US 29 South Corridor Advisory Committee Technical Meeting

Montgomery County
RAPID TRANSIT
US 29

Silver Spring Civic Building
Silver Spring, Maryland
September 10, 2015
6:00 pm to 9:00 pm

Welcome

Topics to be discussed (times approximate):

- Introduction and Background – 15 min
  - Q&A
- Regional Demand Model – 45 min
  - Three (3) Q&A Sections
- Traffic Operations – 45 min
  - Five (5) Q&A Sections
- Crash Data – 15 min
  - Q&A
- Additional Technical Q&A Session – 60 min

Note: Each topic will include multiple question and answer sections. Please hold questions and comments until the Questions slide is shown.

Introduction – Purpose of this Meeting

The goal of this special event is to:

- Review and explain detailed technical information associated with Travel Demand and Ridership Forecasting and Traffic Operations Analyses.
- Provide specific information about how we:
  - collect and use existing data;
  - describe the analysis tools and prediction models we use; and
  - explain how the output information is used to as part of the planning process.
- Respond to questions and concerns members may have about our processes through direct interaction with our engineers and forecasting specialists.

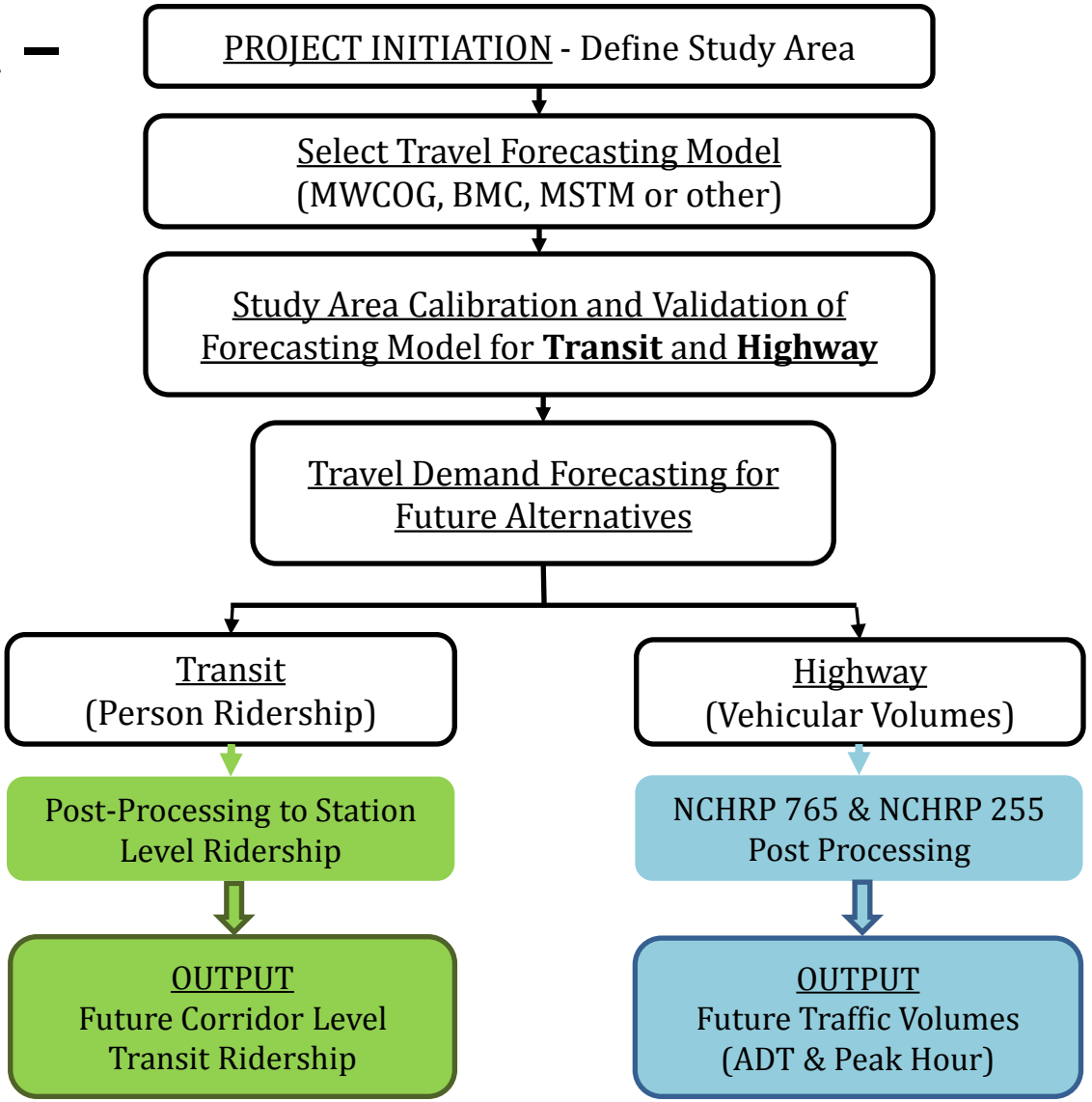
Background – Why we have a process

- Forecasting methodologies are continuously evolving and may differ slightly from project to project.
- Issues raised can be technical or process-related:
  - what work was done?
  - what assumptions were made or input used?
  - how the methods and approaches were chosen?
- This process is mainly driven by established best-practices and professional experience.
- Lead Federal Agencies provide guidance to encourage improvement in the state-of-the-practice in relation to how project-level forecasting is applied using approved models developed by local Metropolitan Planning Organizations.

Background – Why we need forecasts

- Travel and land use forecasting is critical to project development and overall National Environmental Policy Act (NEPA) processes.
- Forecasts provide important information to project managers and decision-makers, and provide foundations for determining purpose and need.
- They are essential in evaluating:
  - Alternative performance
  - Environmental impacts such as noise and safety (based on traffic volume or exposure) and emissions (based on traffic volume and speed)
  - Land development effects (change in land development patterns due to changes in accessibility)
  - Indirect and/or cumulative effects (such as watershed effects).

Background – Forecasting Process



Questions?

- ✓ **Introduction and Background**
  - ✓ **Q&A**
- Regional Demand Model
  - Three (3) Q&A Sections
- Traffic Operations
  - Six (6) Q&A Sections
- Crash Data
  - Q&A
- Additional Technical Q&A Session

Note: Each topic will include multiple question and answer sections.
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Regional Demand Model Agenda

Topics to be discussed:

- Travel Demand Forecasting Review and Four-Step Model
- Overview of the Metropolitan Washington Council of Governments (MWCOG) Regional Travel Demand Model
- Model Assumptions, Inputs & Ouputs

Travel Demand Forecasting: Overview

What is Travel Demand Forecasting?

The process of forecasting the amount of travel demand in the future in an area.

Computerized mathematical models are often used to predict:

- Travel Patterns
- Traffic Volumes
- Transit Ridership

Based on

- Transportation networks (highway or transit)
- Land use and socioeconomic variables (population/households, employment, etc.)

The prediction process can be done for a Region, Statewide, or Local level; each providing its own level of detail.

The US 29 corridor study uses a local corridor level travel demand forecast.

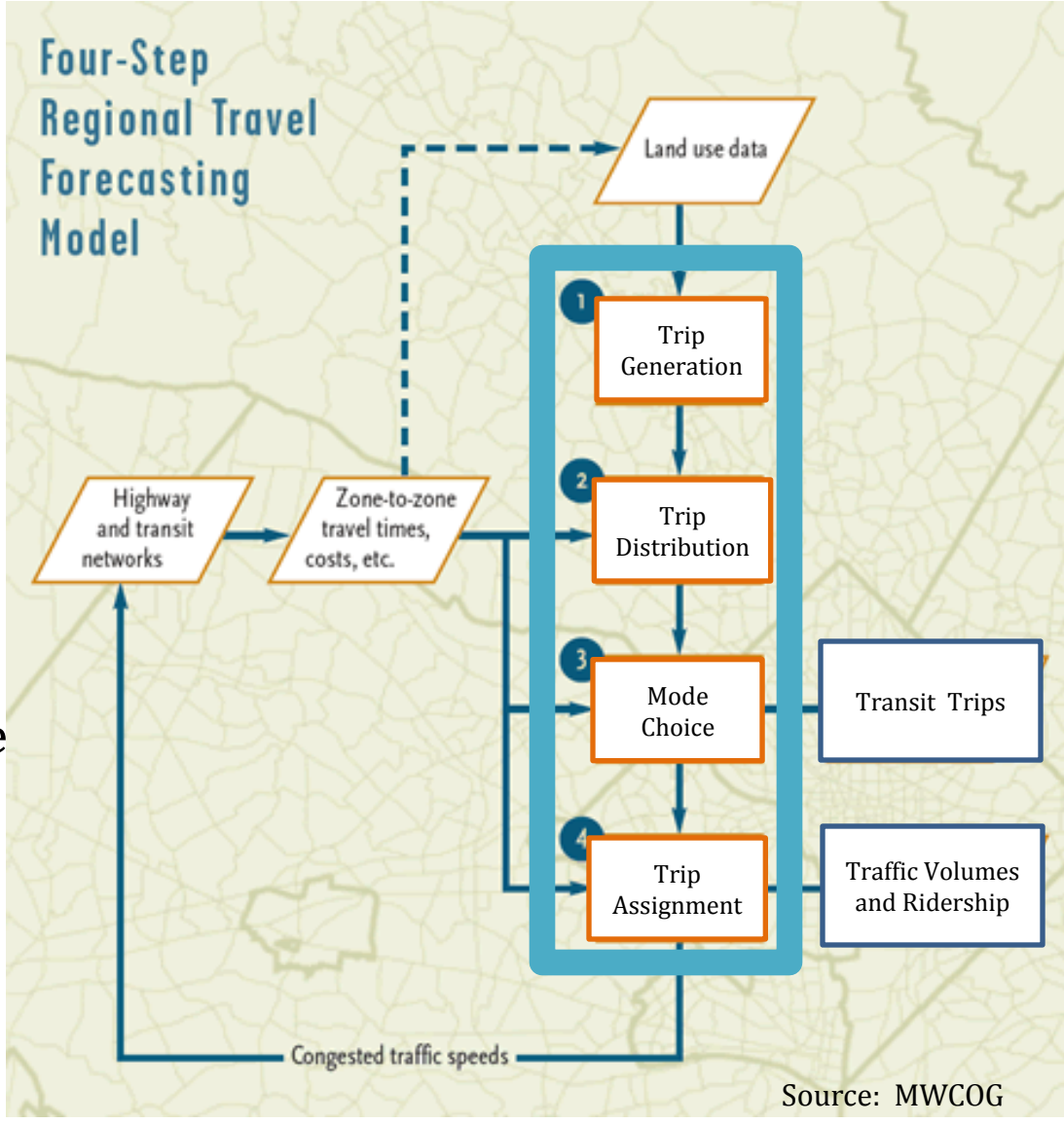
Travel Demand Forecasting: Applications

What do we use Travel Demand Forecasting for?

