Recent Model Developments Using Big Data in Fayetteville and Virginia

presented to

NCMUG

presented by

Cambridge Systematics, Inc.

Feng Liu, Ph.D.

John Lewis

11/1/2018

Presentation Outline

➤ Use of Big Data in the Fayetteville Regional Model Development

➤ Big Data in Lynchburg Regional Model Development and Virginia Statewide Transportation Model Development

➤ Recent Progress and Studies

CAMBRIDGE SYSTEMATICS

Big Data in Fayetteville Regional Model Development

CAMBRIDGE SYSTEMATICS

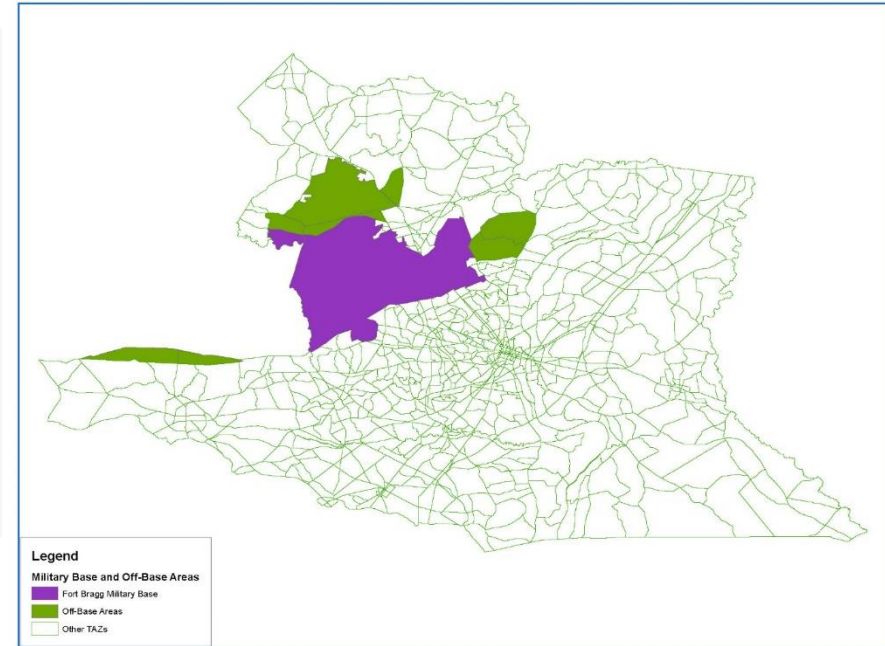# Fayetteville Regional Model Development

➤ Use of Big Data for
  » External Travel;
  » Commercial Trucks; and
  » Special Generators (Fort Bragg Military Base)

CAMBRIDGE SYSTEMATICS

Fayetteville Region

Category	Fort Bragg
Area Population (2015)	425,000
Area Total Employees (2015)	180,790
Active Duty Soldiers	52,280
Reservists	12,624
Civilian Employees	8,757
Army Retirees & Family Members in Area	98,507

CAMBRIDGE SYSTEMATICS

Fort Bragg Modeling

- Capture the unique travel dynamics related to Fort Bragg Military Base

- Sensitive to changes in socio-economic data

- Sensitive to changes in transportation supply

Treat the military base as a special market with at least three person trip purposes including HBW, HBO, and NHB and at least one commercial vehicle trip purpose.

CAMBRIDGE SYSTEMATICS

Observed Data

- Reviewed local observed data for the development of parameters including the Household Travel Survey

- Reviewed additional outside sources for information about the trip making characteristics of Military Bases
  - » ITE Trip Generation Rates
  - » El Paso MPO Travel Model – Fort Bliss model(s)

- Acquired Streetlight Data for MPO Region

CAMBRIDGE SYSTEMATICS

Military Base Origins
(Streetlight data)

Personal Travel

Average Weekday (M-Th)

All Day (12am-12am)

Zone Type: Destination

Destination Zone: 999
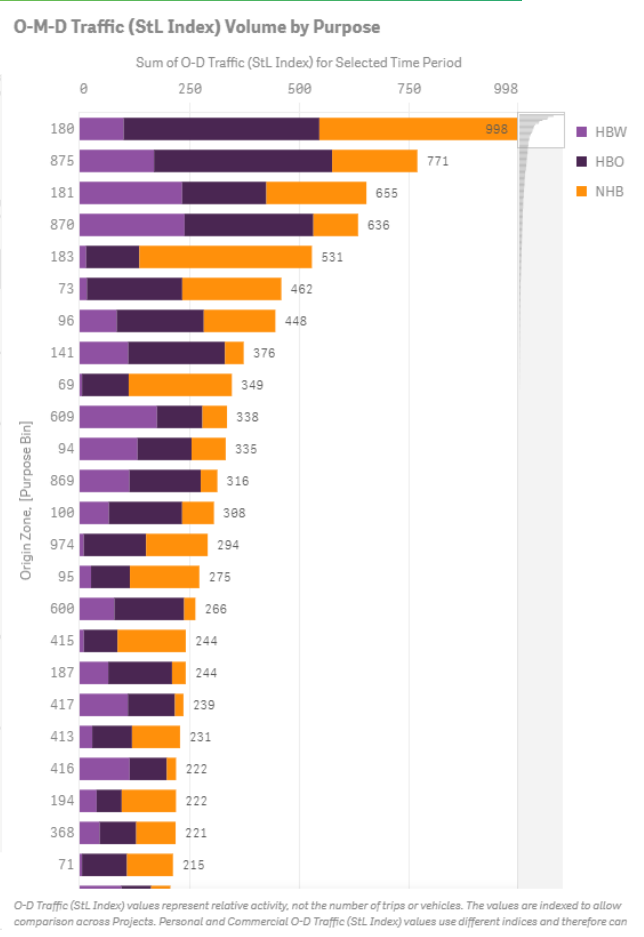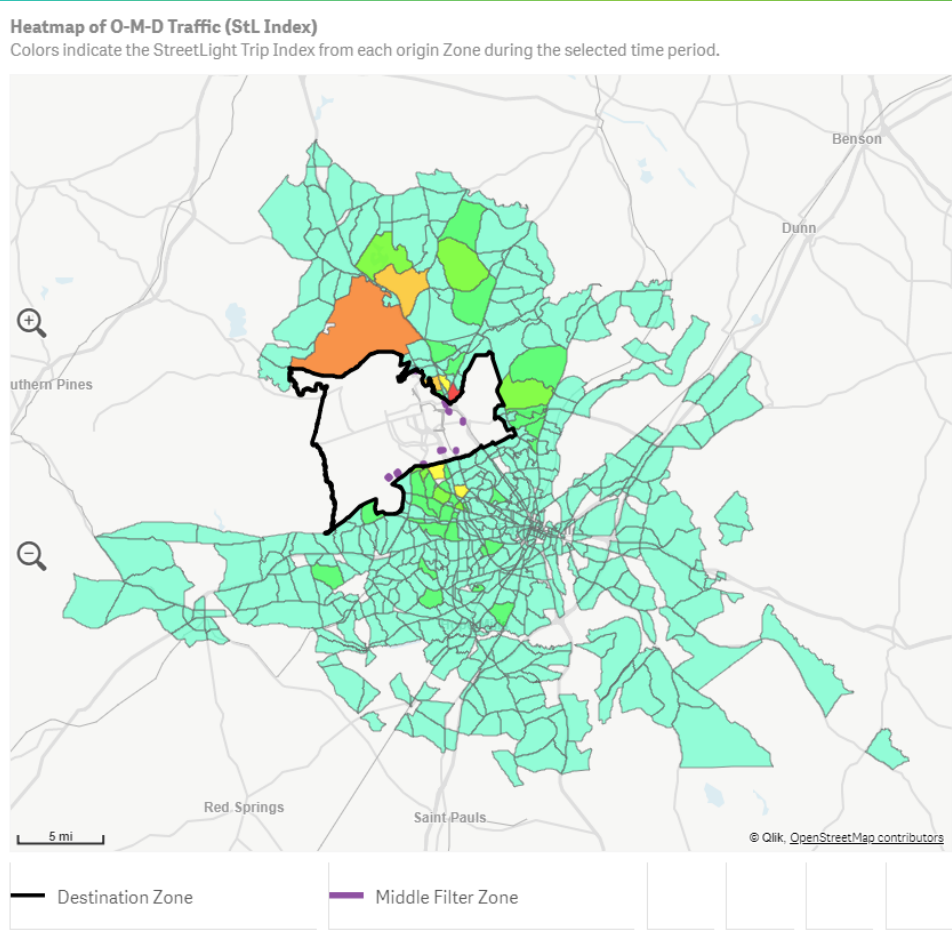
Select One Middle Filter Zone

