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TNMUG Meeting

Data Sources for Travel Demand Modeling & An Overview of Clarksville TDM

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Key Topics

- Data Sources for Travel Demand Modeling
- Clarksville Travel Demand Model

Data Sources for TDM

Data Sources by Model Element

Traffic Analysis Zones (TAZ) :

- Census Geography (blocks, block groups or tracts)
- TAZ boundaries are usually major roadways, jurisdictional boundaries, and geographic boundaries and are defined by homogenous land uses to the extent possible
- Smaller TAZs allow detailed modeling but greater the data needs

Highway Networks:

- Existing TDM Network
- Census Bureau's TIGER/Line Files
- Local Agency GIS Layers
- State DOT's Highway Inventory Layer
- National Transportation Atlas Database
- Freight Analysis Framework (FAF) Version Highway Network
- FHWA National Highway Planning Network

Data Sources by Model Element

Base Year Socioeconomic Data:

Population and Households

- Decennial Census
- American Community Survey (1- and 5-Year Estimates)
- ACS/PUMS 5-Year Dataset
- Local Building Permits

Employment

- Quarterly Census of Employment and Wages (QCEW)
- Third Party Vendors (Data-Axle, Claritas, Dun and Bradstreet etc.)
- Longitudinal Employer–Household Dynamics (LEHD)
- Local Chamber of Commerce, Economic Development Organizations etc.
- State Employment Commissions

Data Sources by Model Element

Forecast Year Socioeconomic Data:

- State Data Centers
- Woods & Poole
- Regional Economic Models, Inc (REMI)
- Local Land use Forecasting Models
- Census Bureau's National Population Projections
- Stakeholder Input

Other Sources:

- Department of Education for School Data
- Universities

Data Sources by Model Element

Trip Generation (Average Trip Rates, Percent Trips by Purpose etc.)

- Local Household Travel Survey
- National Household Travel Survey
- NCHRP 716 - Travel Demand Forecasting: Parameters and Techniques
- Quick Response Freight Methods, Third Edition, 2019
- Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee

Trip Distribution (Mean trip length, trip length frequency distribution, area-to-area flows etc):

- Local Household Travel Survey
- Big Data Sources (AirSage, InRix, Replica, Streetlight, Wejo etc.)
- ACS/CTPP Data
- Traffic Counts at Screenlines and External Stations
- Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee
- NCHRP 716 - Travel Demand Forecasting: Parameters and Techniques

Data Sources by Model Element

Mode Choice (Mode Shares, Area-to-Area Flows etc.)

