips were increased (44%) to account for the 2,900 added on-campus beds since 2010.



Trip Generation – Production Attraction Summary

- Home based trip production growth is consistent with HH growth.

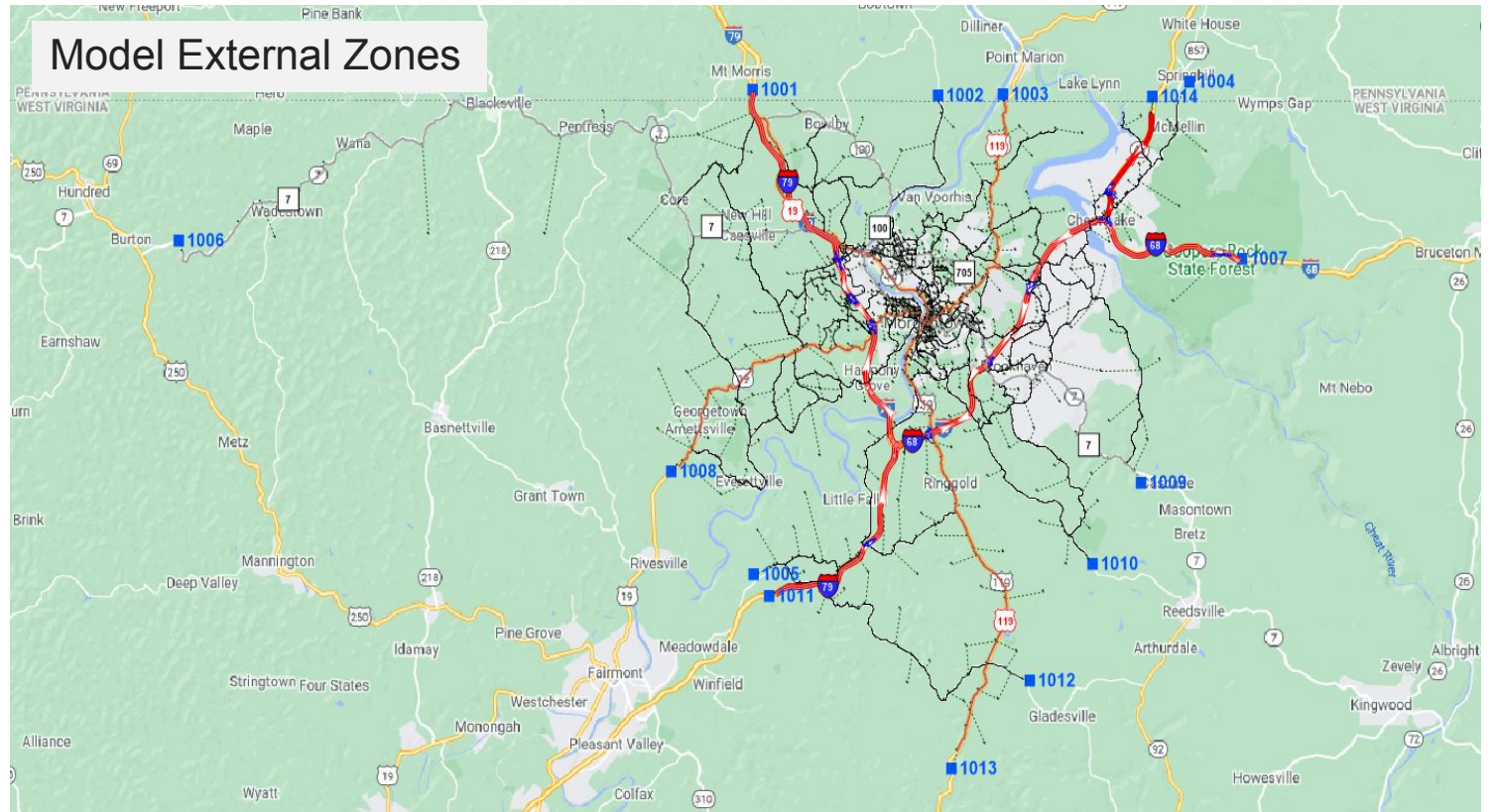


			2010		2019		% Diff	
All Purposes								
ID	MCD	No of Zones	P	A	P	A	P	A
1	Morgantown	86	103,268	147,780	104,387	151,237	1%	2%
2	Western	143	85,967	67,314	92,816	78,421	8%	16%
3	Eastern	113	135,005	109,147	150,595	118,140	12%	8%
4	External	14	67,934	67,933	76,475	76,475	13%	13%
Entire Region		356	392,174	392,174	424,273	424,273	8%	8%
HBW								
ID	MCD	No of Zones	P	A	P	A	P	A
1	Morgantown	86	13,216	27,521	14,326	29,420	8%	7%
2	Western	143	14,793	8,115	16,216	10,833	10%	34%
3	Eastern	113	23,654	16,028	27,285	17,574	15%	10%
4	External	14	17,760	17,759	20,168	20,168	14%	14%
Entire Region		356	69,423	69,423	77,995	77,995	12%	12%
HBO								
ID	MCD	No of Zones	P	A	P	A	P	A
1	Morgantown	86	42,349	58,897	46,739	67,255	10%	14%
2	Western	143	45,382	38,878	49,693	45,062	9%	16%
3	Eastern	113	71,144	61,099	81,807	65,920	15%	8%
4	External	14	16,332	16,332	18,399	18,399	13%	13%
Entire Region		356	175,206	175,206	196,637	196,637	12%	12%
NHB								
ID	MCD	No of Zones	P	A	P	A	P	A
1	Morgantown	86	42,818	42,818	39,428	39,427	-8%	-8%
2	Western	143	20,321	20,322	22,525	22,526	11%	11%
3	Eastern	113	32,021	32,021	34,645	34,645	8%	8%
4	External	14	8,090	8,090	9,039	9,039	12%	12%
Entire Region		356	103,250	103,250	105,636	105,636	2%	2%
HBU								
ID	MCD	No of Zones	P	A	P	A	P	A
1	Morgantown	86	4,886	18,544	3,894	15,135	-20%	-18%
2	Western	143	5,471	0	4,383	0	-20%	0%
3	Eastern	113	8,187	0	6,858	0	-16%	0%
4	External	14	0	0	0	0	0%	0%
Entire Region		356	18,544	18,544	15,135	15,135	-18%	-18%