Excluding Origin = Destination

Purpose

View as #

O-M-D Traffic (StL Index)

855.43 – <998	(red)
712.86 – <855.43	(orange)
570.29 – <712.86	(orange-yellow)
427.71 – <570.29	(yellow)
285.14 – <427.71	(green)
142.57 – <285.14	(light green)
0 – <142.57	(teal)

Heatmap of O-M-D Traffic (StL Index)
Colors indicate the StreetLight Trip Index from each origin Zone during the selected time period.

── Destination Zone   ── Middle Filter Zone

O-M-D Traffic (StL Index) Volume by Purpose

Sum of O-D Traffic (StL Index) for Selected Time Period

Legend: ■ HBW ■ HBO ■ NHB

Origin Zone, [Purpose Bin]	Value
180	998
875	771
181	655
870	636
183	531
73	462
96	448
141	376
69	349
609	338
94	335
869	316
100	308
974	294
95	275
600	266
415	244
187	244
417	239
413	231
416	222
194	222
368	221
71	215

O-D Traffic (StL Index) values represent relative activity, not the number of trips or vehicles. The values are indexed to allow comparison across Projects. Personal and Commercial O-D Traffic (StL Index) values use different indices and therefore can

© Qlik, OpenStreetMap contributors

CAMBRIDGE SYSTEMATICS

Military Base Destinations
(Streetlight data)

Basic Project Metrics

Personal Travel

Average Weekday (M-Th)

All Day (12am-12am)

Zone Type: Origin

Origin Zone: 999

Select One Middle Filter Zone
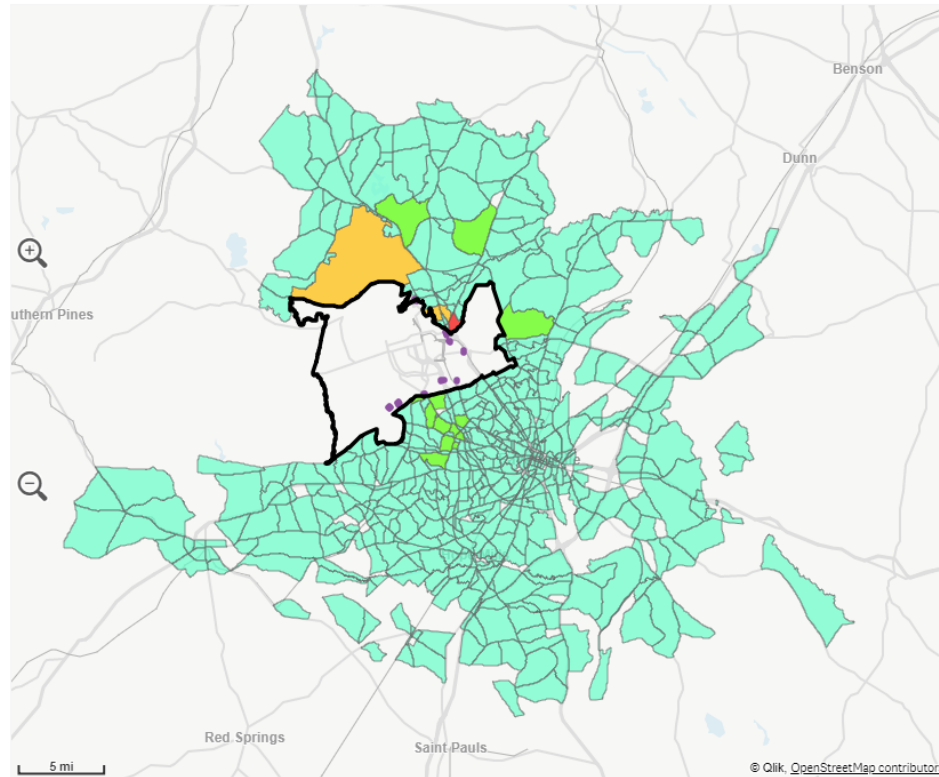
Excluding Origin = Destination
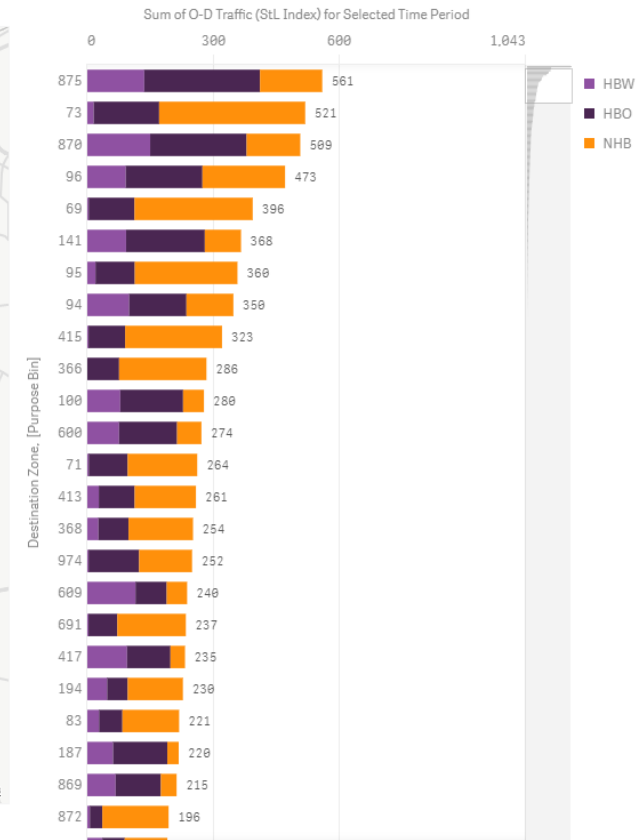
Purpose