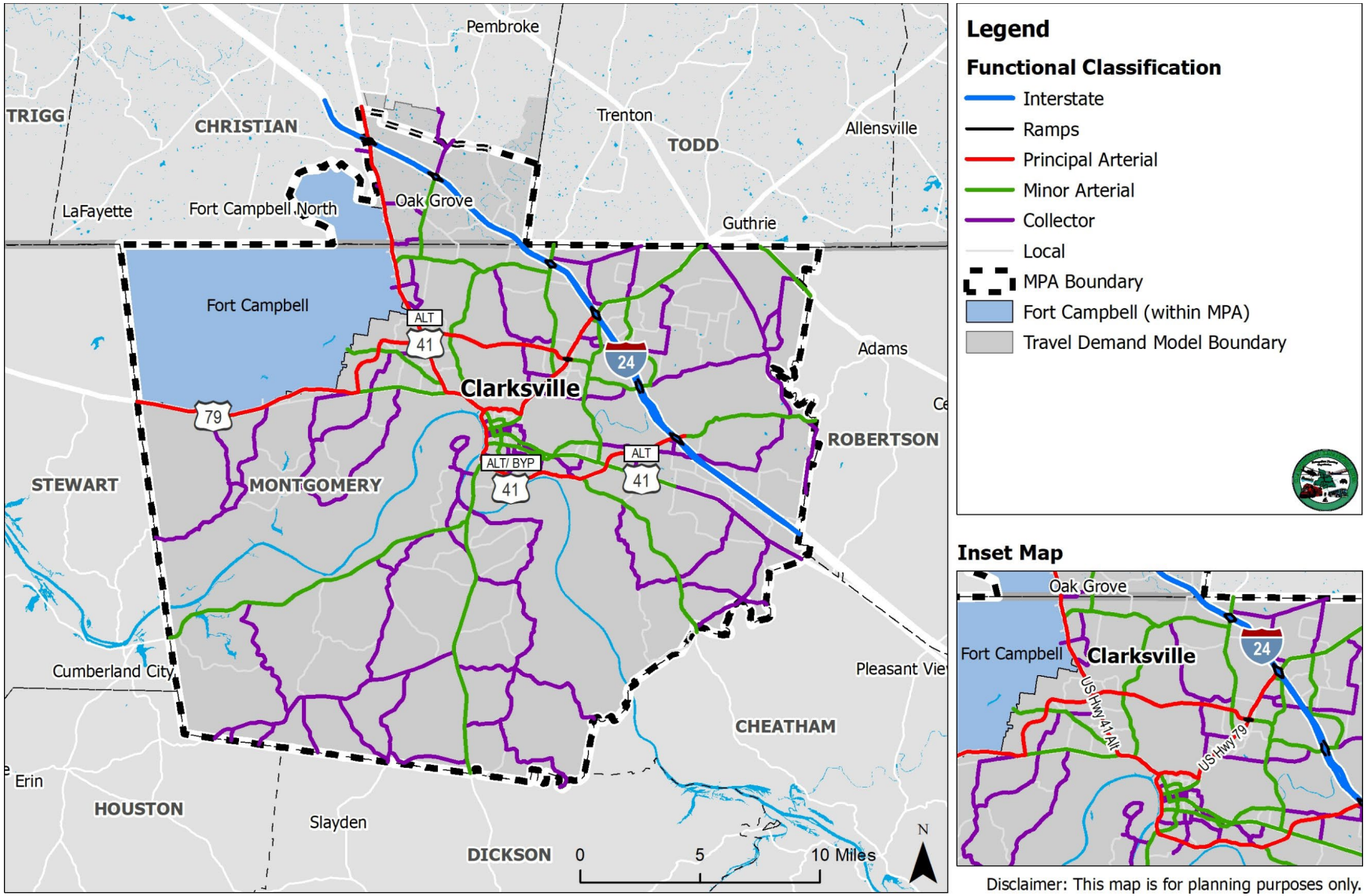
- Local Household Travel Survey
- Transit On-Board Survey Data
- NCHRP 716 - Travel Demand Forecasting: Parameters and Techniques
- Big Data Sources (AirSage, InRix, Replica, Streetlight, Wejo etc.)

Traffic Assignment (Assigned Flows vs. Observed):

- Traffic Counts at Screenlines and External Stations
- Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee
- HPMS Data
- Speed Profiles from Big Data Sources