Trip Generation – External Trips

- Trips at county boundary
 - Source of 2019 data: WVDOT Counts
 - Aggregate CAGR 1.3%

Zone	Roadway	2010	2019	% Diff
1001	I-79 N	28,498	28,334	-1%
1002	WV-53 N	1,156	1,373	19%
1003	US-119 N	4,586	4,243	-7%
1004	WV-857 N	0	1,109	
1005	CO 73	1,760	2,348	33%
1006	WV-7 W	1,140	1,309	15%
1007	I-68 E	19,002	18,792	-1%
1008	US-19 S	2,400	2,244	-6%
1009	WV-7 E	5,674	6,112	8%
1010	CR-81S	2,418	2,580	7%
1011	I-79 S	38,000	46,831	23%
1012	Gladesville Road E	3,534	3,523	0%
1013	US-119 S	3,720	3,723	0%
1014	Mon Expressway	5,868	10,029	71%
Total		117,756	132,550	13%



- 2019 external-to-external trip table was developed based on the 2010 patterns

Trip Distribution

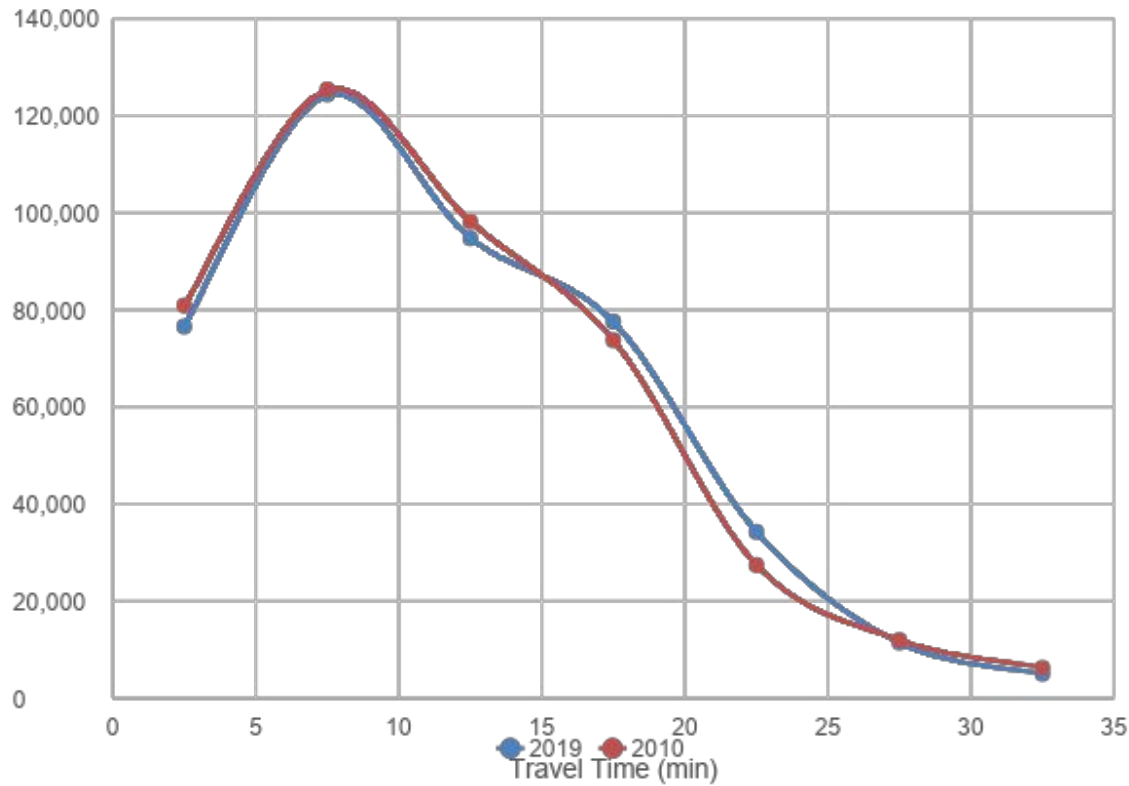
- Enhancements
 - K-factors were added to the Gravity Model to more accurately represent the impedance in trip distribution.
 - Improved screenline comparison and improved assignment near large regional shopping complex, just west of Morgantown along I-79
- Trip pattern validation:
 - The 2010 trip patterns by purpose were utilized as the observed condition
 - LEHD Origin-Destination Employment Statistics (LODES) data was also used to validate the trip pattern for Home-Based Work (HBW) purpose.

Trip Distribution

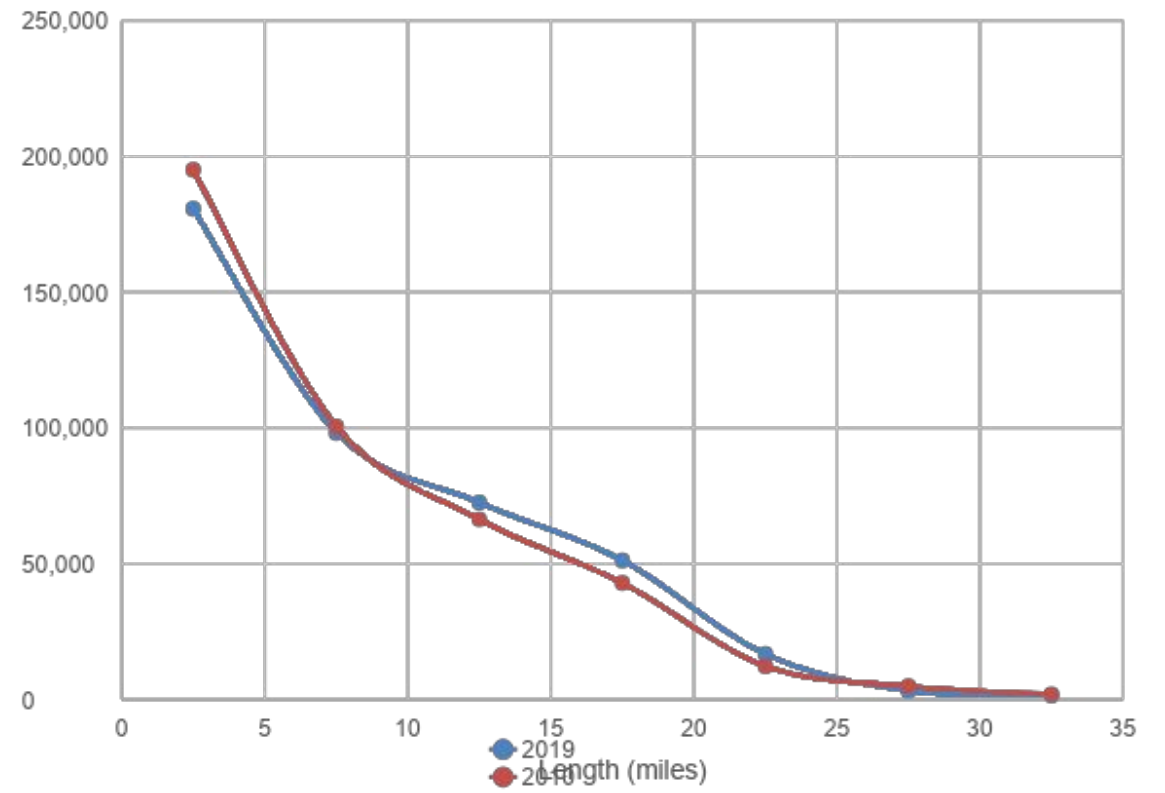
All Purposes:

Year	Ave. Trip Length (miles)	Ave. Trip Duration (min)
2010	11.36	7.78
2019	11.60	8.26
% Diff	2.1%	6.2%

Travel Time Distribution



Travel Length Distribution

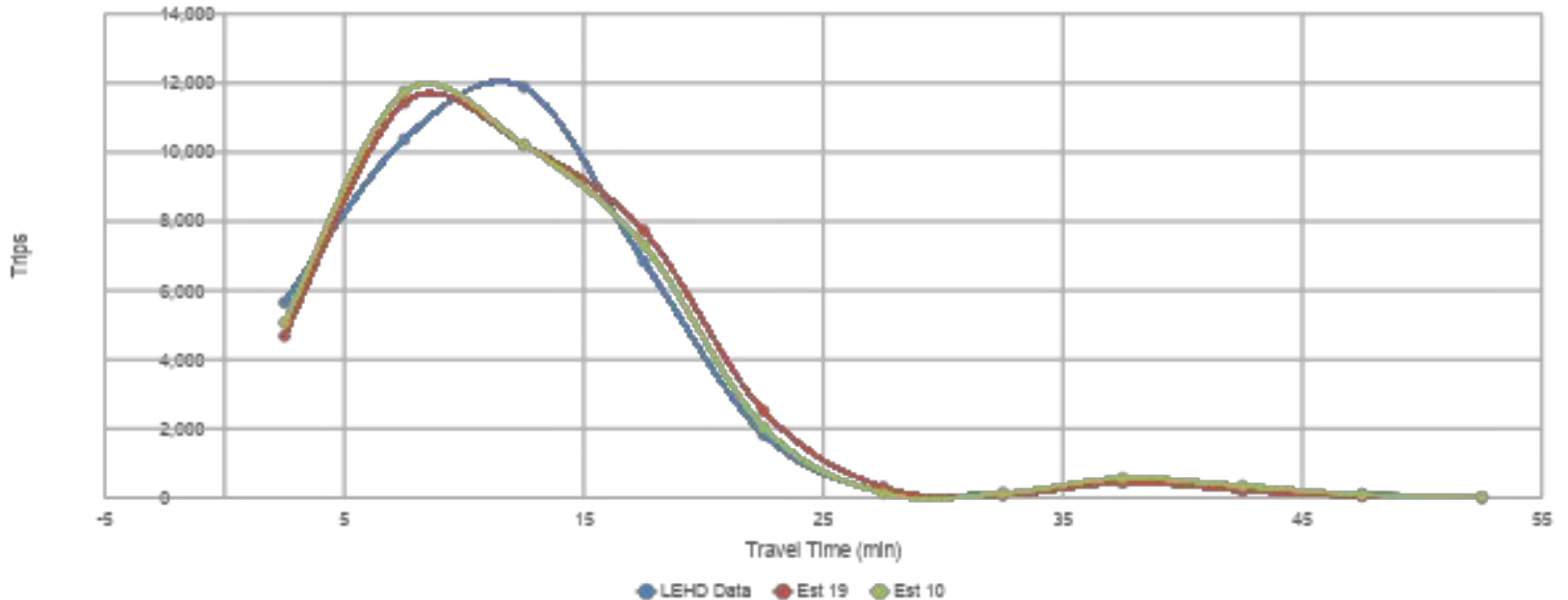


Trip Distribution

Home-Based Work (HBW):

Observed Data (Source: LEHD)	2010 Average Travel Time Estimate (min)	% Diff	2019 Average Travel Time Estimate (min)	% Diff
11.73	11.98	2.2%	12.10	3.2%