- Ridership Forecasting and New Starts/Small Starts Applications
- Project Planning and Corridor Studies
- Long Range Transportation Planning
- Air Quality Conformity Determination
- Transportation Improvement Program (TIP)
- Scenario Analysis
- Subarea Studies

Travel Demand Model: Four Step Model

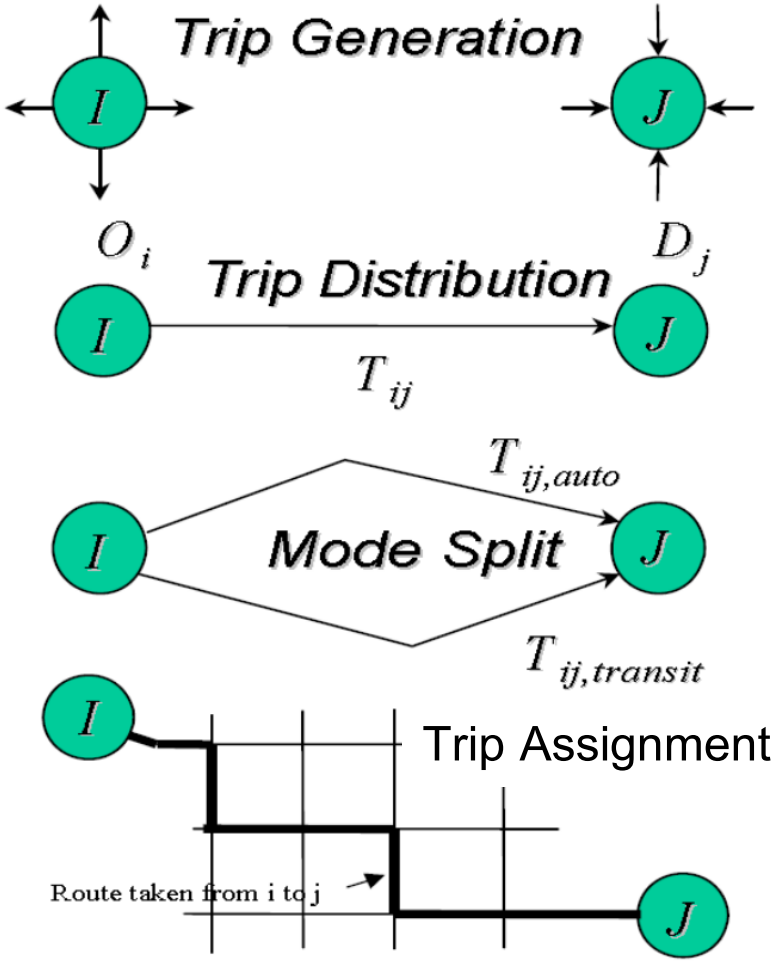
- **Trip generation -** How many trips are generated?
- **Trip distribution -** Where do the trips want go?
- **Mode choice -** What travel mode is used for each trip?
- **Trip Assignment -** What is the route of each trip?



Source: MWCOG

Travel Demand Model: Four Step Model

- Trip generation
  - Predict the number of trips
- Trip distribution
  - Predict where trips want to go
- Mode choice
  - Predict which method of travel the trips will take (ex. bus or walk.
- Trip assignment
  - Assign the exact path the trips will take on the given network to reach their destination. Equilibration of supply and demand.



Graphic from Meyer & Miller (2001), p. 272

Questions?

- ✓ **Travel Demand Forecasting Review and Four-Step Model**
- Overview of the Metropolitan Washington Council of Governments (MWCOG) Regional Travel Demand Model
- Model Assumptions, Inputs & Outputs

Metropolitan Washington Council of Governments Regional Demand Model

- Metropolitan Washington Council of Governments (MWCOG) regional demand model was used in the forecasting process (http://www.mwcog.org/)
- The latest officially adopted regional model Version 2.3.57
- The latest officially approved planning assumptions:
  - Round 8.3 Cooperative Forecasting (officially approved October 2014)
  - 2040 Constrained Long Range Plan and FY 2015 -20 Transportation Improvement Program (officially adopted October 2014)

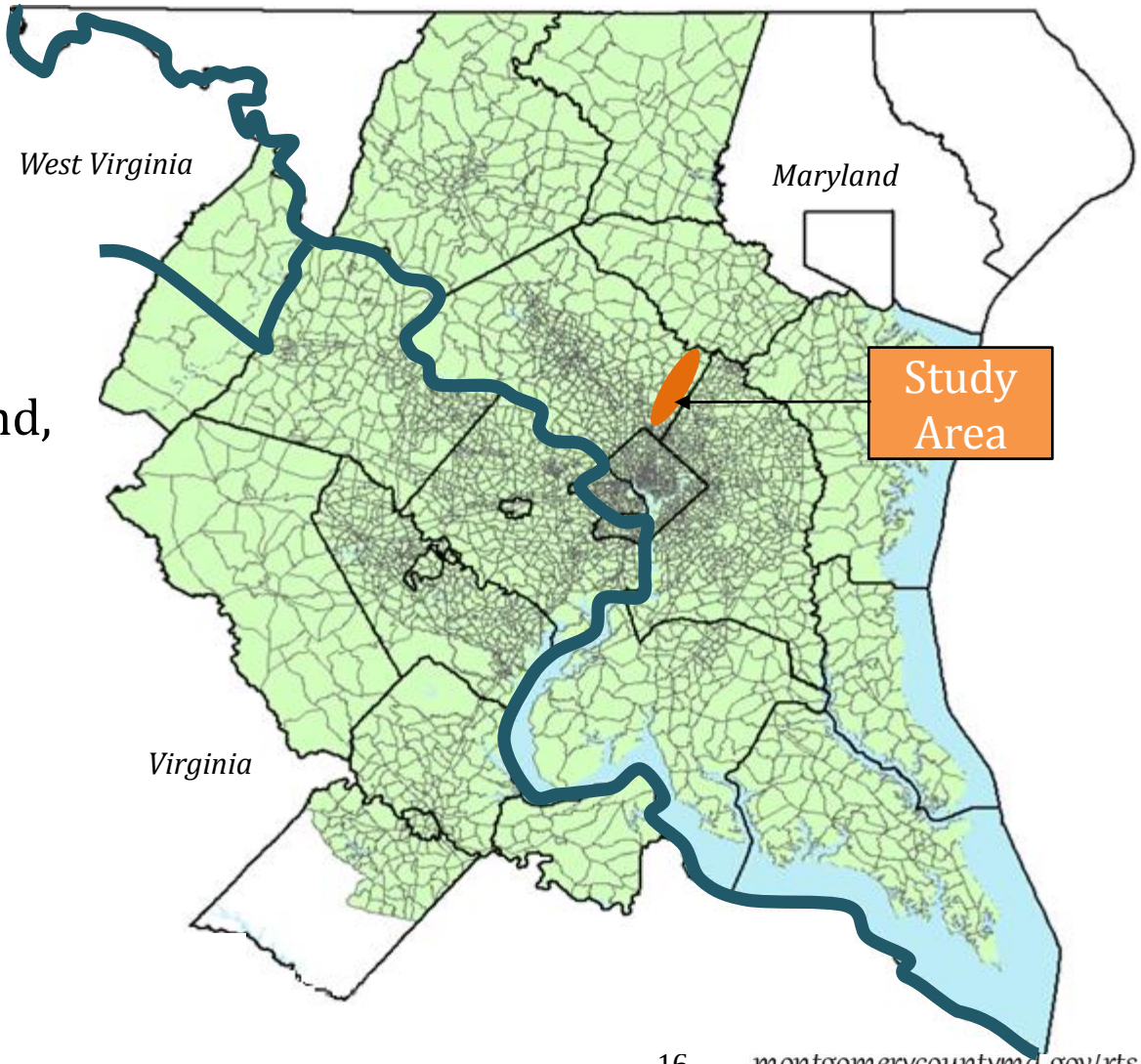
Travel Demand Forecasting: Data Sources

- National Census Data (www.census.org)
- Household Travel Survey
- Transit On-Board Surveys
- Commercial Vehicle Survey
- Traffic and Ridership Data

Source: MWCOG

Travel Demand Forecasting: MWCOG Boundaries

- 6,800 sq. mi.
- 22 jurisdictions
- Includes DC, Maryland, Virginia, and West Virginia

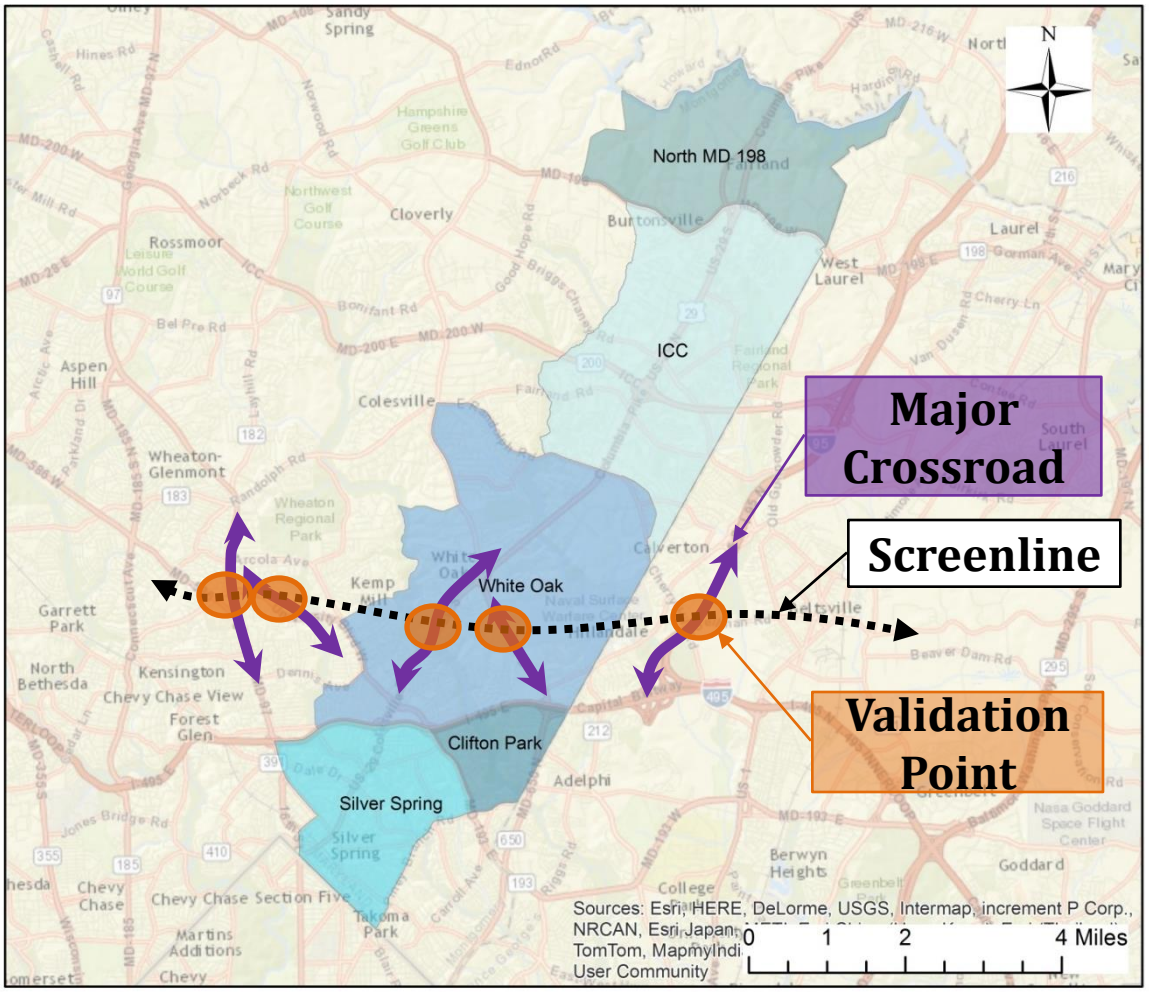


Source: MWCOG

MWCOG Model: Calibration and Validation

- Region level
- Jurisdiction level
- Jurisdiction-to-jurisdiction level
- For highway assignments: Regional screenlines
- For transit assignments: Metrorail station groups
- At the corridor level
  - Traffic volumes
  - Ridership (boarding and alighting)
- Compare the model estimated volumes with the observed volumes
- Compare the model estimated boarding with observed boarding