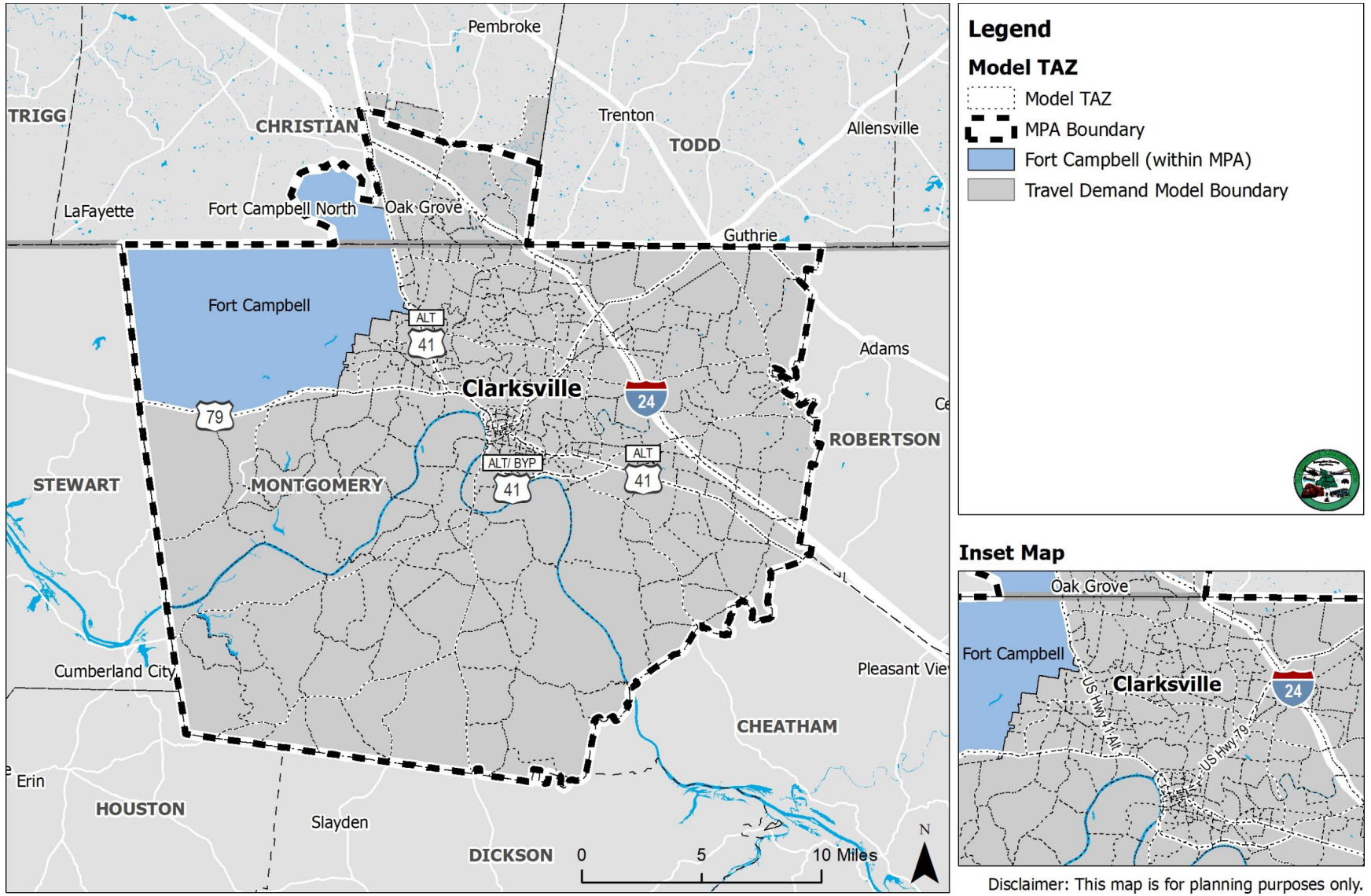
Clarksville Travel Demand Model

Network



Disclaimer: This map is for planning purposes only.

TAZ (Internal – 363 and External – 41)



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Socio-Economic Data Development – Housing/Population

- Household data for each TAZ developed using:
  - Census 2020 block housing and population data
  - Local jurisdiction permit data
  - 2019 Housing Data Estimated by Subtracting 2019 Net Permit Data from 2020 Census Data

Variable	Montgomery County, TN	Christian County, KY	Model Study Area Total
DU	81,778	4,761	86,539
OCCDU	77,135	3,301	80,436
HHPOP	206,468	8,672	215,140

Socio-Economic Data Development – Employment

- Point-level employment data purchased from Data-Axle.
- Data contains:
  - Name
  - Address
  - City/State/ZIP
  - Estimate of Number of employees
  - SIC and NAICS Codes
- Each point geocoded and checked for location accuracy.
  - Additional data cleaning and removal of duplicates.
- Aggregated to TAZ and then proportionately adjusted to meet County-level QCEW control total.

Socio-Economic Data Development – Employment Cont.