Travel Time Distribution

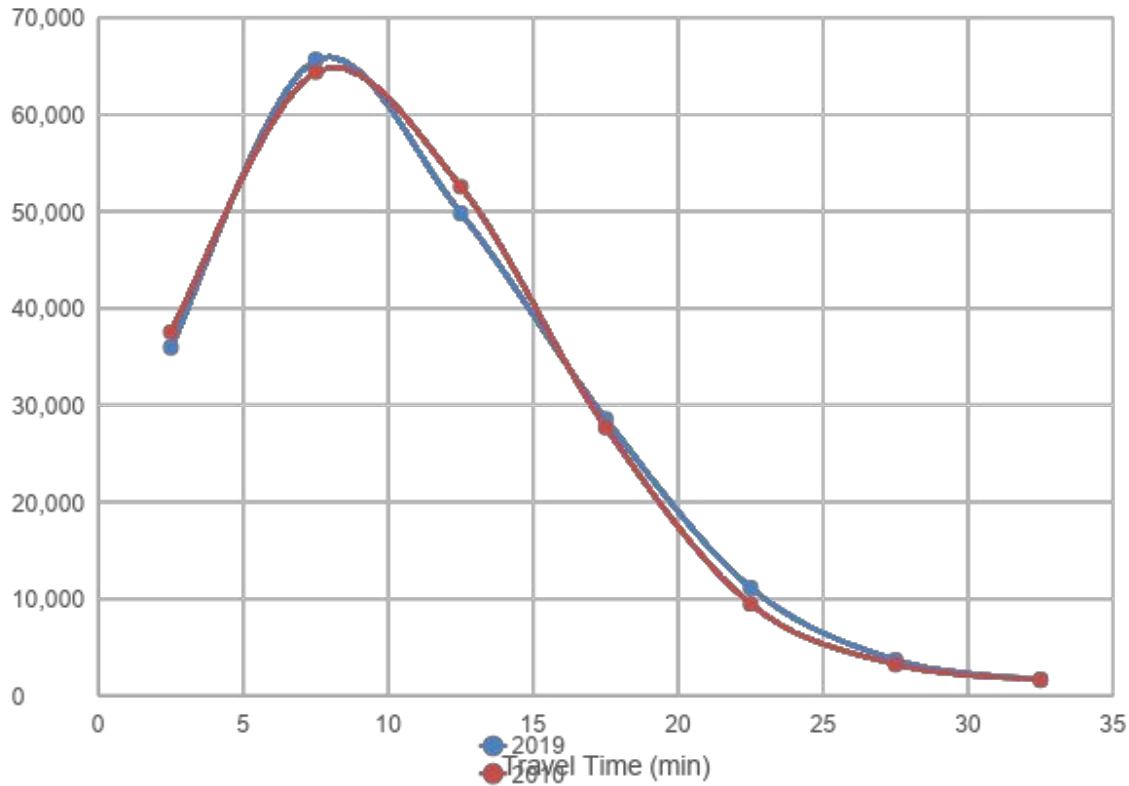


Trip Distribution

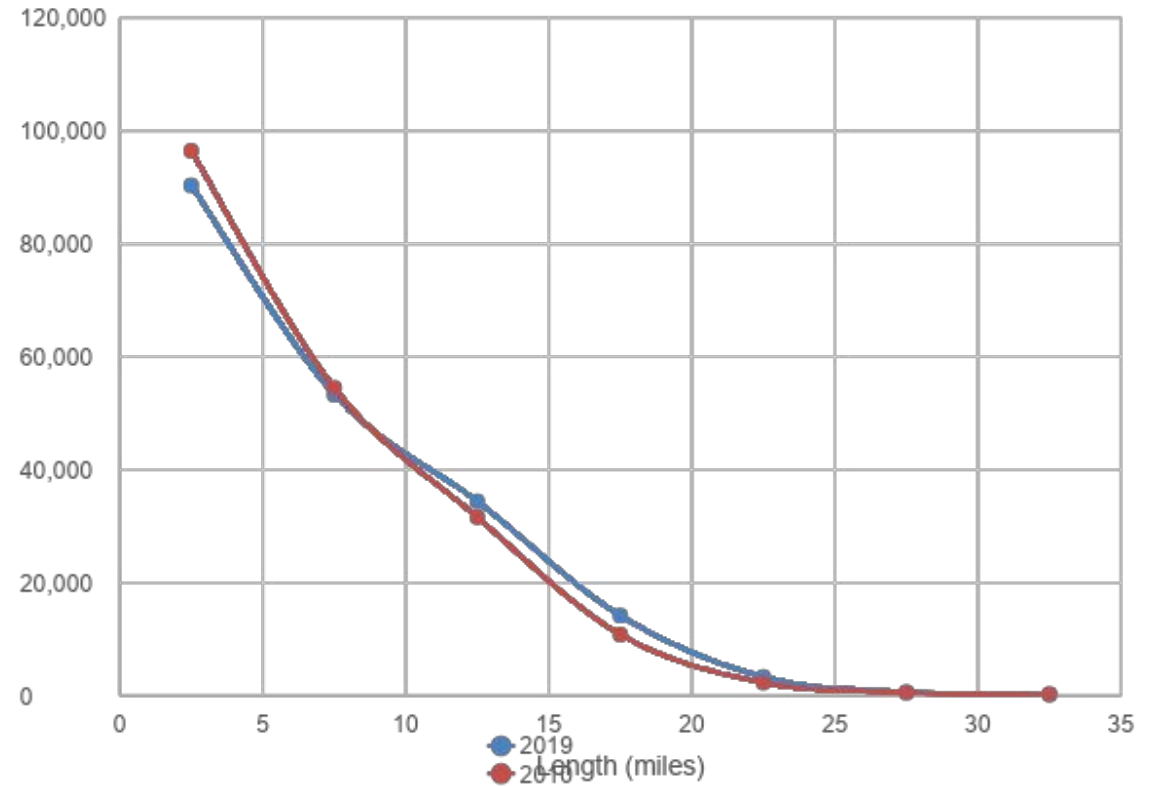
Home-Based Other (HBO):

Year	Ave. Trip Length (miles)	Ave. Trip Duration (min)
2010	10.55	6.68
2019	10.75	7.16
% Diff	1.9%	7.3%