View as #

O-M-D Traffic (StL Index)

782.29 - <1.04k
521.53 - <782.29
260.76 - <521.53
0 - <260.76

Heatmap of O-M-D Traffic (StL Index)
Colors indicate the StreetLight Trip Index to each destination Zone during the selected time period.

— Origin Zone   — Middle Filter Zone

© Qlik, OpenStreetMap contributors

O-M-D Traffic (StL Index) Volume by Purpose
Sum of O-D Traffic (StL Index) for Selected Time Period

Destination Zone [Purpose Bin]	Value
875	561
73	521
870	509
96	473
69	396
141	368
95	360
94	350
415	323
366	286
100	280
600	274
71	264
413	261
368	254
974	252
609	240
691	237
417	235
194	230
83	221
187	220
869	215
872	196

Legend: HBW, HBO, NHB

O-D Traffic (StL Index) values represent relative activity, not the number of trips or vehicles. The values are indexed to allow comparison across Projects. Personal and Commercial O-D Traffic (StL Index) values use different indices and therefore can
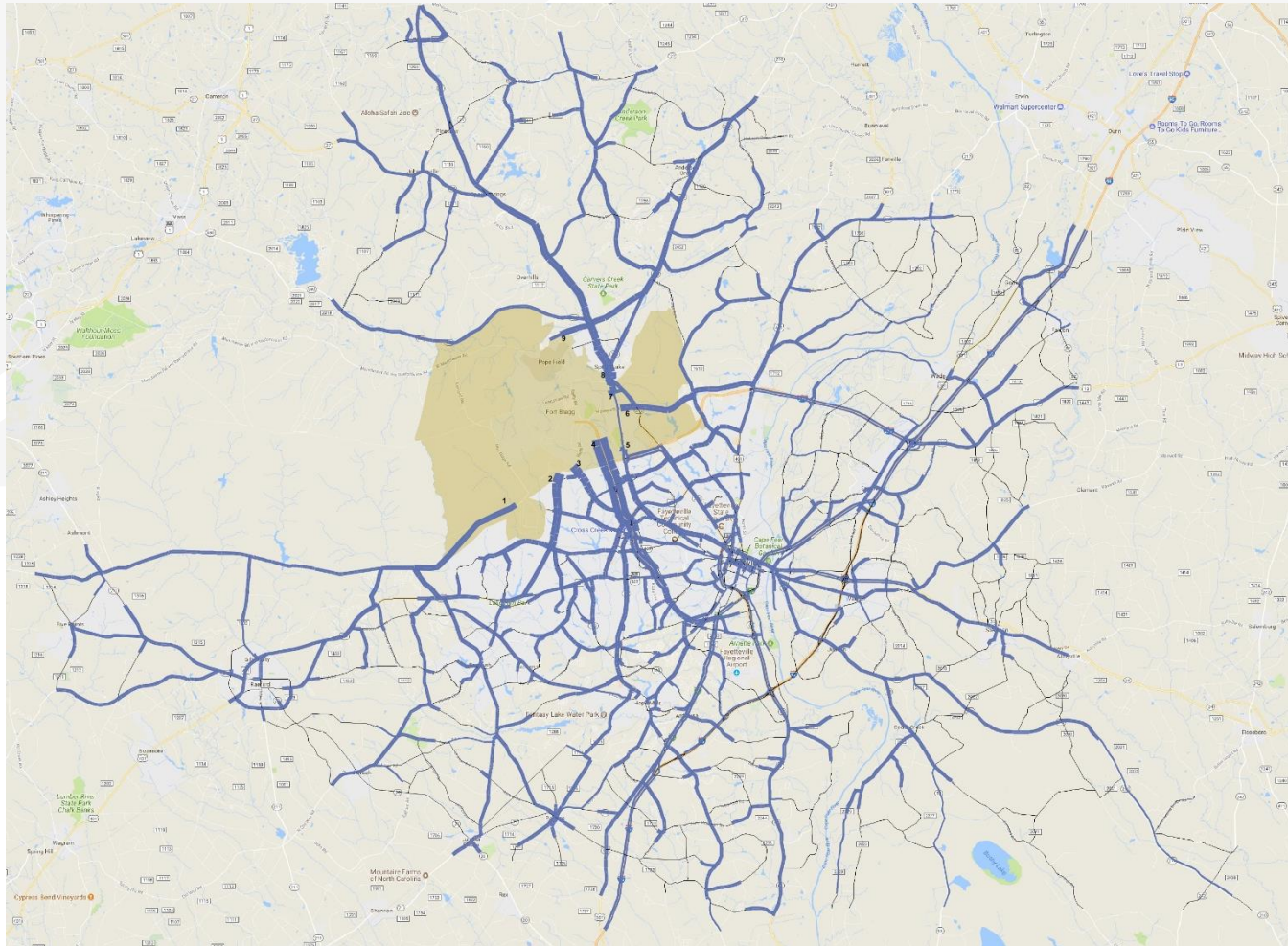
9