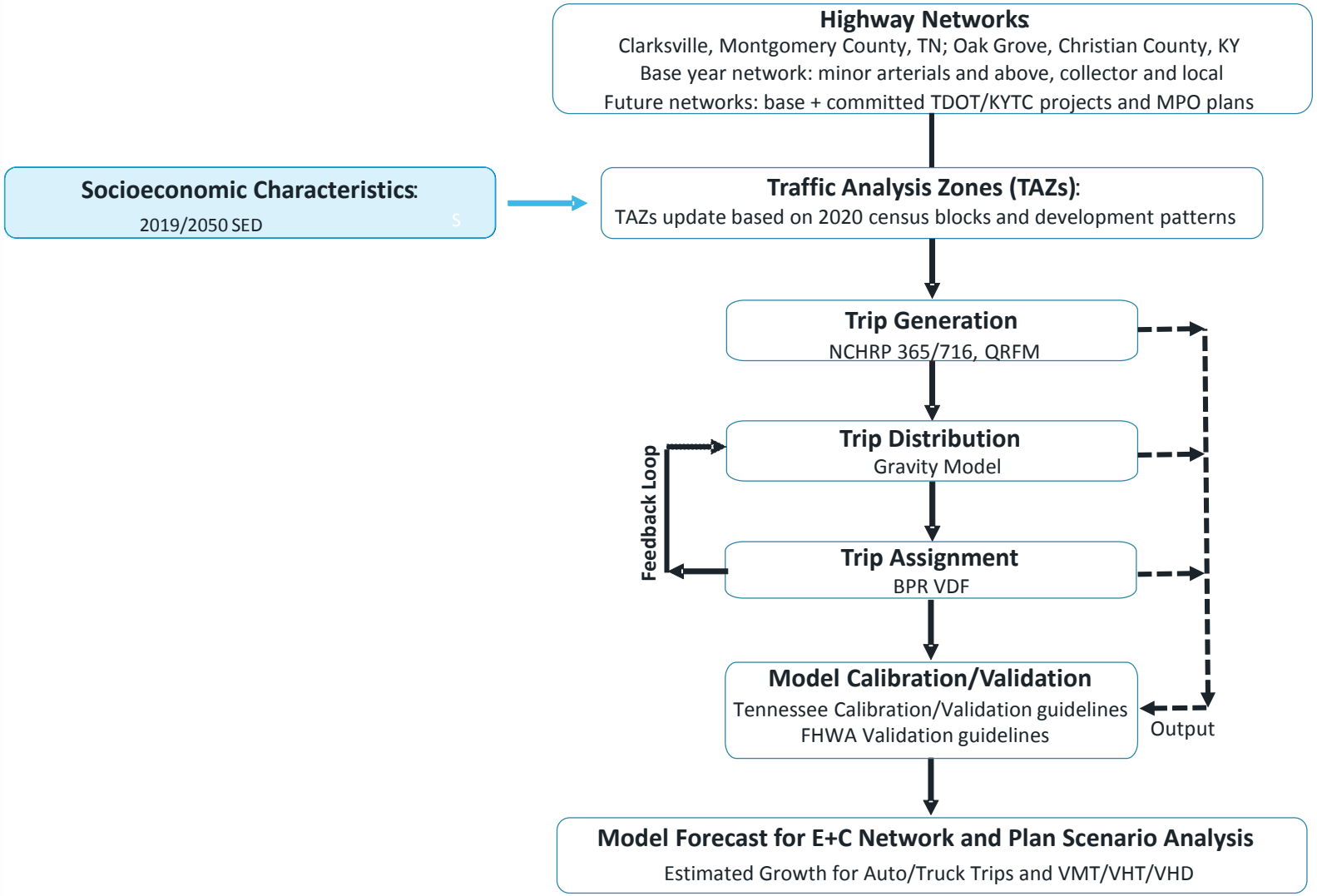
Recommended 2019 Employment Control Total			
County	2019 Annual Average QCEW Employment*	Percent in Model Area	Recommended 2019 Model Employment Control Total
Mongtomgery County	55,987	100.0%	55,987
Christian County	30,914	4.9%	1,530

*Data used was obtained from the BLS annual Quarterly Census of Employment and Wages and reflects the year's average employment.