MWCOG Model: Screenline Example



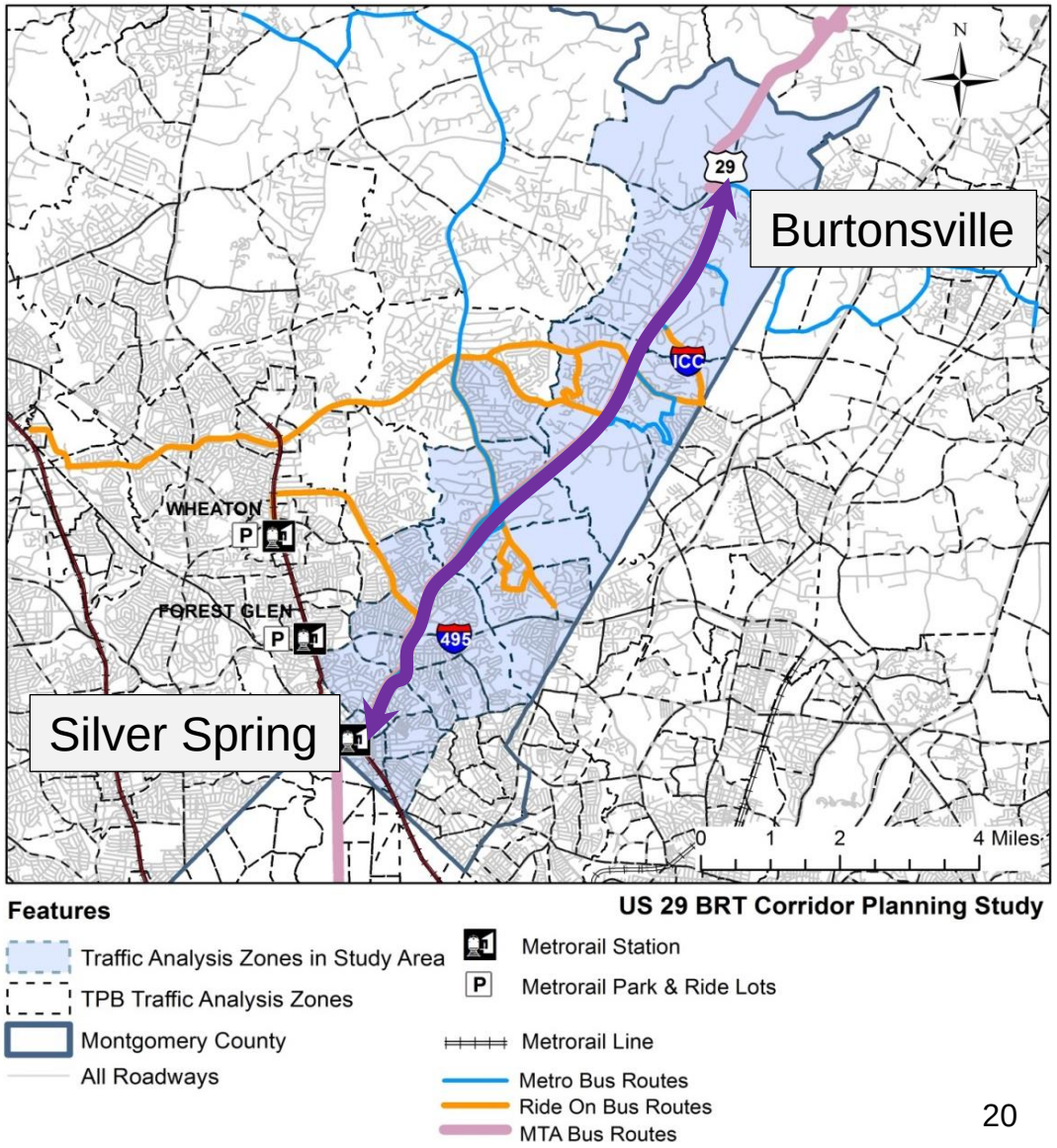
Questions?

- ✓ Travel Demand Forecasting Review and Four-Step Model
- ✓ **Overview of the Metropolitan Washington Council of Governments (MWCOG) Regional Travel Demand Model**
- Model Assumptions, Inputs & Outputs

MWCOG Model Inputs: Study Area

The study area, highlighted in blue, represents the area within which data will be pulled for analysis; it does not cut or remove roadways or zones outside of the study area.

The study area is selected to buffer the corridor without expanding out so far that the results will be too insignificant to notice.



MWCOG Model Inputs: Transportation Analysis Zones

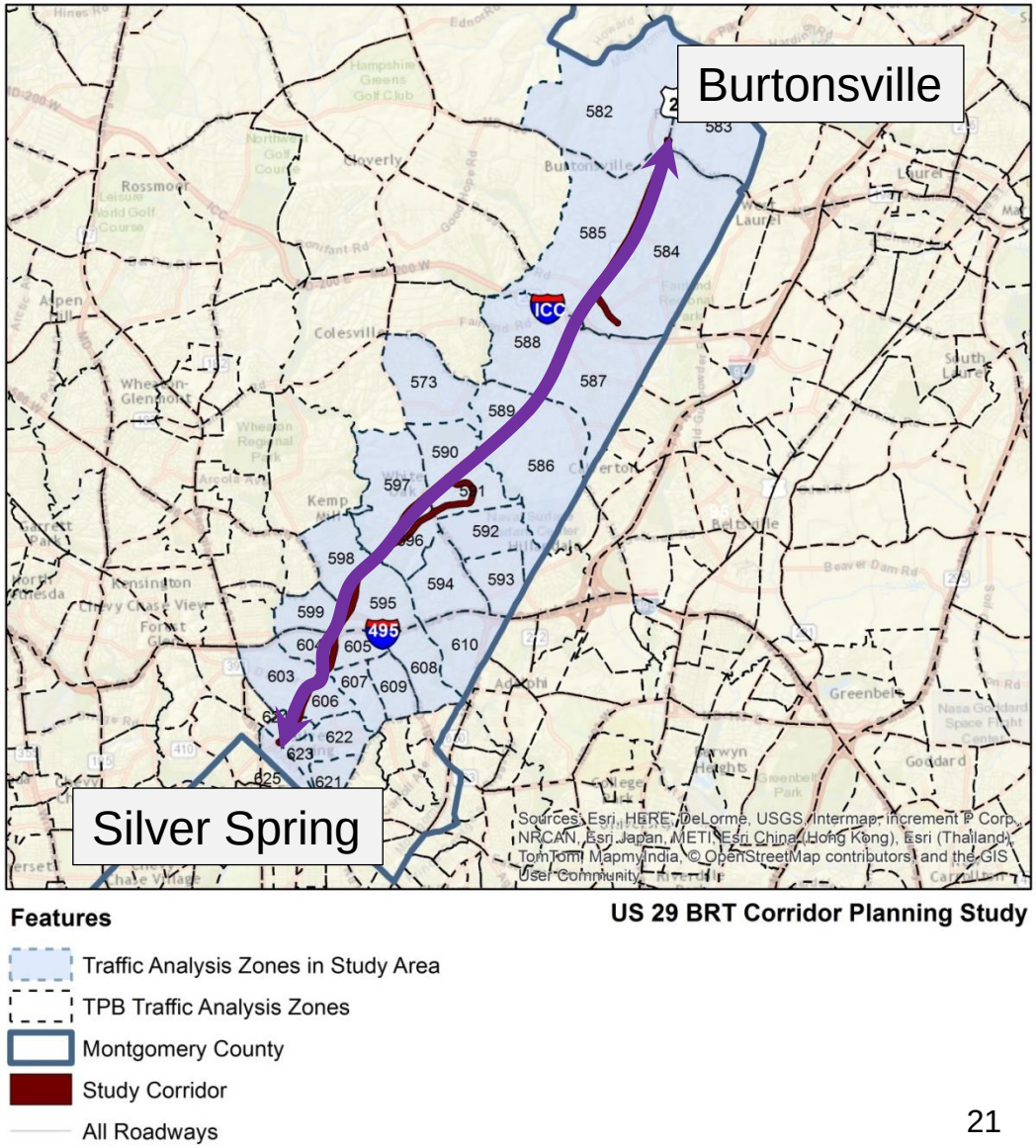
Transportation Analysis Zones, or TAZs, are the commonly used unit of geography in travel demand models to represent socioeconomic and land use data.

By providing smaller sections to work with, the TAZs give detailed insight on where the growth will occur. This results in more accurate trip patterns throughout the study area.

Map of all TAZs used in the MWCOG model may be found here:

http://www.mwcog.org/uploads/pub-documents/vl5fWFY20101230091537.pdf

Source: Cambridge Systematics



Model Inputs– Land Use and Socioeconomics

- Round 8.3 Cooperative Forecasting
- Cooperative Forecasting is a regional "top-down" and local "bottom-up" approach
- Local projections based on Montgomery County Master Plan and Pipeline developments
- Montgomery County forecasting for White Oak was added as a modification
- *Why was round 8.4 not used?* Round 8.4 was initiated December 2014, after the US 29 project was well under way. Additionally, Round 8.4 land use changes affect counties outside of Montgomery, with minor employment and population increases (less than 1%) and is not officially approved by the MWCOG board.