CAMBRIDGE SYSTEMATICS

Streetlight - Total Trips
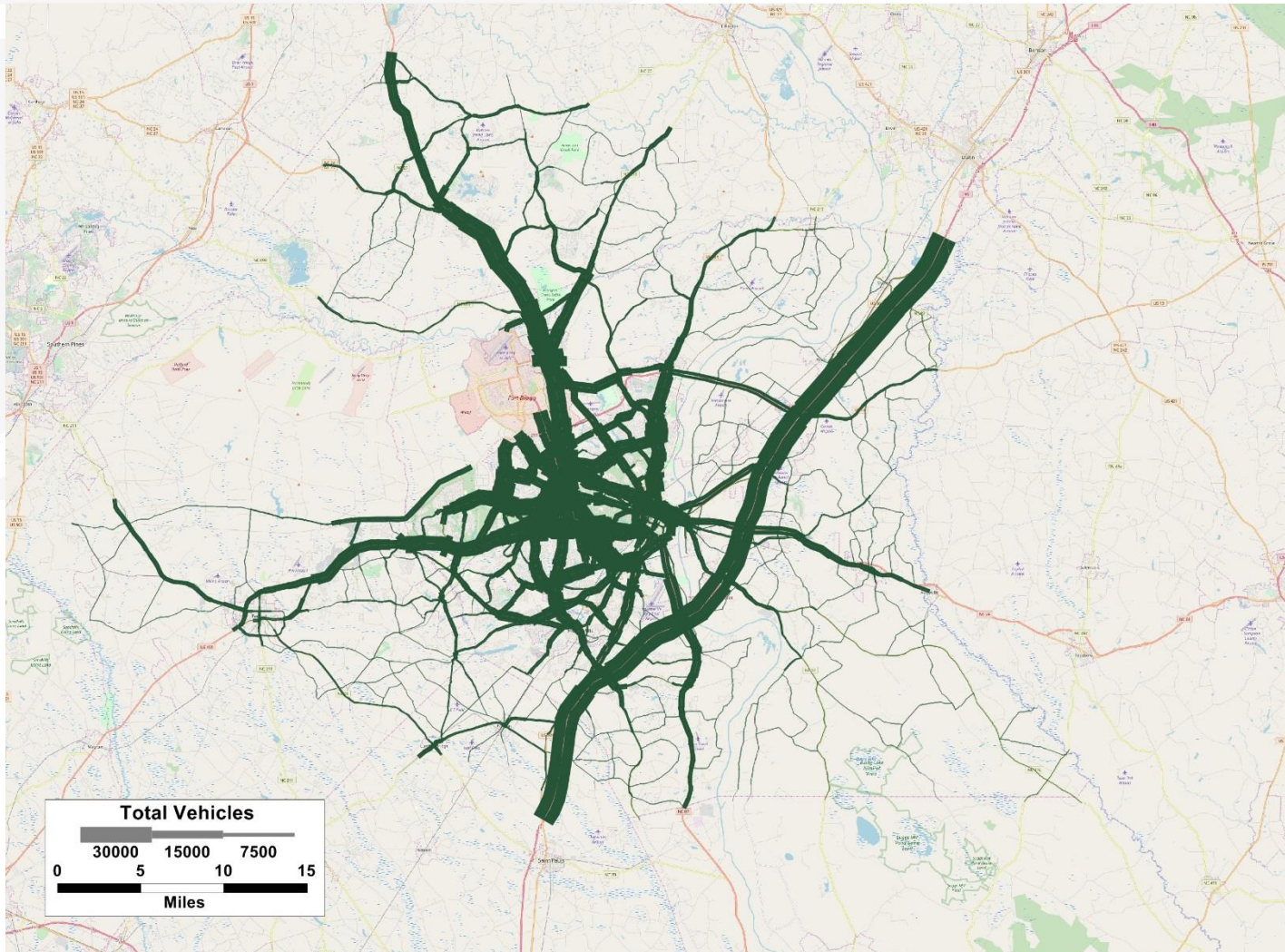
Calibrated Daily Traffic to/from Military Base
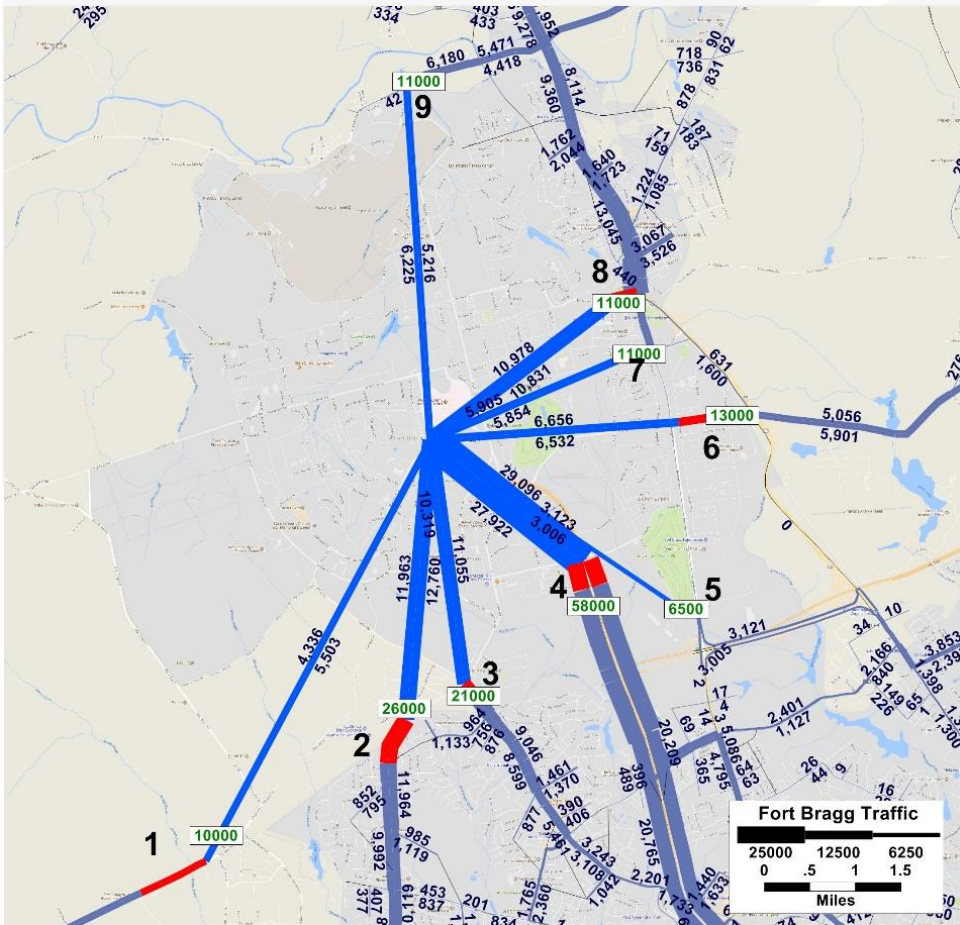
Location	2015 ADT	Model	Diff	% Diff
Chicken Rd	10,000	9,840	(160)	-2%
N Reilly Rd	26,000	24,723	(1,277)	-5%
Yadkin Rd	21,000	21,374	374	2%
All American Fwy	58,000	57,018	(982)	-2%
Knox St	6,500	6,129	(371)	-6%
Honeycutt Rd	13,000	13,188	188	1%
Randolph St	11,000	11,759	759	7%
Butner Rd	20,000	21,809	1,809	9%
W. Manchester Rd	11,000	11,442	442	4%
Total	176,500	177,282	782	0%

CAMBRIDGE SYSTEMATICS

Military Base Daily Passenger Vehicle Trips

CAMBRIDGE SYSTEMATICS

Approach to Future Year ODs

- Use Calibrated Streetlight OD data for Base Year

- Develop Origin and Destination Growth Factors for Fort Bragg Trips and External Travel
  - » Use MPO model trip rates to estimate trip ends for TAZs
  - » Estimate trip ends for Fort Bragg Military Base TAZ

- Estimate Future Year Trip Ends by Purpose
  - » Fratar Base Year ODs to match future trip-ends.