Travel Time Distribution



Travel Length Distribution

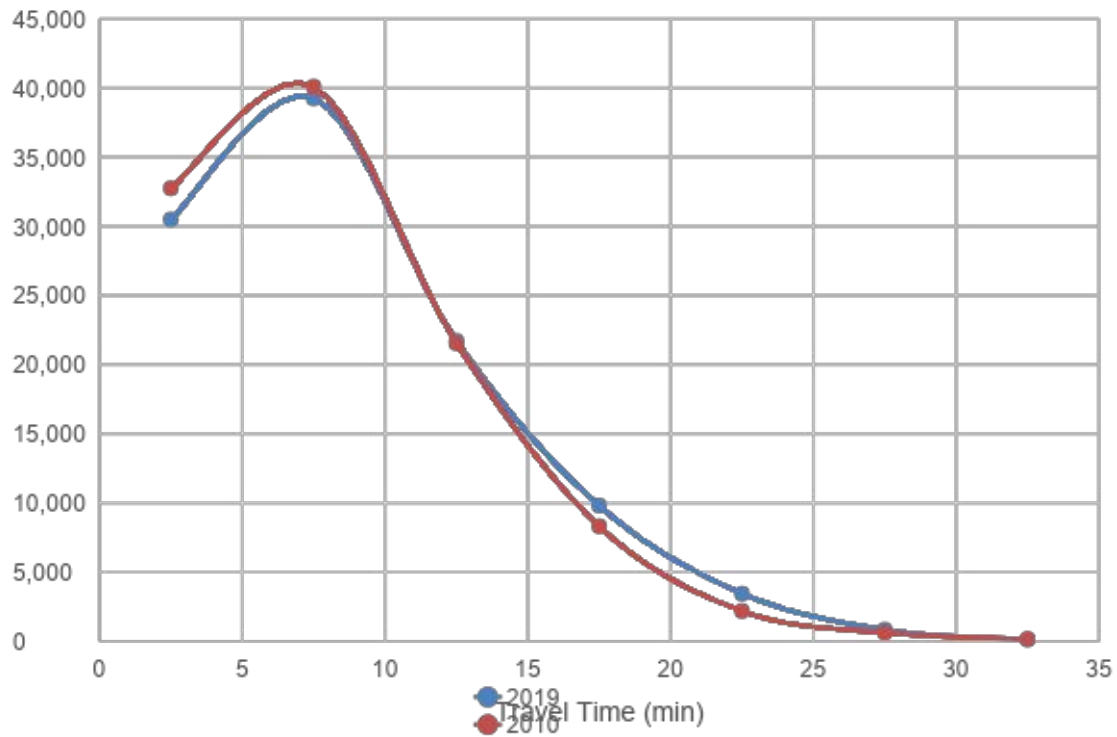


Trip Distribution

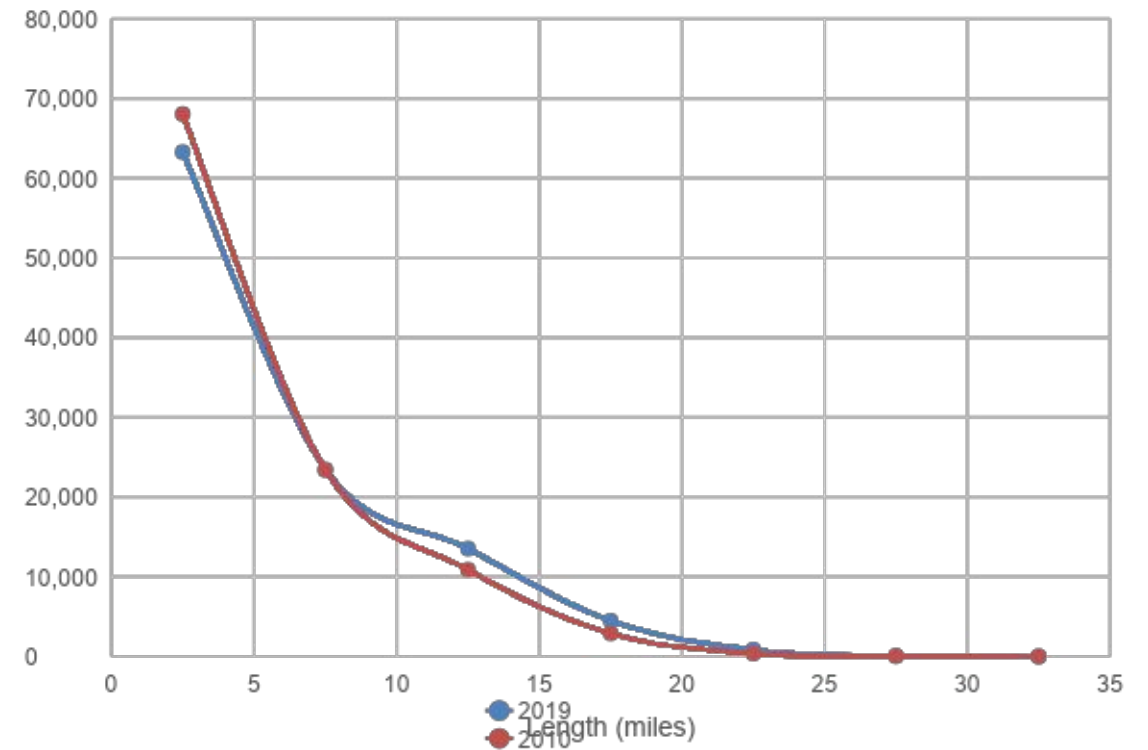
Non-Home-Based (NHB):

Year	Ave. Trip Length (miles)	Ave. Trip Duration (min)
2010	8.22	5.13
2019	8.69	5.70
% Diff	5.6%	11.0%