Model Inputs

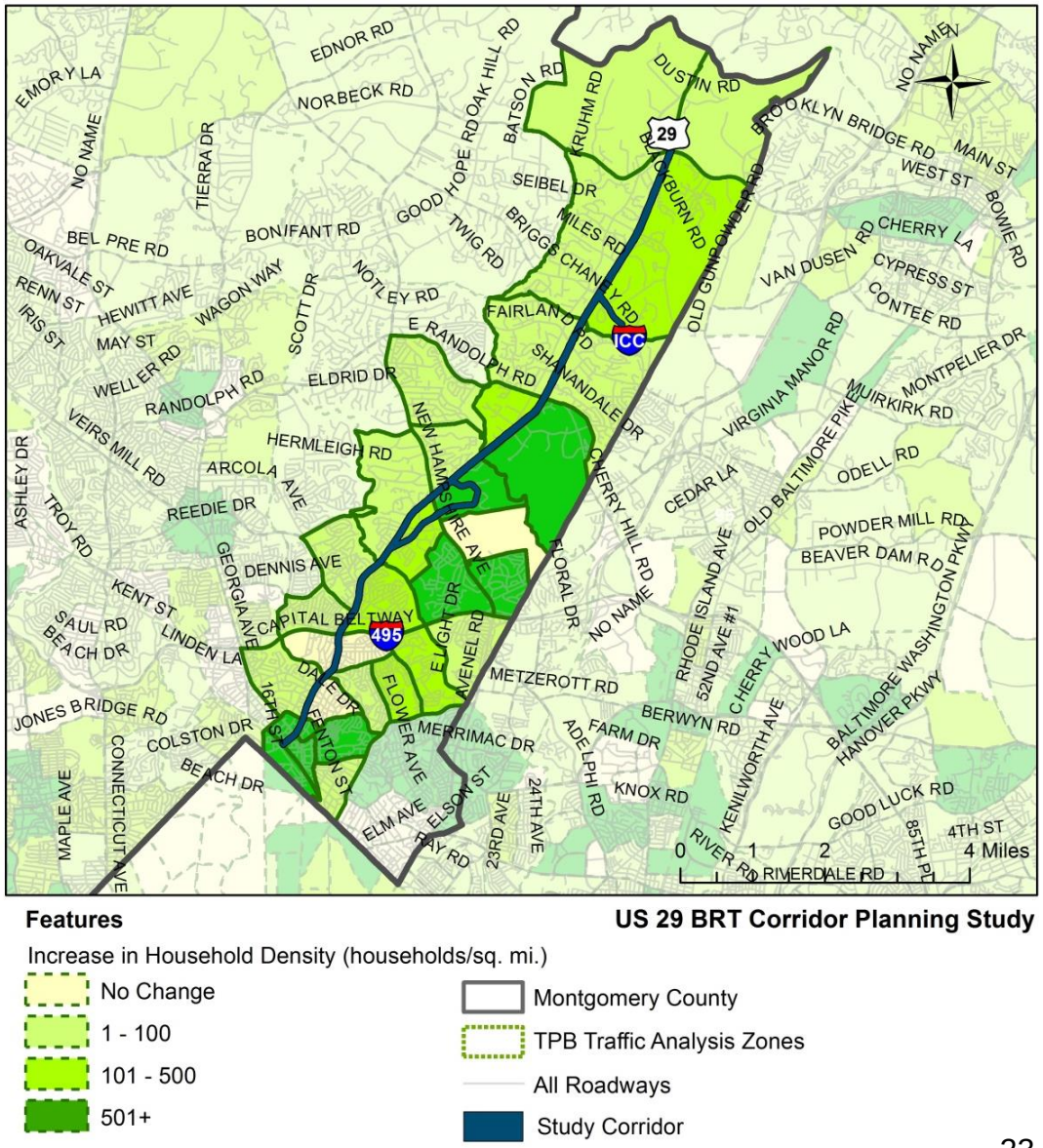
Household Growth 2014-2040

- 52,100 Households in 2014
- 61,000 Households in 2040
  (17% increase)

Where do these numbers come from?

MWCOG Round 8.3, with update from Montgomery County, which provides the future forecasts of both households and employment through the Parks & Planning office.

(http://www.montgomeryplanning.org/)



Source: Cambridge Systematics, based on MWCOG Round 8.3 and Montgomery County

Model Inputs

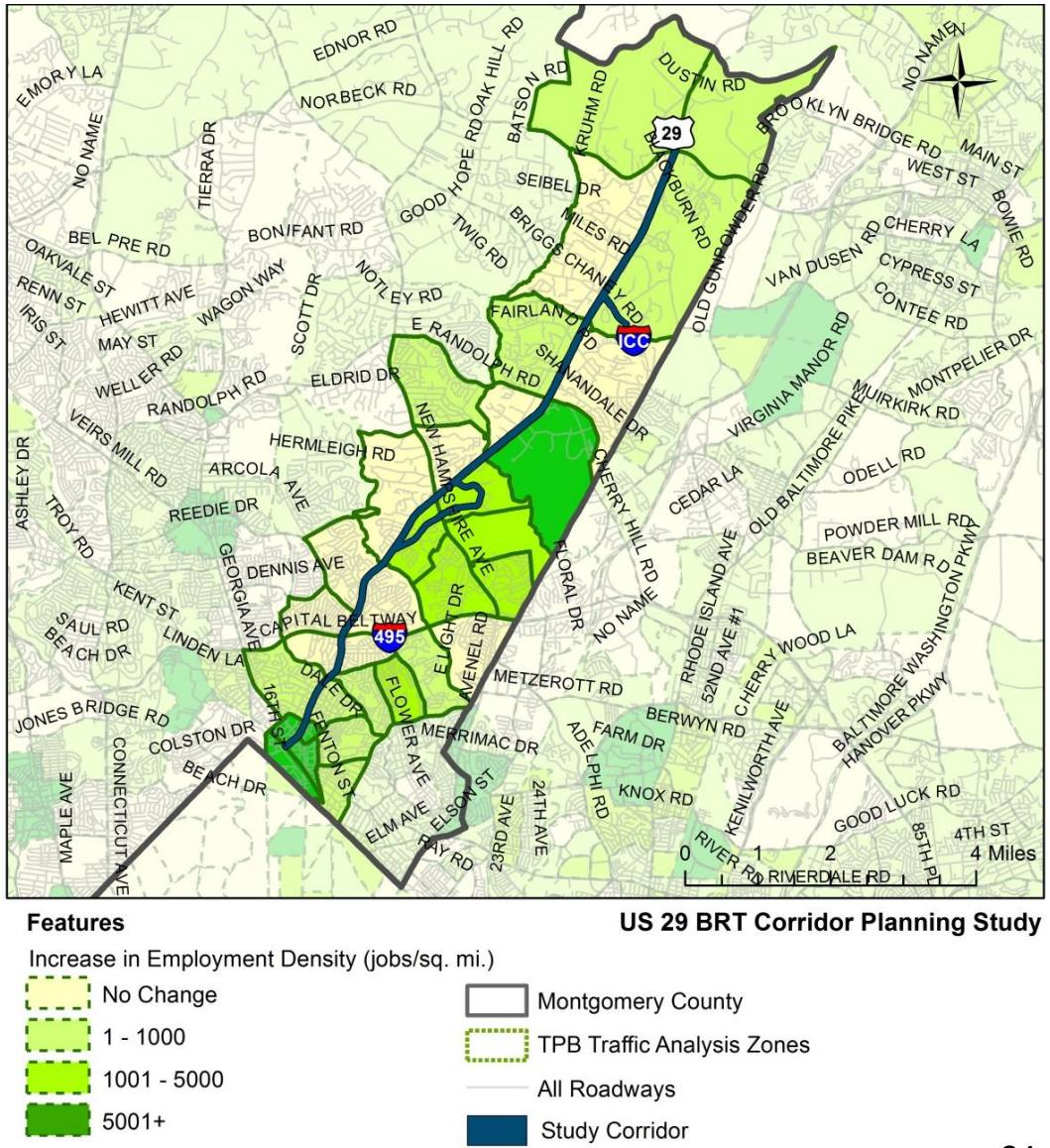
Employment Growth 2014-2040

- 2014 Employment 67,400
- 2040 Employment 120,000
  (78% increase)

Where do these numbers come from?

MWCOG Round 8.3, with update from Montgomery County, which provides the future forecasts of both households and employment through the Parks & Planning office.

(http://www.montgomeryplanning.org/)