Origins	Destinations

CAMBRIDGE SYSTEMATICS

Streetlight Trucks

CAMBRIDGE SYSTEMATICS

Model Components Based on Streetlight Data

➤ Base Year External Vehicle Trips

   » Trucks and Passenger Vehicles

➤ Base Year Internal Truck Trips

➤ Base Year Military Base Trips

CAMBRIDGE SYSTEMATICS

Big Data in Model Developments in Virginia

CAMBRIDGE SYSTEMATICS

Lynchburg Regional Model Development

➤ Use of Big Data for External Travel and Commercial Trucks
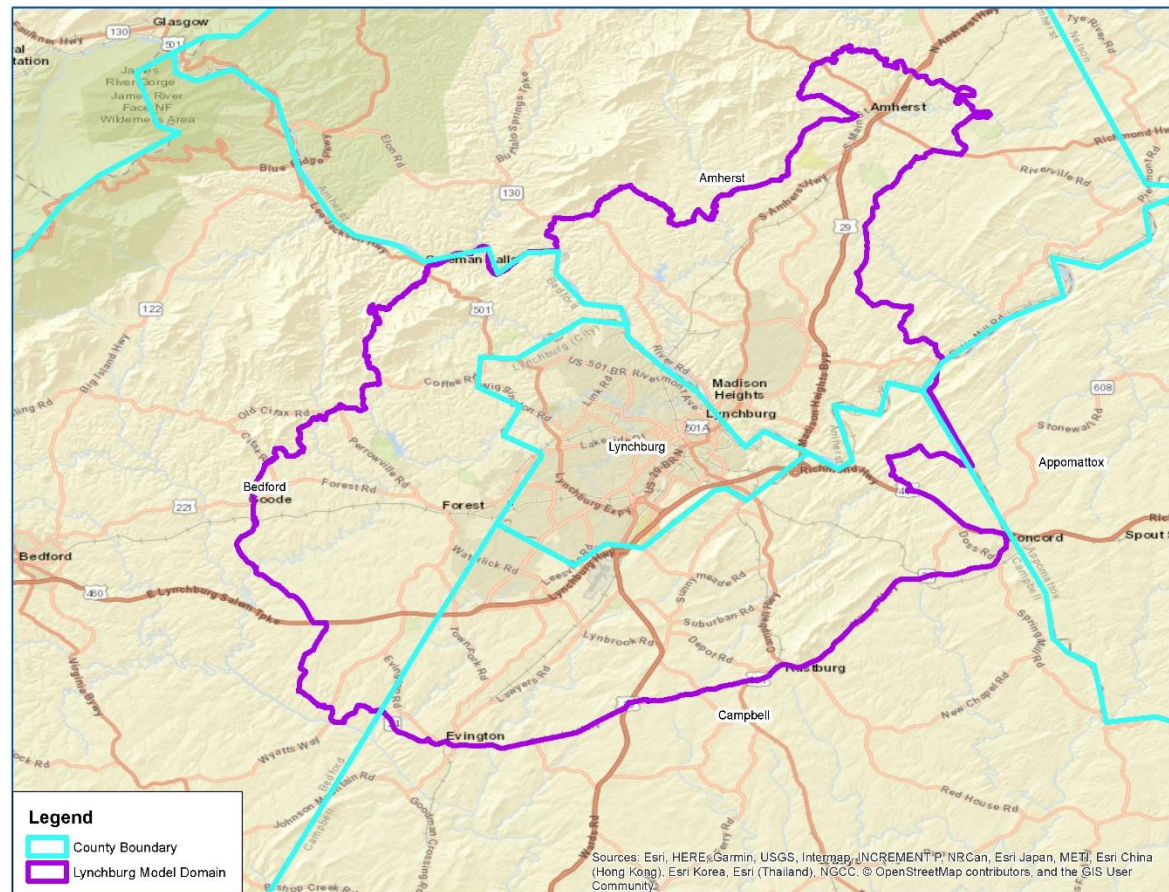
Lynchburg Regional Model Development

- External Travel
  - » StreetLight LBS

- Commercial Trucks
  - » StreetLight GPS

- Develop trip tables using Origin Destination Matrix Estimation (ODME)