Travel Time Distribution



Travel Length Distribution

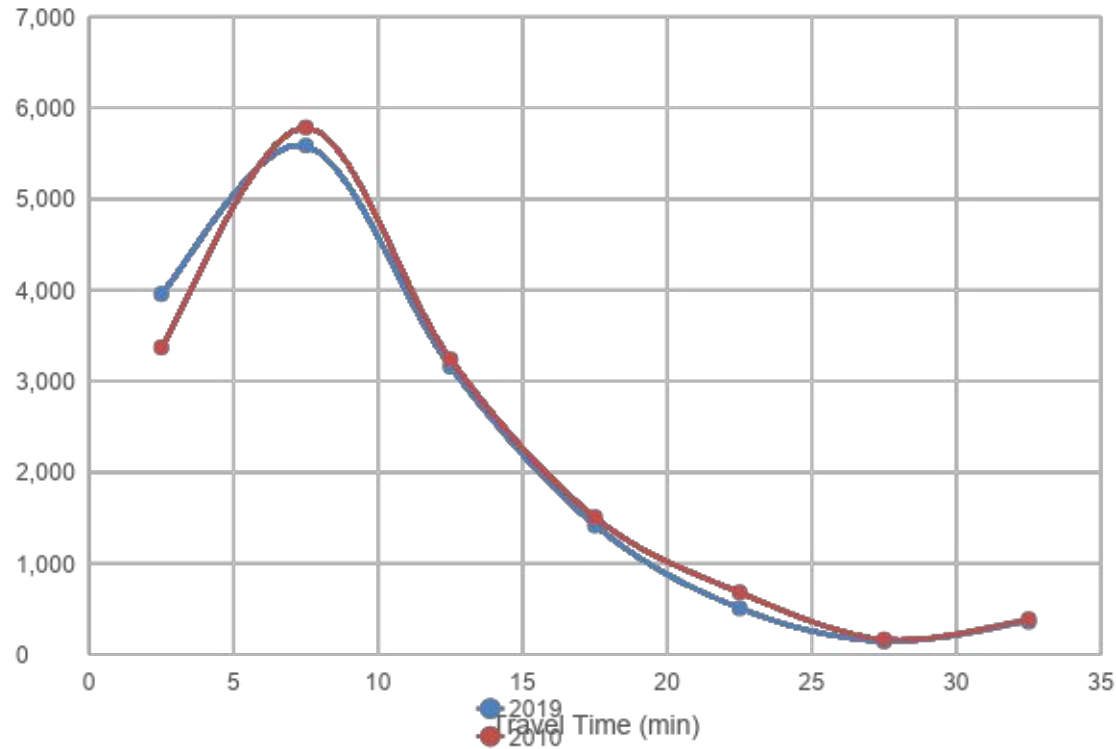


Trip Distribution

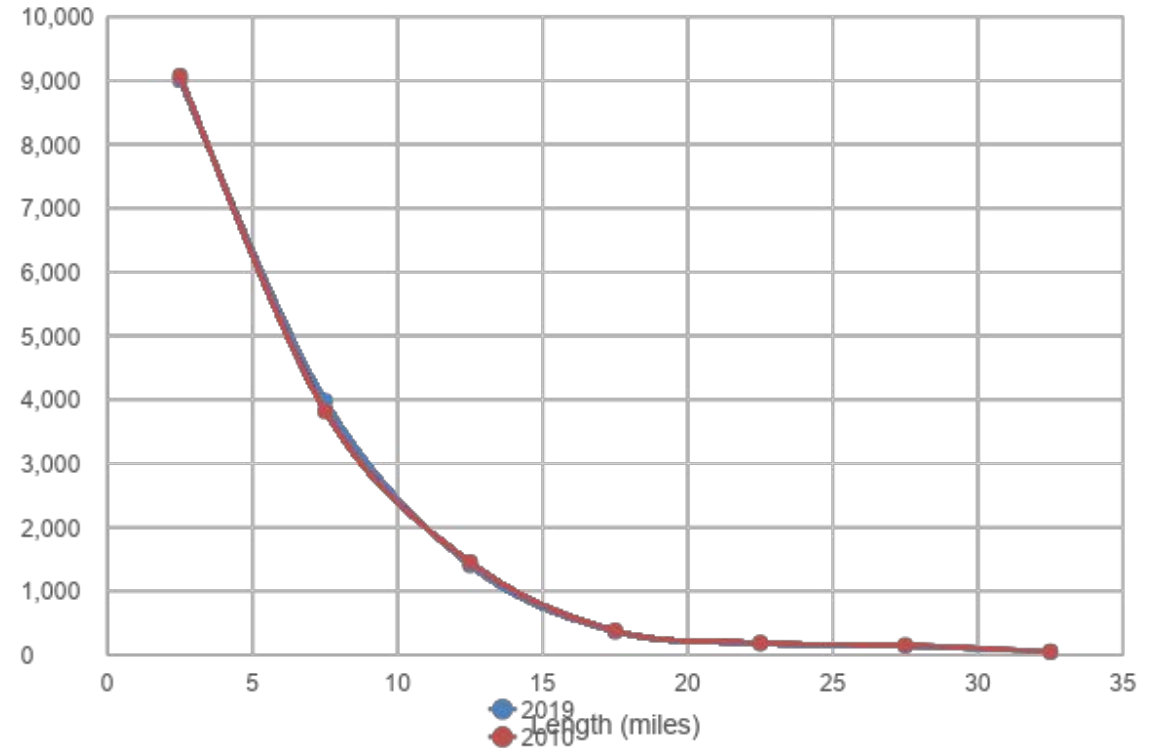
Home-Based University (HBU):

Year	Ave. Trip Length (miles)	Ave. Trip Duration (min)
2010	9.98	5.72
2019	9.46	5.68
% Diff	-5.2%	-0.7%

Travel Time Distribution



Travel Length Distribution



Highway Assignment

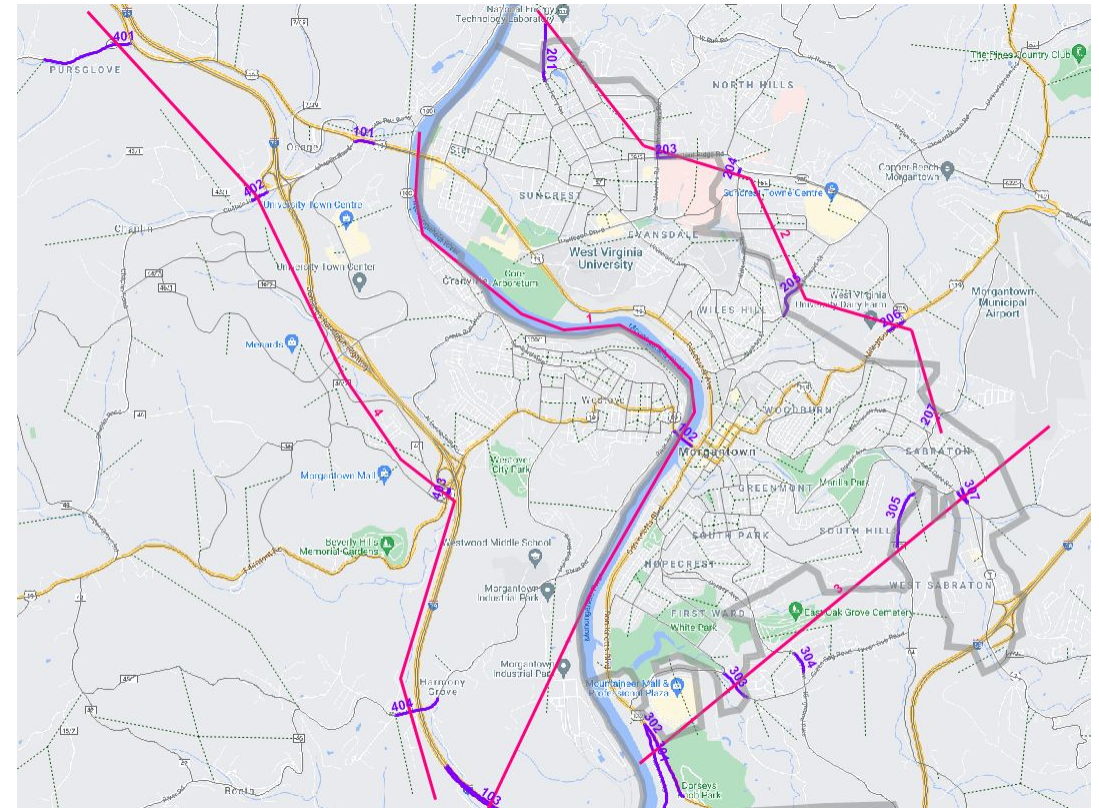
- Base Calibration Results:
 - Observed and estimated Vehicle-Miles Traveled (VMT) by facility and area type:

Facility Type	Observed VMT			Estimated VMT			Est. / Obs. Ratio		
	Area Type			Area Type			Area Type		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Freeway	307,578	140,892	448,470	293,510	148,927	442,437	0.95	1.06	0.99
Expressway	0	33,396	33,396	0	35,150	35,150		1.05	1.05
Principal Arterial	586,280	0	586,280	597,339	0	597,339	1.02		1.02
Minor Arterial	439,814	40,143	479,957	416,799	50,058	466,858	0.95	1.25	0.97
Collector	157,364	30,837	188,201	142,917	33,867	176,784	0.91	1.10	0.94
Local Access	42,630	6,050	48,680	28,620	5,751	34,371	0.67	0.95	0.71
Ramp	217,618	8,736	226,354	180,436	9,460	189,896	0.83	1.08	0.84
Total	1,751,284	260,054	2,011,338	1,659,621	283,213	1,942,835	0.95	1.09	0.97

Highway Assignment

- Base Calibration Results:
 - Screenline summary

Screenline No.	Count Code	Roadway	FT	Obs	Est	Diff	% Diff
1	101	US-19	Principal Arterial	42,300	39,829	-2,471	-6%
	102	US-19	Principal Arterial	17,600	19,320	1,720	10%
	103	I-79	Freeway	47,596	48,050	454	1%
	Total			107,496	107,200	-296	0%
2	202	VAN VOORHIS	Collector	13,300	14,759	1,459	11%
	203	CHESTNUT RIDGE RD	Principal Arterial	29,300	25,157	-4,143	-14%
	204	CHESTNUT RIDGE RD	Collector	16,000	17,239	1,239	8%
	205	STEWART ST	Minor Arterial	8,300	9,549	1,249	15%
	206	US-119	Minor Arterial	15,400	20,347	4,947	32%
	207	COUNTY HIGHWAY 62	Minor Arterial	7,700	4,852	-2,848	-37%
	Total			90,000	91,903	1,903	2%
3	301	SMITHTOWN RD	Collector	2,645	2,184	-461	-17%
	302	US-119	Principal Arterial	17,357	18,832	1,475	8%
	303	GREEN BAG RD	Minor Arterial	8,793	4,653	-4,140	-47%
	304	DORSEY AVE	Minor Arterial	5,650	5,244	-406	-7%
	305	GREENBAG ROAD	Minor Arterial	8,872	6,729	-2,143	-24%
	306	EARL CORE RD	Minor Arterial	19,408	20,274	866	4%
	307	SABRATON AVE	Local Access	5,759	1,931	-3,828	-66%
	Total			68,484	59,845	-8,639	-13%
4	401	MASON DIXON HWY	Principal Arterial	5,973	7,577	1,604	27%
	402	CHAPLIN RD	Local Access	12,000	6,146	-5,854	-49%
	403	US-19	Minor Arterial	14,800	12,164	-2,636	-18%
	404	RIVER RD	Collector	4,300	3,855	-445	-10%
	Total			37,073	29,742	-7,331	-20%



Highway Assignment

- Base Calibration Results:
 - Root Mean Square Error (RMSE) by traffic volume range is within accepted criteria

Observed Volume Range	No. of Observations	Est/Obs Ratio	RMSE	Acceptable RMSE Range	
				FDOT	VDOT
0 - 500	6	0.86	43%	-	
500 - 1,500	21	0.90	47%	-	
1,500 - 2,500	16	1.02	44%	-	
2,500 - 3,500	11	1.10	35%	-	
3,500 - 4,500	24	1.03	19%	45 - 100%	100%
4,500 - 5,500	13	0.90	23%	35 - 45%	100%
5,500 - 7,000	14	0.81	34%	35 - 45%	45%
7,000 - 8,500	15	1.08	33%	35 - 45%	45%
8,500 - 10,000	15	0.91	33%	35 - 45%	45%
10,000 - 12,500	22	0.80	29%	27 - 35%	35%
12,500 - 15,000	10	0.81	33%	27 - 35%	35%
15,000 - 17,500	4	1.06	20%	25 - 30%	30%
17,500 - 20,000	8	1.13	19%	25 - 30%	30%
20,000 - 25,000	7	1.07	23%	15 - 27%	27%
25,000 - 35,000	8	1.06	14%	15 - 27%	27%
35,000 +	10	0.96	11%	15 - 25%	25%
All	204	0.97	27%	30 - 50%	40%

Summary – The Base Calibration Highway Assignment Results achieve accepted standards and are deemed acceptable for the purposes of this project.

Highway Assignment

- Enhanced Calibration
 - This is an option to improve the overall replication of the observed traffic counts
 - Recognizes the accuracy limitations of socioeconomic data and synthetic trip tables.
 - Provides a better baseline of traffic for any post-model traffic forecast refinements
- Process Overview
 - One-Time technique Stantec uses to reduce the gap between the observed and estimated traffic by iteratively adjusting the origin-destination trip table and assigning it to the network.
 - The process then provides a 'layer' of additional trips that is applicable to base and future years
 - The added trips are merged with the trips prior to Highway Assignment and are therefore sensitive to network alternatives
- Option Application
 - The updated model provides user with an option to switch the merges the trip layer prior to assignment.
 - The resulting average trip duration compared to the base calibration would reduce by 8%

Highway Assignment

- Base Calibration Results (Repeated as reference):

Facility Type	Observed VMT			Estimated VMT			Est. / Obs. Ratio		
	Area Type			Area Type			Area Type		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Freeway	307,578	140,892	448,470	293,510	148,927	442,437	0.95	1.06	0.99
Expressway	0	33,396	33,396	0	35,150	35,150		1.05	1.05
Principal Arterial	586,280	0	586,280	597,339	0	597,339	1.02		1.02
Minor Arterial	439,814	40,143	479,957	416,799	50,058	466,858	0.95	1.25	0.97
Collector	157,364	30,837	188,201	142,917	33,867	176,784	0.91	1.10	0.94
Local Access	42,630	6,050	48,680	28,620	5,751	34,371	0.67	0.95	0.71
Ramp	217,618	8,736	226,354	180,436	9,460	189,896	0.83	1.08	0.84
Total	1,751,284	260,054	2,011,338	1,659,621	283,213	1,942,835	0.95	1.09	0.97