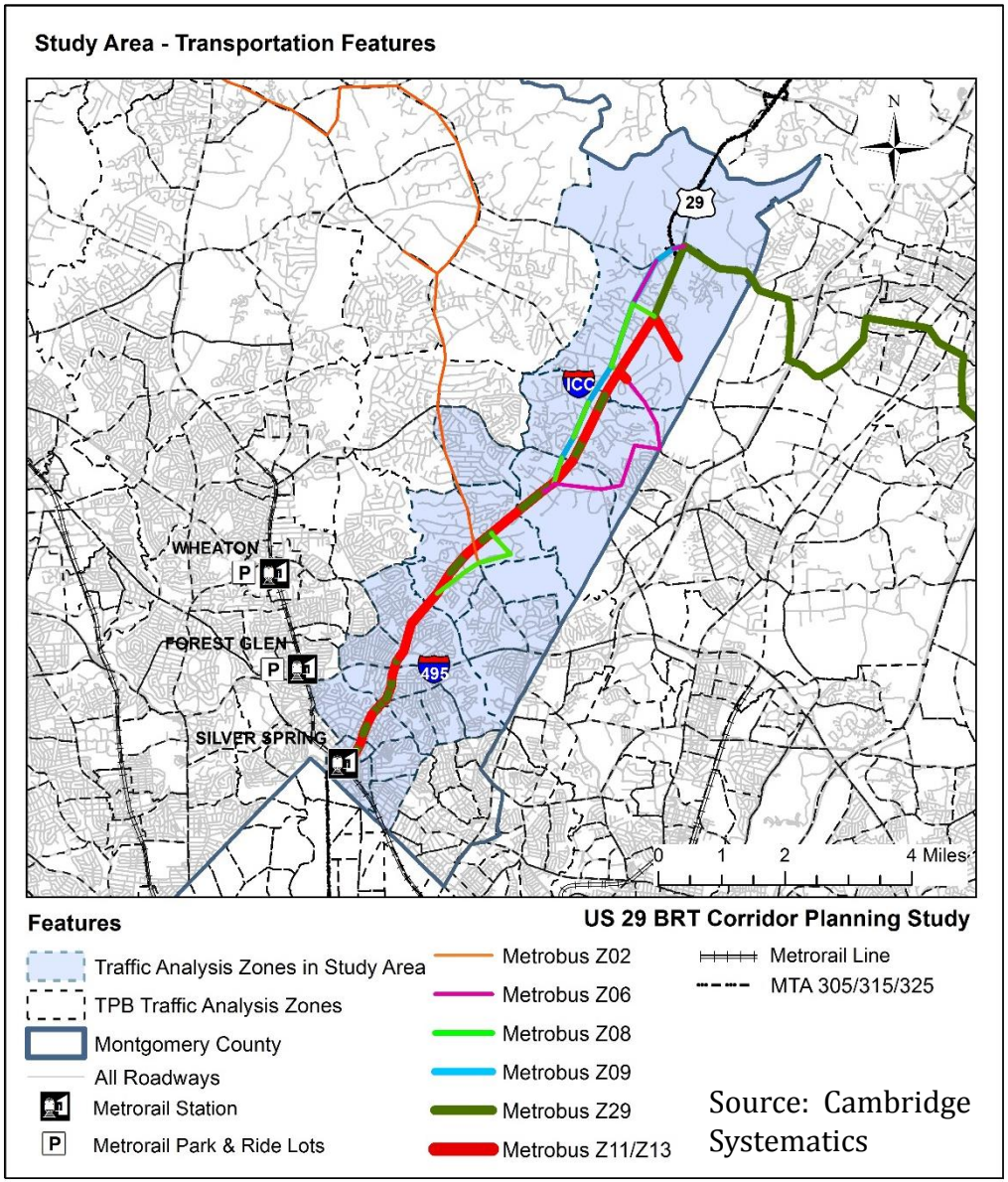


Source: Cambridge Systematics, based on MWCOG Round 8.3 and Montgomery County

Model Inputs

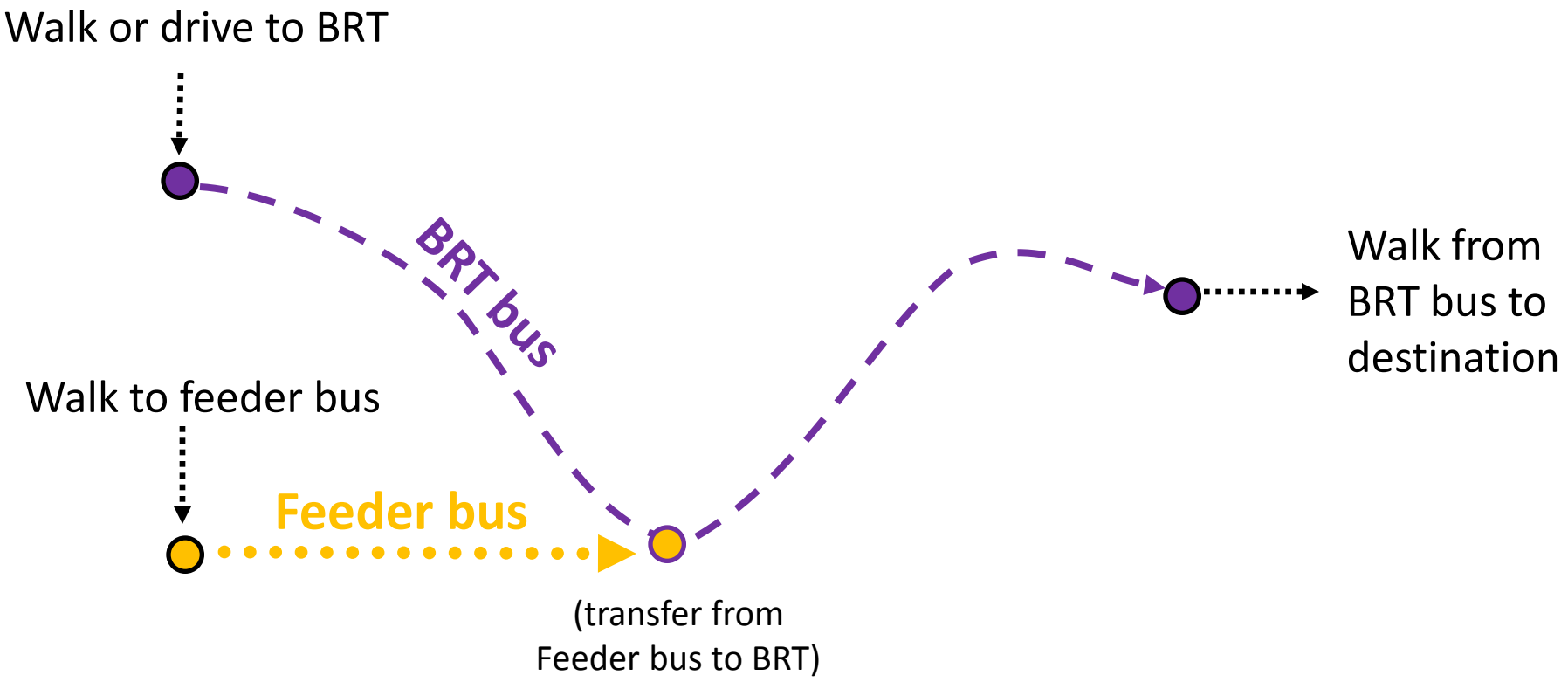
- Representation of Transit Systems
  - Ten modes, including BRT/streetcar
  - Frequency/headway, run time
  - Span of service

Source: WMATA



Source: Cambridge Systematics

Model Inputs: Representation of Transit Systems



Model Inputs: No Build Assumptions

- Existing roadways and transit systems
- 2040 Financially Constrained Long-Range Transportation Plan (CLRP) adopted on October 15, 2014
  - More than 300 projects
  - Silver Line, Corridor Cities Bus Rapid Transit, and Purple Line
  - US 29 (Columbia Pike) Interchange at Musgrove/Fairland Rd & Z-line

Source: MWCOG

Source: MWCOG

Model Outputs: Travel Demand

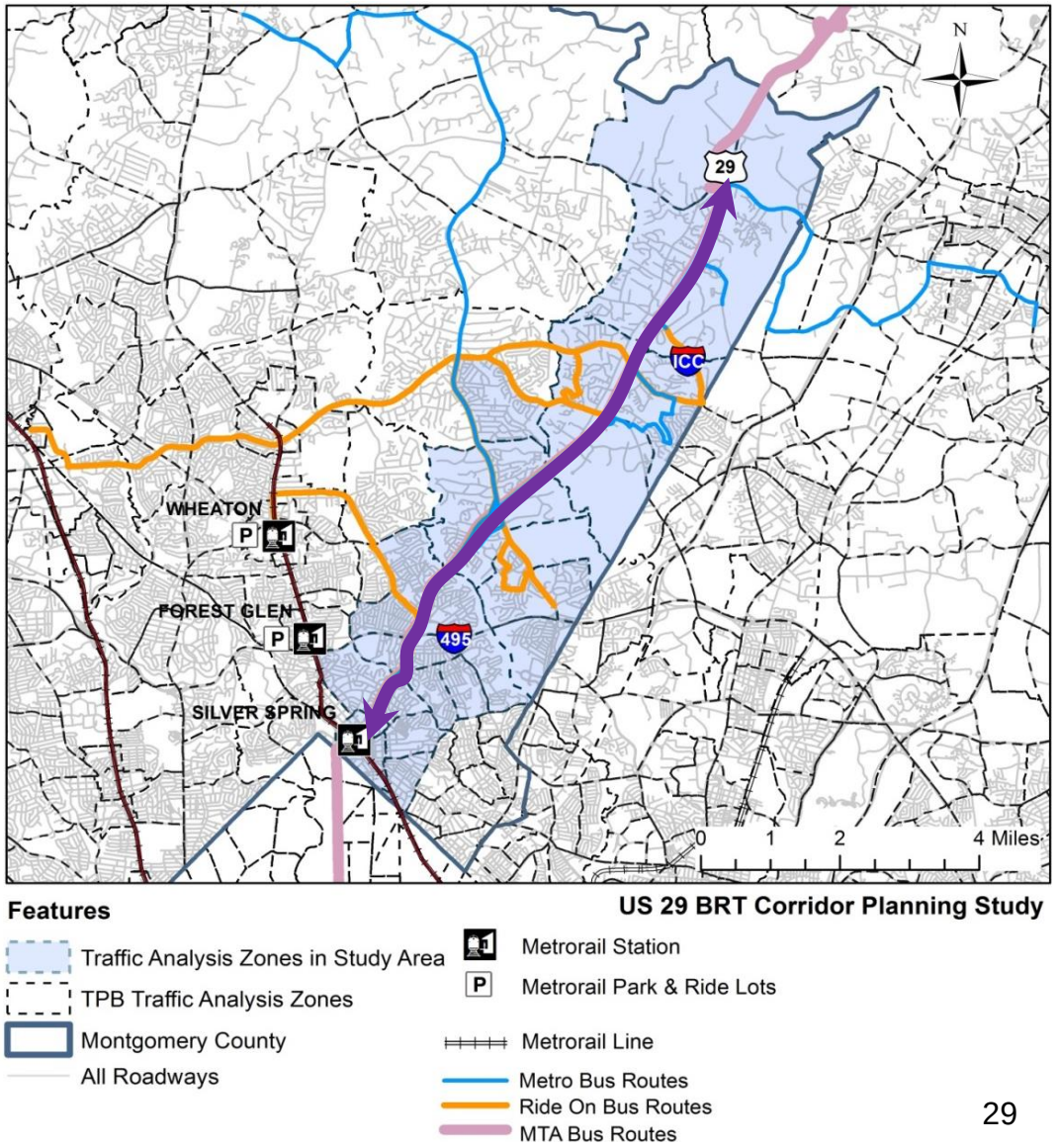
- Trip productions and attractions
- Trips by origin and destination pairs
- Trips by modes
- Vehicle and transit trips on the networks
  - By time periods
  - Post-processed based on industry standard procedure

Travel Markets: Trip Patterns (2040)

In 2040, approximately 733,000 trips are expected to interact with the Study Area:

- 176,000 (24%) of those trips originate and remain within the Study Area
- 251,000 (34%) of those trips originate from the Study Area and travel outside of the Study Area
- 306,000 (42%) of those trips originate outside of the Study Area and travel to the Study Area

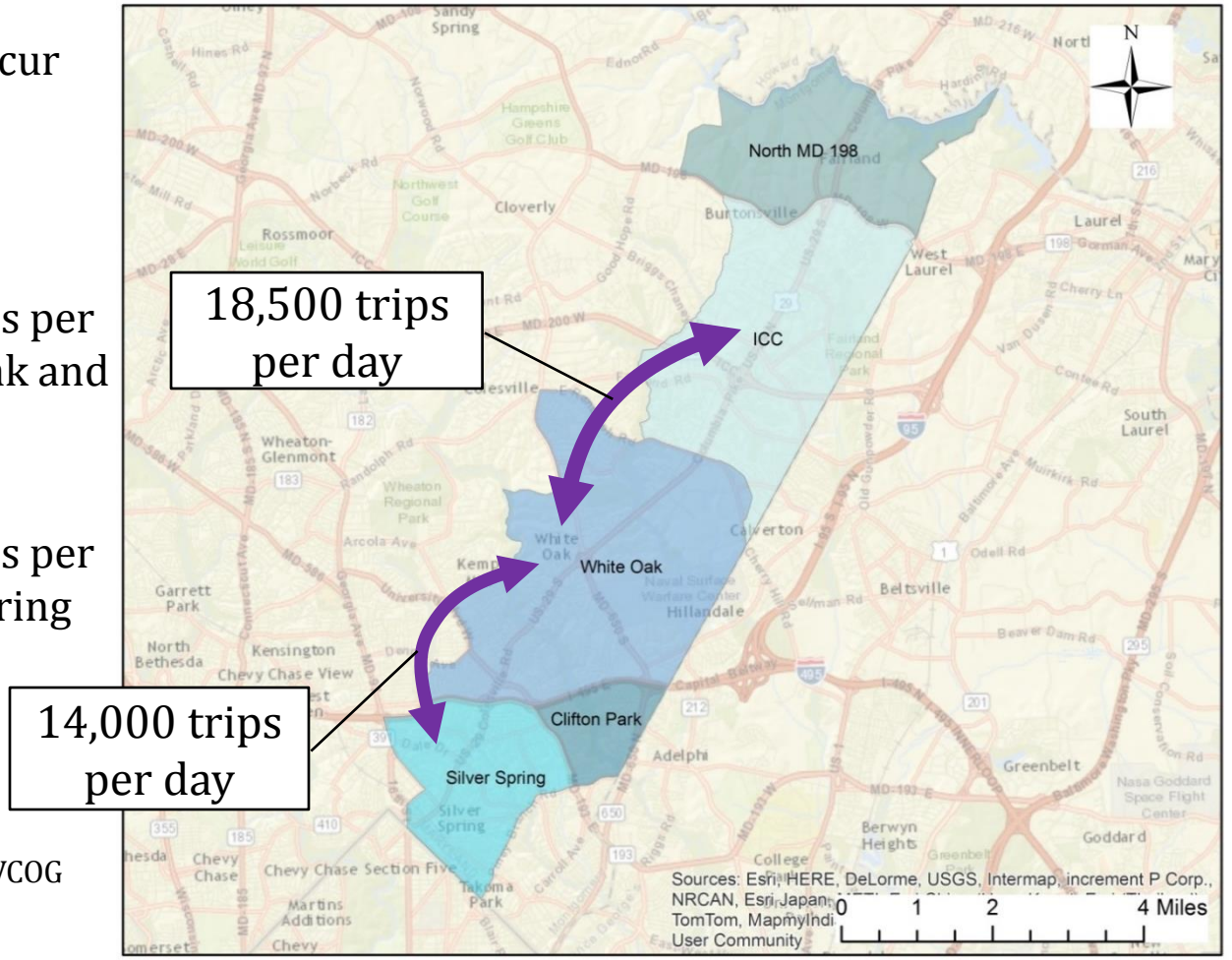
Source: 2040 forecasts developed using MWCOG regional travel demand model