CAMBRIDGE SYSTEMATICS

Location-Based Services and GPS-Based

Source: StreetLight, StreetLight InSight®

CAMBRIDGE SYSTEMATICS

Shares of Trips by Trip Purpose

CAMBRIDGE SYSTEMATICS
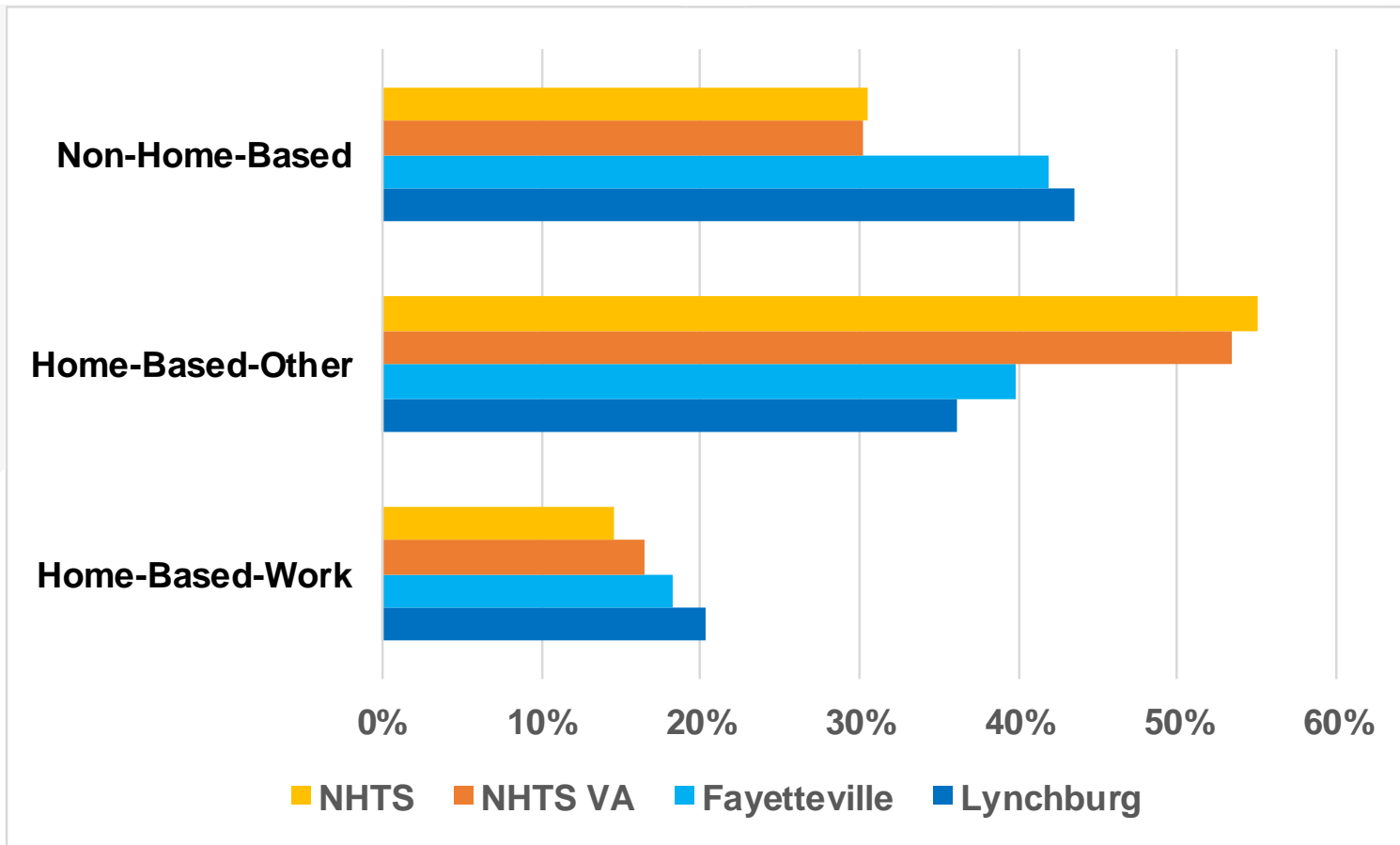
Time of Day Factors

AM Peak Period

(Existing Model, NHTS Add-On, StreetLight LBS by Home-Based-Work, Home-Based-Other, Non-Home-Based)

PM Peak Period

(Existing Model, NHTS Add-On, StreetLight LBS by Home-Based-Work, Home-Based-Other, Non-Home-Based)

CAMBRIDGE SYSTEMATICS
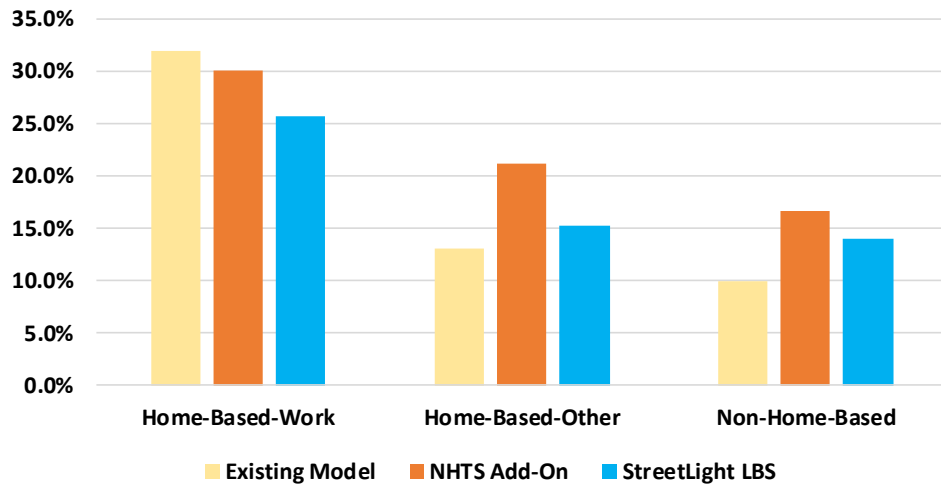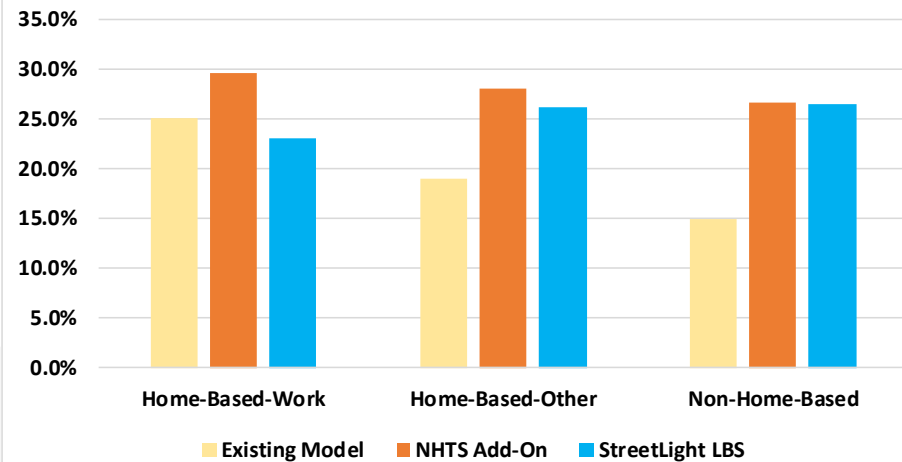
Virginia Statewide Transportation Model

➤ Big data in model development and validation:

» special generators

» external travel

» intra-state truck trips

Source: FHWA Overview of Capital Investment Grant Program

CAMBRIDGE SYSTEMATICS

Structure and Functionalities
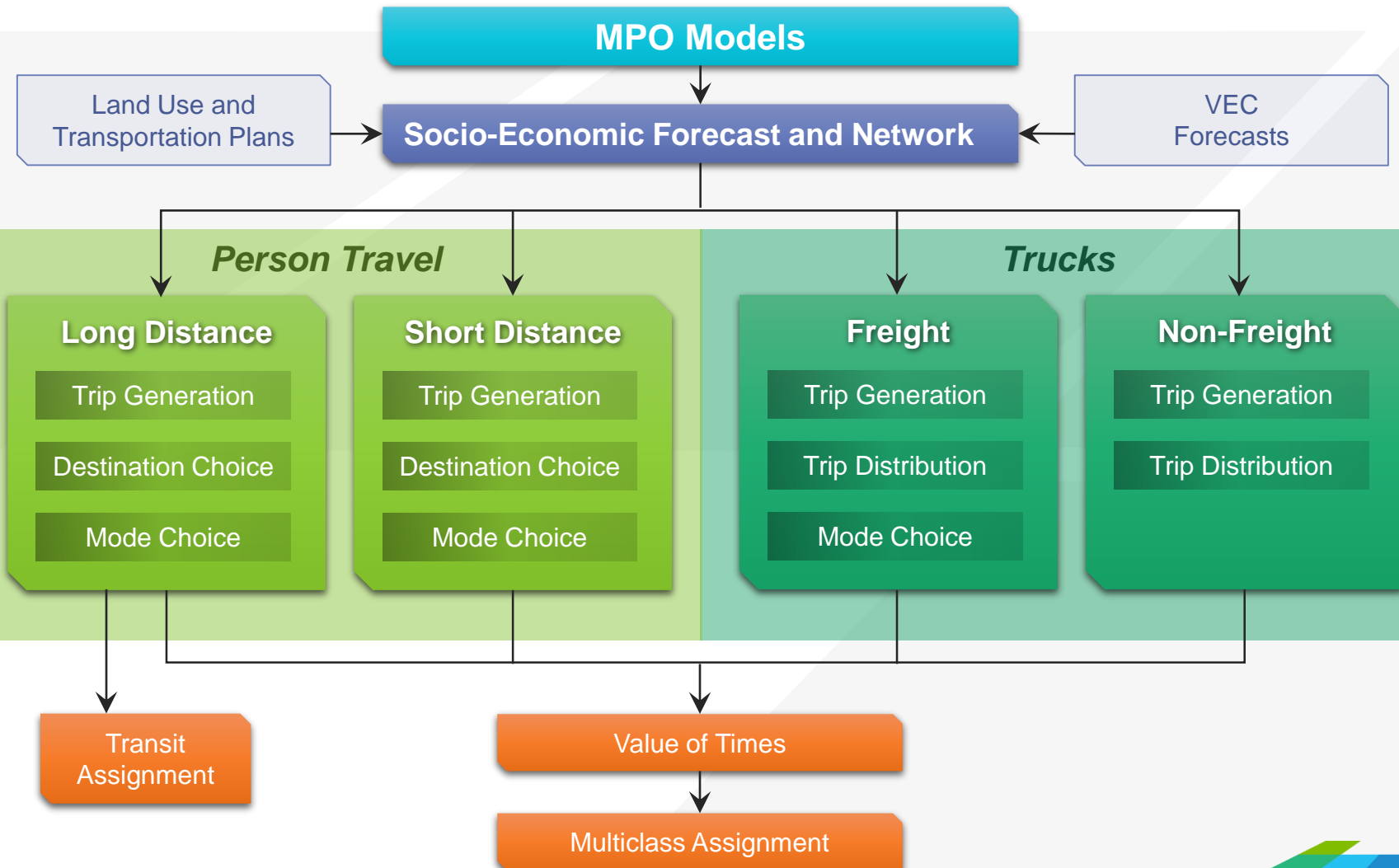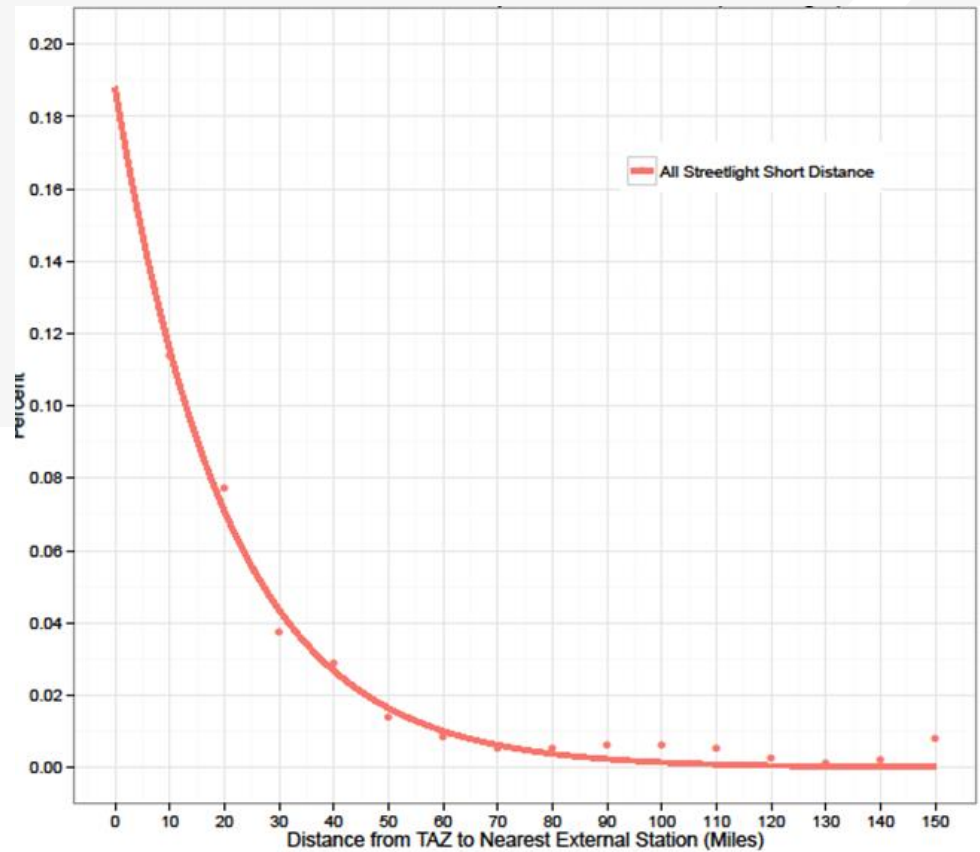
Model Domain (Passenger Travel)