- Enhanced Calibration Results:

Facility Type	Observed VMT			Estimated VMT			Est. / Obs. Ratio		
	Area Type			Area Type			Area Type		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Freeway	307,578	140,892	448,470	318,775	143,586	462,361	1.04	1.02	1.03
Expressway	0	33,396	33,396	0	32,865	32,865		0.98	0.98
Principal Arterial	586,280	0	586,280	587,393	0	587,393	1.00		1.00
Minor Arterial	439,814	40,143	479,957	438,424	43,085	481,510	1.00	1.07	1.00
Collector	157,364	30,837	188,201	158,370	32,062	190,432	1.01	1.04	1.01
Local Access	42,630	6,050	48,680	41,189	6,663	47,852	0.97	1.10	0.98
Ramp	217,618	8,736	226,354	209,758	9,406	219,165	0.96	1.08	0.97
Total	1,751,284	260,054	2,011,338	1,753,910	267,667	2,021,577	1.00	1.03	1.01

Highway Assignment

- Enhanced Calibration Results:
 - Root Mean Square Error (RMSE) by traffic volume range:

Observed Volume Range	No. of Observations	Base Calibration		Enhanced Calibration		Acceptable RMSE Range (Source:FSUTMS)
		Est/Obs Ratio	RMSE	Est/Obs Ratio	RMSE	
0 - 500	6	0.86	43%	1.04	16%	-
500 - 1,500	21	0.90	47%	1.01	21%	-
1,500 - 2,500	16	1.02	44%	1.03	24%	-
2,500 - 3,500	11	1.10	35%	1.08	17%	-
3,500 - 4,500	24	1.03	19%	1.01	8%	45 - 100%
4,500 - 5,500	13	0.90	23%	0.98	9%	35 - 45%
5,500 - 7,000	14	0.81	34%	1.01	7%	35 - 45%
7,000 - 8,500	15	1.08	33%	1.02	6%	35 - 45%
8,500 - 10,000	15	0.91	33%	1.00	9%	35 - 45%
10,000 - 12,500	22	0.80	29%	0.96	8%	27 - 35%
12,500 - 15,000	10	0.81	33%	0.99	6%	27 - 35%
15,000 - 17,500	4	1.06	20%	0.99	4%	25 - 30%
17,500 - 20,000	8	1.13	19%	1.03	5%	25 - 30%
20,000 - 25,000	7	1.07	23%	0.97	8%	15 - 27%
25,000 - 35,000	8	1.06	14%	1.02	7%	15 - 27%
35,000 +	10	0.96	11%	1.02	8%	15 - 25%
All	204	0.97	27%	1.01	11%	30 - 50%

- Significant improvement in calibration metrics including estimated to observed ratio and the root mean square error.

Highway Assignment

- Comparison of the locations with the highest magnitude of difference with the observed traffic, in base and enhance calibration:

Base Calibration

Count ID	Name	Facility Type	Obs	Est	Diff	% Diff
2	University Town Center Dr	Principal Arterial	15,000	5,155	-9,845	-66%
101	I-68	Freeway	49,610	41,300	-8,310	-17%
82	University Town Center Dr	Principal Arterial	12,300	4,962	-7,338	-60%
57	US-19	Principal Arterial	14,400	7,592	-6,808	-47%
69	DUPONT RD	Collector	8,100	2,069	-6,031	-74%
76	CHAPLIN RD	Local Access	12,000	6,146	-5,854	-49%
106	I-68	Freeway	42,140	36,329	-5,811	-14%
1	University Town Center Dr	Principal Arterial	13,000	7,370	-5,630	-43%
79	Mall Rd	Local Access	12,200	6,962	-5,238	-43%
43	GREEN BAG RD	Minor Arterial	12,500	7,568	-4,932	-39%
5	PATTESON DR	Principal Arterial	26,900	31,540	4,640	17%
4	US-19	Principal Arterial	29,300	33,976	4,676	16%
116	I-68	Freeway	30,788	35,559	4,771	15%
32	US-119	Minor Arterial	15,400	20,347	4,947	32%
6	VAN VOORHIS RD	Principal Arterial	30,800	35,916	5,116	17%
26	COUNTY HIGHWAY 73	Principal Arterial	23,600	29,106	5,506	23%
31	STATE ROUTE 705	Principal Arterial	21,900	28,288	6,388	29%
39	US-119	Principal Arterial	20,200	28,041	7,841	39%
133	I-79	Freeway	46,936	54,972	8,036	17%
18	US-19	Principal Arterial	18,600	27,467	8,867	48%

Enhanced Calibration

Count ID	Name	Facility Type	Obs	Est	Diff	% Diff
101	I-68	Freeway	49,610	46,256	-3,354	-7%
16	US-19	Principal Arterial	20,100	16,839	-3,261	-16%
146	I-79	Freeway	41,874	38,984	-2,890	-7%
30	US-119	Principal Arterial	24,100	21,526	-2,574	-11%
57	US-19	Principal Arterial	14,400	12,137	-2,263	-16%
147	I-79 Ramp	Ramp	11,927	9,823	-2,104	-18%
11	CHESTNUT RIDGE RD	Principal Arterial	29,300	27,429	-1,871	-6%
75	US-19	Principal Arterial	42,300	40,745	-1,555	-4%
150	I-79 Ramp	Ramp	12,177	10,647	-1,530	-13%
341	EARL L CORE RD	Minor Arterial	9,529	8,061	-1,468	-15%
324	US-19	Principal Arterial	9,947	11,439	1,492	15%
26	COUNTY HIGHWAY 73	Principal Arterial	23,600	25,101	1,501	6%
70	CHAPLIN RD	Principal Arterial	35,600	37,330	1,730	5%
18	US-19	Principal Arterial	18,600	20,570	1,970	11%
145	I-79	Freeway	47,596	49,772	2,176	5%
4	US-19	Principal Arterial	29,300	32,060	2,760	9%
111	I-68	Freeway	35,442	38,878	3,436	10%
116	I-68	Freeway	30,788	34,842	4,054	13%
133	I-79	Freeway	46,936	51,133	4,197	9%
144	I-79	Freeway	42,100	50,003	7,903	19%

Comments & Next Steps

- Seeking Comments & Questions
- Model is Ready for Application – Anticipated in the next several weeks