Model Outputs: Internal Trips (2040)

The highest number of trips occur within zones; however, some noteworthy internal trips are:

- Approximately **18,500** trips per day flow between White Oak and ICC area
- Approximately **14,000** trips per day flow between Silver Spring and White Oak

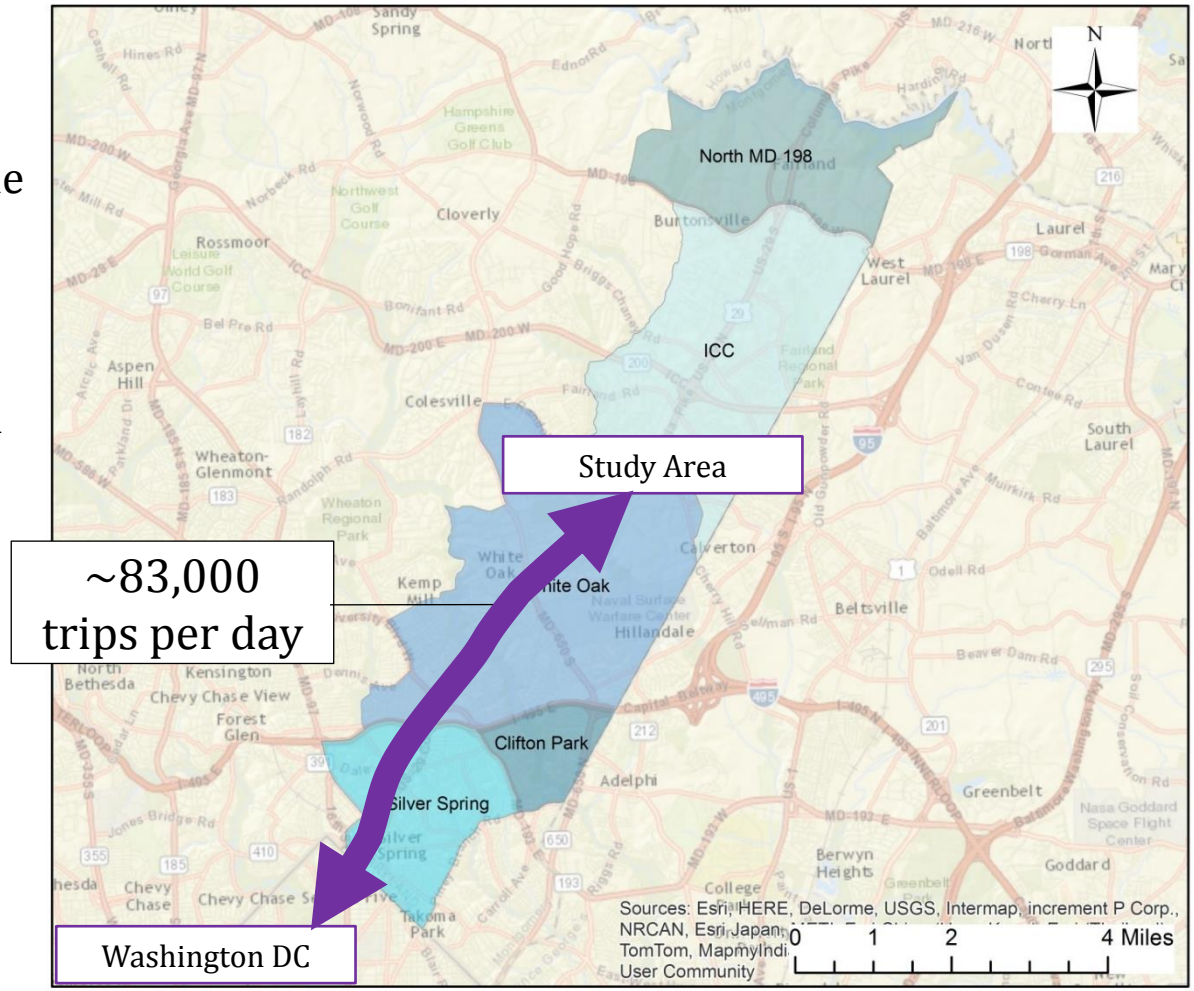


Source: 2040 forecasts developed using MWCOG regional travel demand model

Travel Markets: External Trips (2040)

Noteworthy are trips that flow to/from Washington D.C. from the Study Area.

Approximately **83,000** trips per day flow between the Study Area and Washington DC.

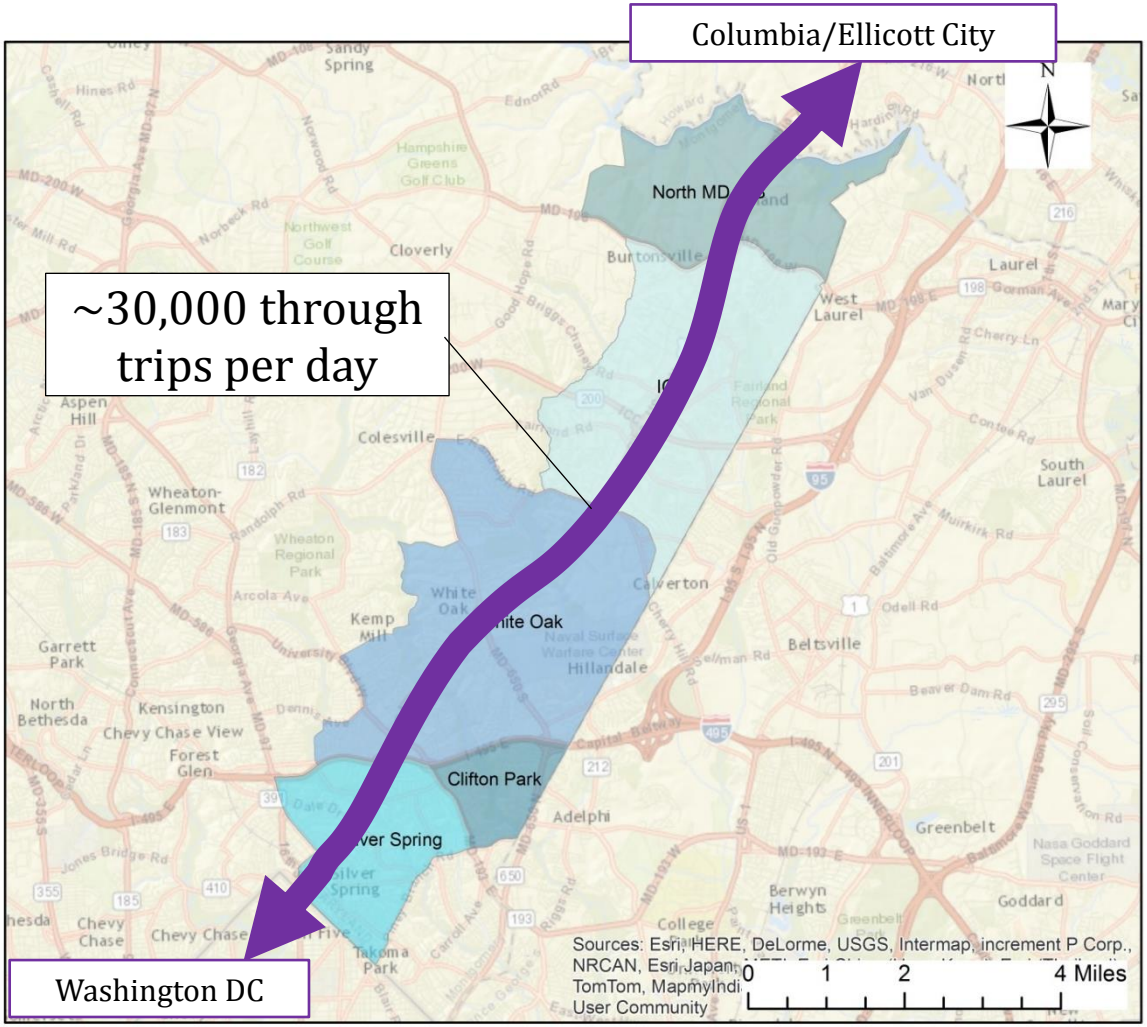


Source: 2040 forecasts developed using MWCOG regional travel demand model

Travel Markets: External Trips (2040)

Noteworthy are trips that flow to/from Washington D.C. from north of the Study Area.

Approximately **30,000** trips per day flow between Columbia/Ellicott City and Washington DC through the Study Area.



Source: 2040 forecasts developed using MWCOG regional travel demand model

Model Outputs: Transit

- Total daily ridership
  - Boarding and alighting by stop
  - Mode of access at stations
  - Park-and-Ride usage
- Passenger loads
- New transit trips/change in transit mode share

Travel Demand and Ridership Forecasting

Key Take Away:

- Latest Planning Assumptions
- Latest Regional Travel Demand Model
- Corridor-focused Approach
- Calibrated & Validated Network for both vehicle and transit

Questions?