Virginia Statewide Model
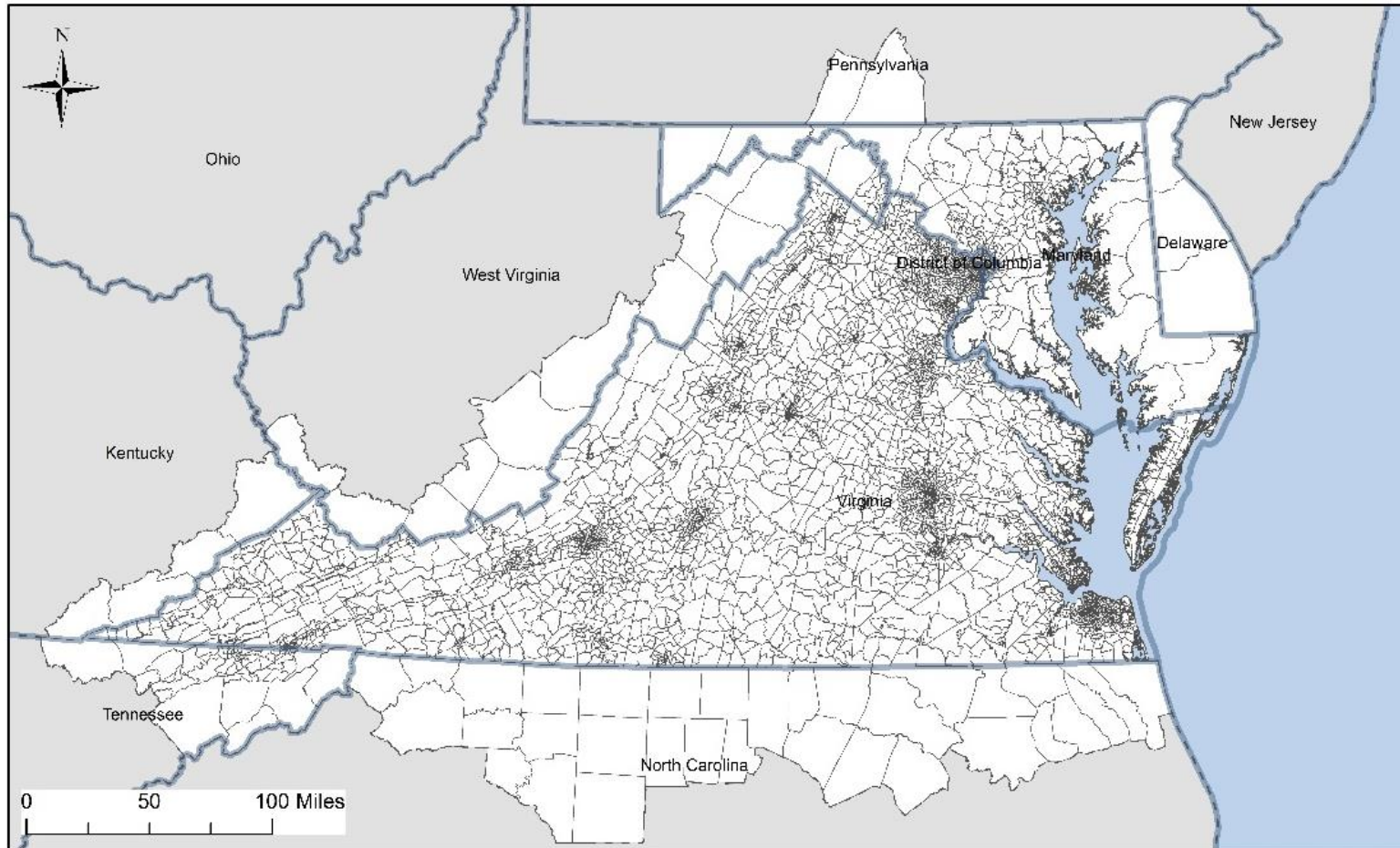
Features

☐ States

| Traffic Analysis Zones in VA and Adjacent Areas

External Travel

> Internal-External Share Model
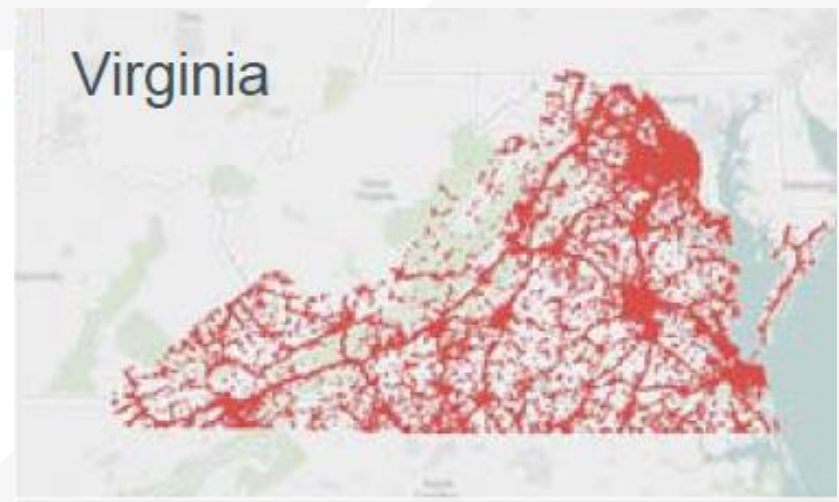
CAMBRIDGE SYSTEMATICS

Special Generators

- Airports
  - » ITE Airport Trip Generation Rates
  - » StreetLight OD tables

- Recreational Travel
  - » Visitation
  - » StreetLight OD tables

CAMBRIDGE SYSTEMATICS

Intra-State Truck Trips

➤ Non-Freight Truck Travel

  » ATRI Data

  » Developed truck trip tables using Origin
    Destination Matrix Estimation (ODME)

Virginia

CAMBRIDGE SYSTEMATICS

Recent Progress

NCHRP 08-95: Cell Phone Location Data for Travel Behavior Analysis

» Cambridge Systematics
» MIT

CAMBRIDGE SYSTEMATICS

CS Research

- Location-Based Services

  » LA Metro

  » Caltrans Next-Gen

- Shared Mobility

  » Rideshare

  » Bikeshare

- Visitor

  » Taxi data

  » Airbnb

CAMBRIDGE SYSTEMATICS

Acknowledgments

➤ Cambridge Systematics, Inc.
  » Kimon Proussaloglou, Ph.D.
  » Jay Evans, P.E.
➤ NCDOT
  » Tae-Gyu Kim, Ph.D.
  » Soon Chung, Ph.D.
➤ VDOT
  » Peng Xiao, P.E.
  » Yifang Yuan, P.E.

➤ StreetLight
  » Kim Harrison

CAMBRIDGE SYSTEMATICS

Contact Information

➤ Feng Liu
» fliu@camsys.com
» +1.301.347.9100

➤ John Lewis
» jlewis@camsys.com
» +1.919.741.7698

➤ CS Raleigh Office
» 1201 Edwards Mill Road, Suite 130
Raleigh, NC 27607

CAMBRIDGE SYSTEMATICS