Socio-Economic Data Development – School Enrollment

- Obtained school attendance data from the U.S. Department of Education through the National Center for Education Statistics (NCES) data tool.
- Includes public and private schools, colleges and universities, and vocational and business schools.
- For modeling purposes, the school attendance is measured by the number of students attending a school in a TAZ and not by the number of students residing in that TAZ.
- School data was geocoded, assigned to the TAZ, and school enrollment was aggregated to the TAZ level.

CUAMPO Travel Demand Model



Model Calibration Results

- Trip Generation

Trip Rates: Modeled vs Benchmark

Trip Rate	Modeled	Low Benchmark	High Benchmark
Person Trips per Person	3.3	3.3	4.0
Person Trips per Household	8.8	8.0	10.0
HBW Person Trips per Employee	1.55	1.20	1.55
HBW Trips	13.9%	12.0%	24.0%
HBO Trips	56.5%	45.0%	60.0%
NHB Trips	29.6%	20.0%	33.0%

Model Calibration Results

- Trip Distribution

Average Trip Length by Trip Purpose

Trip Purpose	2019 Model Average Trip Length (min)	NHTS Average Trip Length (min)
HBW	21.6	20.4
HBO	17.6	17.6
NHB	17.4	17.7

Auto Occupancy Factors

Trip Purpose	Modeled	Low Benchmark	High Benchmark
HBW	1.08	1.05	1.10
HBO	1.65	1.65	1.95
NHB	1.60	1.60	1.90

Model Validation Results

- Trip Assignment

VMT by Functional Classification

Functional Classification	Model VMT	HPMS 2019 VMT	Difference	Percent Difference	Percent Difference Limit
Regional	4,731,346	4,739,521	-8,175	-0.17%	+/- 2-5
Freeways/Expressways	1,429,232	1,479,105	-49,873	-3.37%	+/- 6-7
Principal Arterials	1,313,127	1,329,253	-16,126	-1.21%	+/- 10-15
Minor Arterials	1,363,887	1,353,229	10,658	0.79%	+/- 10-15
Collectors	625,100	577,933	47,167	8.16%	+/- 20-25

Model Validation Results

- Trip Assignment

% Error

ADT Range	Number of Observations	Total Count[1]	Total Model Volume[2]	% Dev	% Dev Limit[3]
ADT<1,000	44	21,148	31,509	49.0	+/- 200.0
1,000 < =ADT < 2,500	33	53,595	65,852	22.9	+/- 100.0
2,500 <= ADT < 5,000	24	87,574	99,549	13.7	+/- 50.0
5,000 <= ADT < 10,000	53	364,095	373,388	2.6	+/- 25.0
10,000 < =ADT <25,000	44	722,638	732,268	1.3	+/- 20.0
25,000 < =ADT < 50,000	26	849,121	832,629	-1.9	+/- 15.0
Areawide	225	2,158,463	2,195,455	1.7	+/- 5.0

Facility Type	Number of Observations	Total Count	Total Model Volume	% Dev	% Dev Limit
Freeway/Interstate	14	403,567	404,229	0.2	+/- 6-7
Principal Arterial	27	692,363	680,781	-1.7	+/- 10-15
Minor Arterial	65	726,400	733,769	1.0	+/- 10-15
Collector	103	300,755	340,774	13.3	+/- 20-25
Areawide	225	2,158,463	2,195,455	1.7	+/- 5

Model Validation Results

- Trip Assignment

  % Error

  Screenline

Line Number	Number of Observations	Total Count[1]	Total Model Volume[2]	% Dev	Allowable % Dev
1	2	32,174	31,805	-1.1	+/-20.0
2	4	85,045	86,794	2.1	+/-10.0
3	4	131,658	122,725	-6.8	+/-10.0
4	3	20,226	22,205	9.8	+/-20.0
5	4	136,611	139,149	1.9	+/-10.0