- ✓ Introduction and Background
- ✓ Regional Demand Model
  - ✓ Travel Demand Forecasting Review and Four-Step Model
  - ✓ Overview of the Metropolitan Washington Council of Governments (MWCOG) Regional Travel Demand Model
  - ✓ **Model Assumptions, Inputs & Outputs**
- Traffic Operations
  - Six (6) Q&A Sections
- Crash Data
  - Q&A
- Additional Technical Q&A Session

Traffic Operations Agenda

Topics to be discussed:

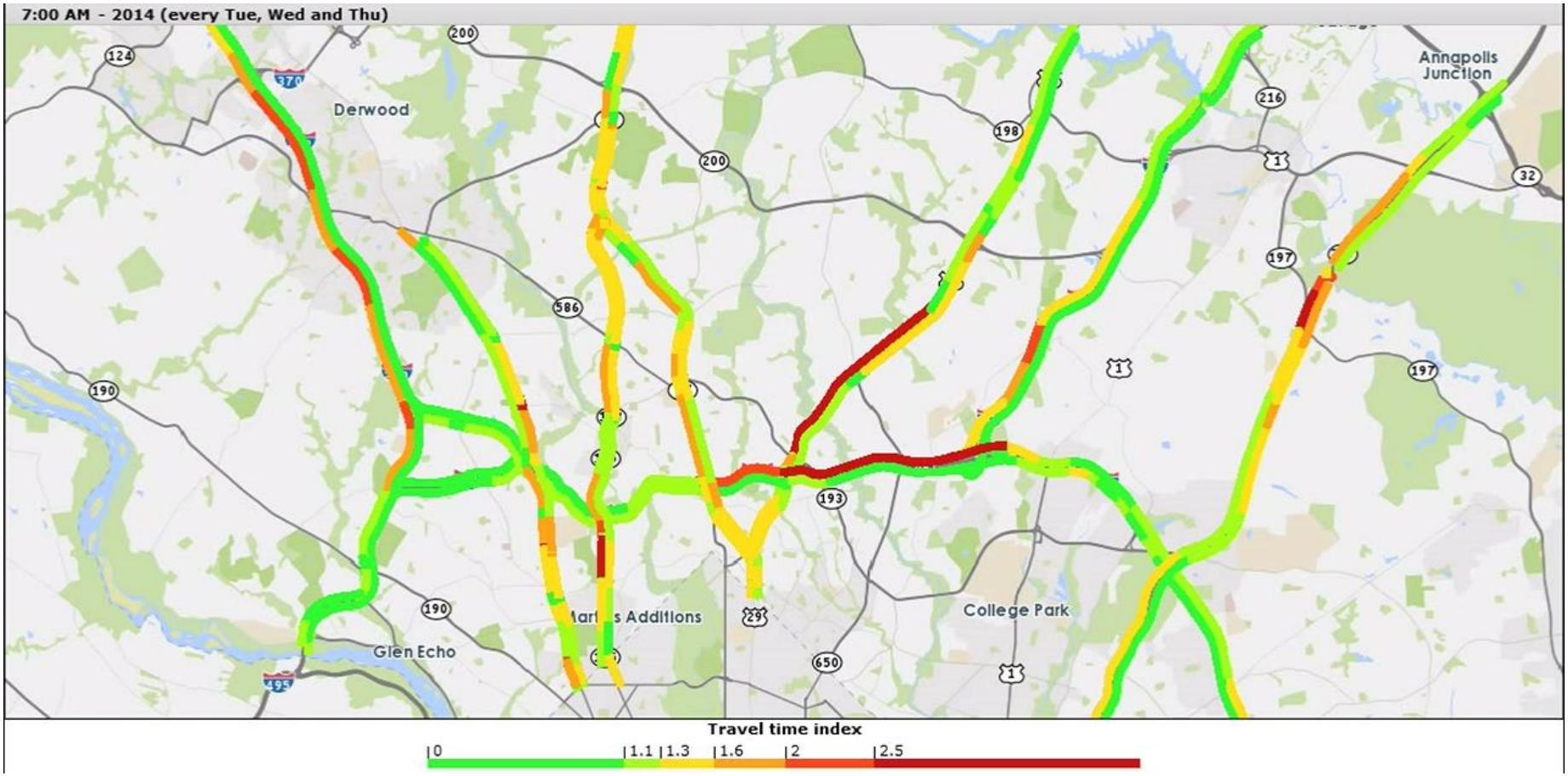
- Data Sources
- Software Used
- Traffic Operations Methodology
  - Existing Volumes and Network Inputs
  - Calibration and Evaluation Measures
  - Future No Build Assumptions and Results

Question and Answers after every bullet point

Traffic Operations – Data Sources

1. Traffic counts (cars, trucks, and pedestrian) are from the Maryland State Highway Administration's Traffic Monitoring System (TMS)
2. Signal timing were the latest available from Montgomery County's Division of Traffic Engineering and Operations
3. Bus boarding/alighting from WMATA, RideOn, and MTA (AM&PM peaks and daily for the past year)
4. Field observations (7 – 9 AM and 4 – 6 PM)
   a) Observed driver behaviors, lane configurations, signal timing and phasing data
   b) Recorded vehicle and bus travel times by segment
   c) Reviewed congestion patterns using RITIS.org and the Maryland SHA Mobility Report (page 147 or III.B.25)
5. MWCOG regional growth

RITIS.org



24 hour data represents the average of all Tuesdays, Wednesdays, and Thursdays in 2014 year.

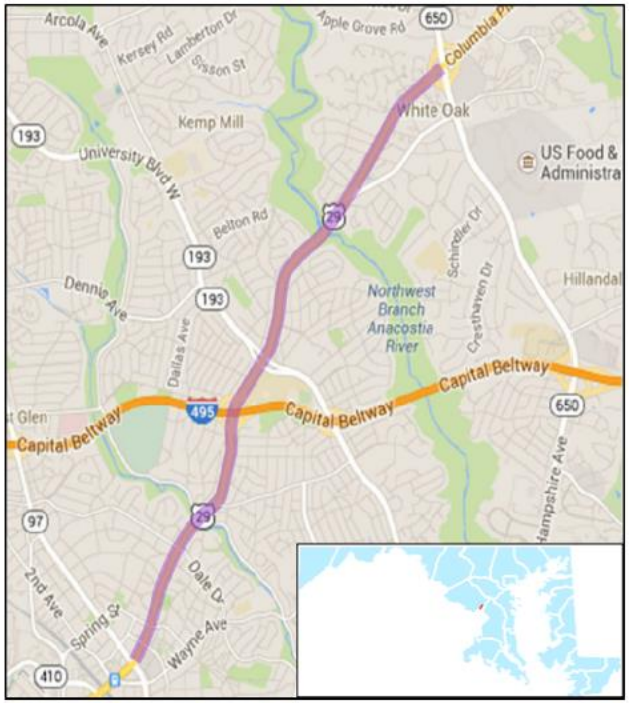
Traffic Operations – Data Sources (MD SHA Mobility Report)

US 29

Limits:	MD 97 to MD 650
Corridor Length:	3.8 miles
Speed Limit:	35 - 45 MPH
Travel Lanes:	(3 - 4) Northbound (2 - 4) Southbound
Signal Controlled Intersections:	13
Grade Separated Interchanges:	2
Major Cross Streets:	MD 97, Spring St / Cedar St, Dale Dr Sligo Creek Pkwy / St Andrews Way I-495, MD 193, Lockwood Dr, MD 650

Routes and Ridership

Routes	Avg. Daily Ridership	METRO Routes	Avg. Daily Ridership
Ride On 8	685		
Ride On 9	1,302		
Ride On 13	301	Z2	1,087
Ride On 14	887	Z6	3,117
Ride On 21	233	Z8	3,268
Ride On 22	419	Z9	796
MTA 915	N/A	Z11	1,015
MTA 929	N/A	Z13	1,015
MTA 995	N/A	Z29	796



2013 AADT	Trucks	Peak Hour Traffic
33,000 - 66,000 vpd	3% - 6%	7.5% - 8%

Maryland SHA Mobility Report (page 147 or III.B.25)
(http://apps.roads.maryland.gov/SHAServices/mapsBrochures/brochuresAndPublications/SHA_Mobility_Report.pdf)

Questions?

- ✓ **Data Sources**
- Software Used
- Traffic Operations Methodology
  - Existing Volumes and Network Inputs
  - Calibration and Evaluation Measures
  - Future No Build Assumptions and Results

Question and Answers after every bullet point

Traffic Operations – Software Used

- VISSIM 7.0
  - Microsimulation software recreates the real-world roadway network
  - Includes pedestrians, transit stops/routes, vehicles, trucks, bicycles, and signals
  - Reports the traffic operations results for all conditions
- Synchro/SimTraffic 9.0
  - Macro/Microsimulation software recreates the real-world roadway network
  - Includes pedestrians, vehicles, trucks and signals
  - Efficiently optimized signal timings in an iterative manner for future No Build conditions
  - Will be used to develop and screen the Future Build

Traffic Operations – Software Used

VISSIM Simulation – Southbound US 29 / Existing AM Peak Hour

Questions?

- ✓ Data Sources
- ✓ **Software Used**
- Traffic Operations Methodology
  - Existing Volumes and Network Inputs
  - Calibration and Evaluation Measures
  - Future No Build Assumptions and Results

Question and Answers after every bullet point

Existing Traffic Volumes

- Obtained traffic counts from 2012 to 2014 (included pedestrian volumes) (http://shagbhisdadt.mdot.state.md.us/itms_Public/default.aspx)
- Balanced existing AM and PM peak hour traffic volumes for one cohesive traffic volume network (8 to 9 AM and 5 to 6 PM)
- Developed Average Daily Traffic (ADT)
- Determined truck percentages on cross streets and US 29

Microsimulation Network Inputs

- Existing geometric conditions
- Signal timing and phasing plans for each signal during the peak hours
- Speed distributions to reflect turning speeds and driver behaviors
- Truck percentages for each roadway
- Vehicular and pedestrian AM and PM peak hour volumes
- Bus systems along US 29 (WMATA, RideOn, & MTA)
  - Routes & schedules
  - Stops & dwell times
  - Boardings & alightings

Questions?

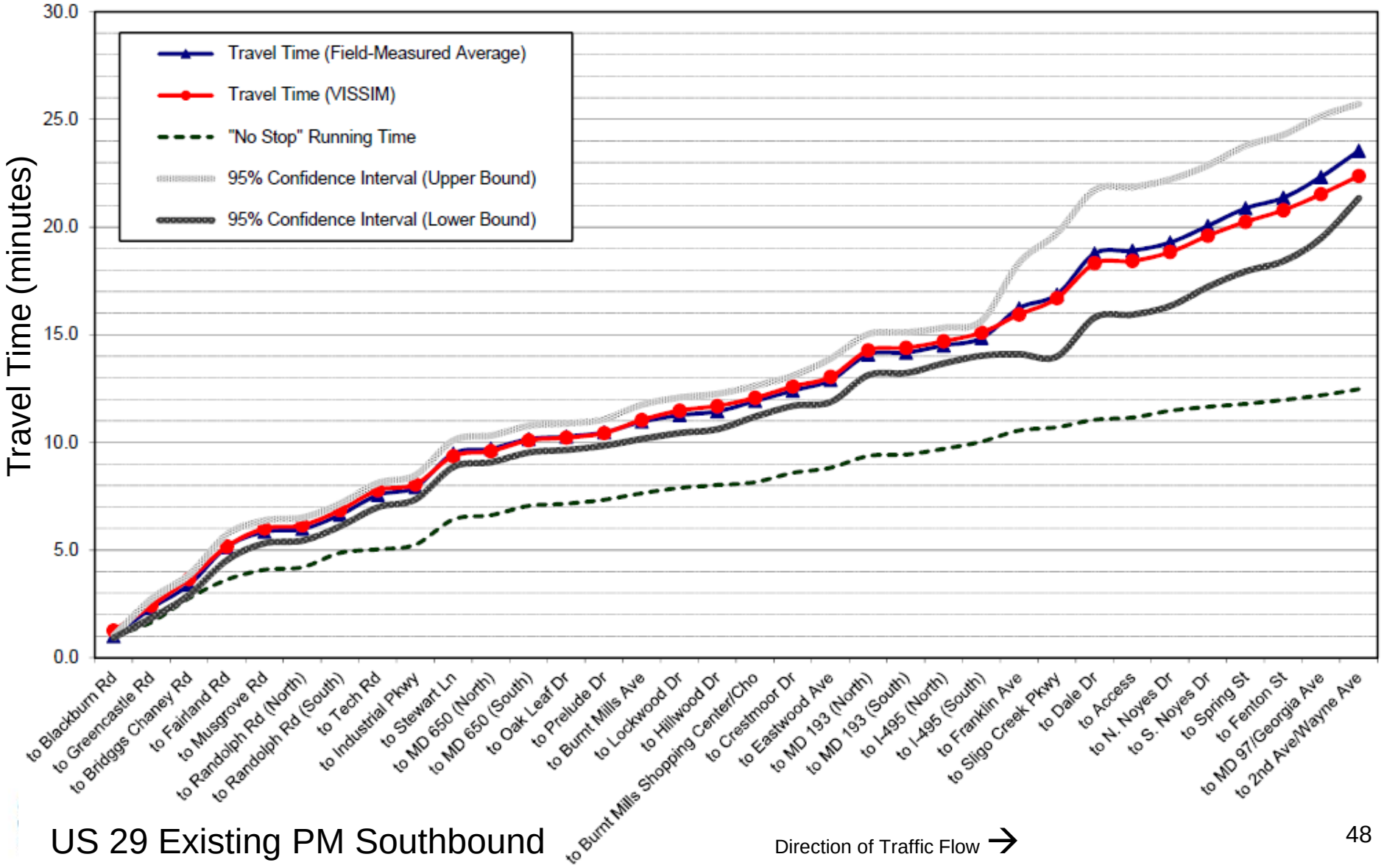
- ✓ Data Sources
- ✓ Software Used
- Traffic Operations Methodology
  - ✓ **Existing Volumes and Network Inputs**
  - Calibration and Evaluation Measures
  - Future No Build Assumptions and Results