Model Validation Results

- Trip Assignment

% RMSE

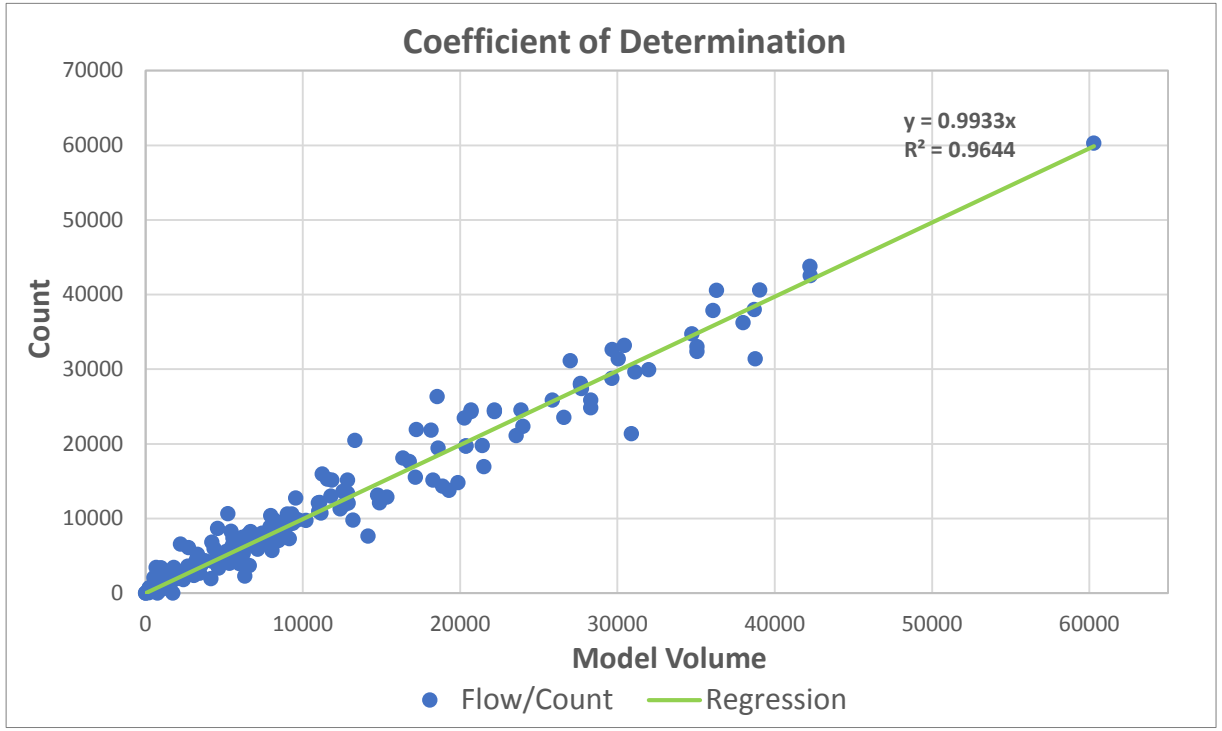
ADT Range	Number of Observations	Total Count	Total Model Volume	% RMSE	% RMSE Limit
ADT<5,000	101	162,317	196,326	65.2	45.0 - 100.0
5,000 <= ADT < 10,000	53	364,095	373,942	22.5	35.0 - 45.0
10,000 < =ADT < 15,000	20	247,149	255,353	24.0	27.0 - 35.0
15,000 < =ADT < 20,000	12	214,402	211,637	22.6	25.0 – 30.0
20,000 < =ADT < 30,000	22	539,504	541,322	10.1	15.0 – 27.0
30,000 < =ADT <50,000	16	570,704	556,585	10.0	15.0 – 25.0
Areawide	225	2,158,463	2,195,455	21.4	35.0 – 45.0

Functional Class	Number of Observations	Total Count	Total Model Volume	% RMSE	% RMSE Limit
Freeway/Interstate	14	403,567	404,229	7.7	20.0
Principal Arterial	27	692,363	680,781	15.8	30.0
Minor Arterial	65	726,400	733,769	16.3	40.0
Collector	103	300,755	340,774	49.9	70.0
Areawide	225	2,158,463	2,195,455	21.4	35.0-45.0

Model Validation Results

- Trip Assignment

Coefficient of Determination: Model Volume vs Traffic Count



Model Interface