Question and Answers after every bullet point

Traffic Operations – Calibration

- The existing network was calibrated for both the AM and PM peak hours and in each direction of US 29 to accurately represent existing conditions
  - *Calibration refines vehicle behaviors along a network to reflect field conditions; for this study, calibration was based on vehicle volumes and travel times.*
- Traffic volumes within the network were calibrated to statistically-acceptable calibration targets
- The model was calibrated to ensure corridor travel times are within Federal Highway approved standards
- Bus travel times from the model were compared to the bus schedules and field-measured bus travel time data

Traffic Operations – Calibration Example



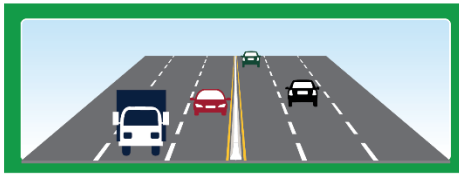
US 29 Existing PM Southbound

Direction of Traffic Flow →

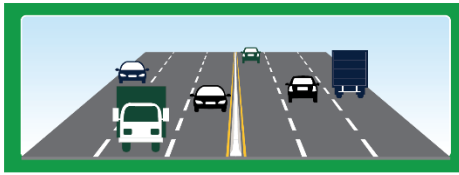
Traffic Operations – Evaluation Measures

- Highway Capacity Manual (HCM) Methodology
  - Intersection and approach delays and Level of Service (LOS)
  - Intersection-to-intersection travel times for both cars and buses, translated to speeds and LOS for each link
  - Weave, diverge, and merge densities and LOS
- Pedestrian delays at each crosswalk in the Silver Spring area (Wayne Ave to Spring St)
- Number of vehicles that were not served within the network during the one AM and one PM peak hour
- Additional evaluation measures will be taken into consideration when evaluating BRT alternatives

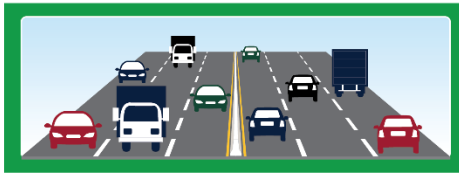
Traffic Operations – Level of Service



LOS A I Free Flow
Segment: Travel speed as a % of free flow speed > 85%
Intersection: Delay ≤10 seconds/vehicle



LOS B I Unimpeded Flow
Segment: Travel speed as a % of free flow speed > 67 to 85%
Intersection: Delay between 10 to 20 seconds/vehicle



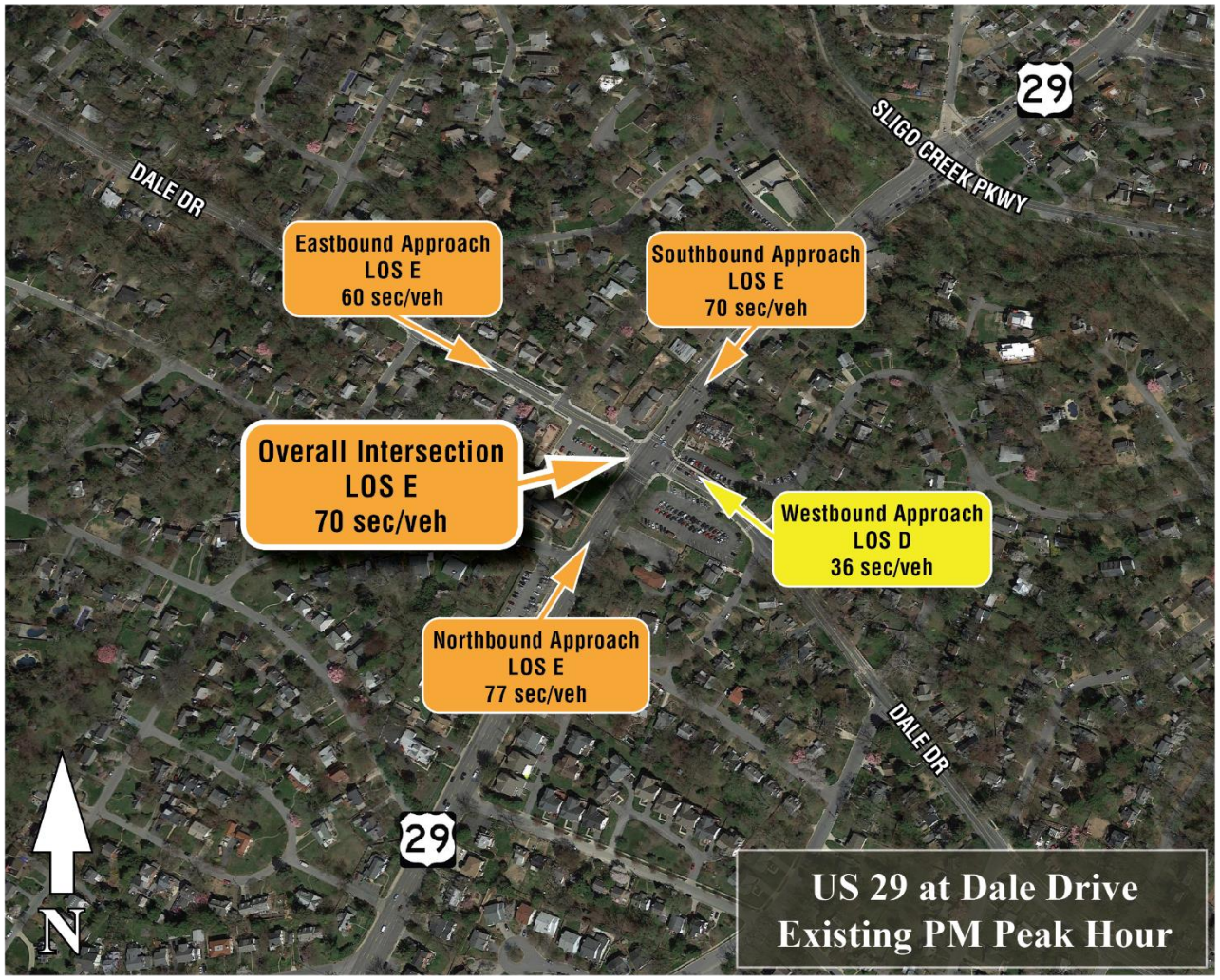
LOS C I Stable Flow
Segment: Travel speed as a % of free flow speed > 50 to 67%
Intersection: Delay between 20 to 35 seconds/vehicle

LOS D I Approaching Unstable Flow
Segment: Travel speed as a % of free flow speed > 40 to 50%
Intersection: Delay between 35 to 55 seconds/vehicle

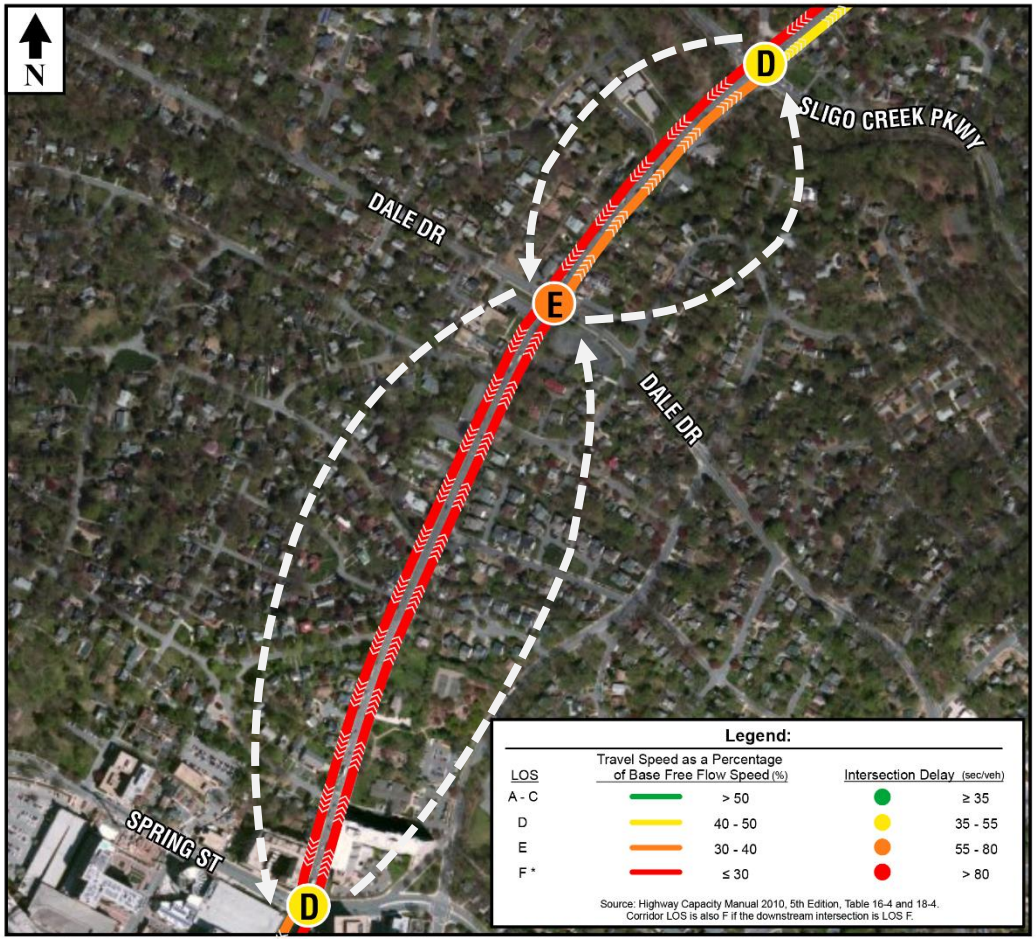
LOS E I Unstable Flow
Segment: Travel speed as a % of free flow speed > 30 to 40%
Intersection: Delay between 55 to 80 seconds/vehicle

LOS F I Breakdown Flow
Segment: Travel speed as a % of free flow speed ≤30%
Intersection: Delay > 80 seconds/vehicle

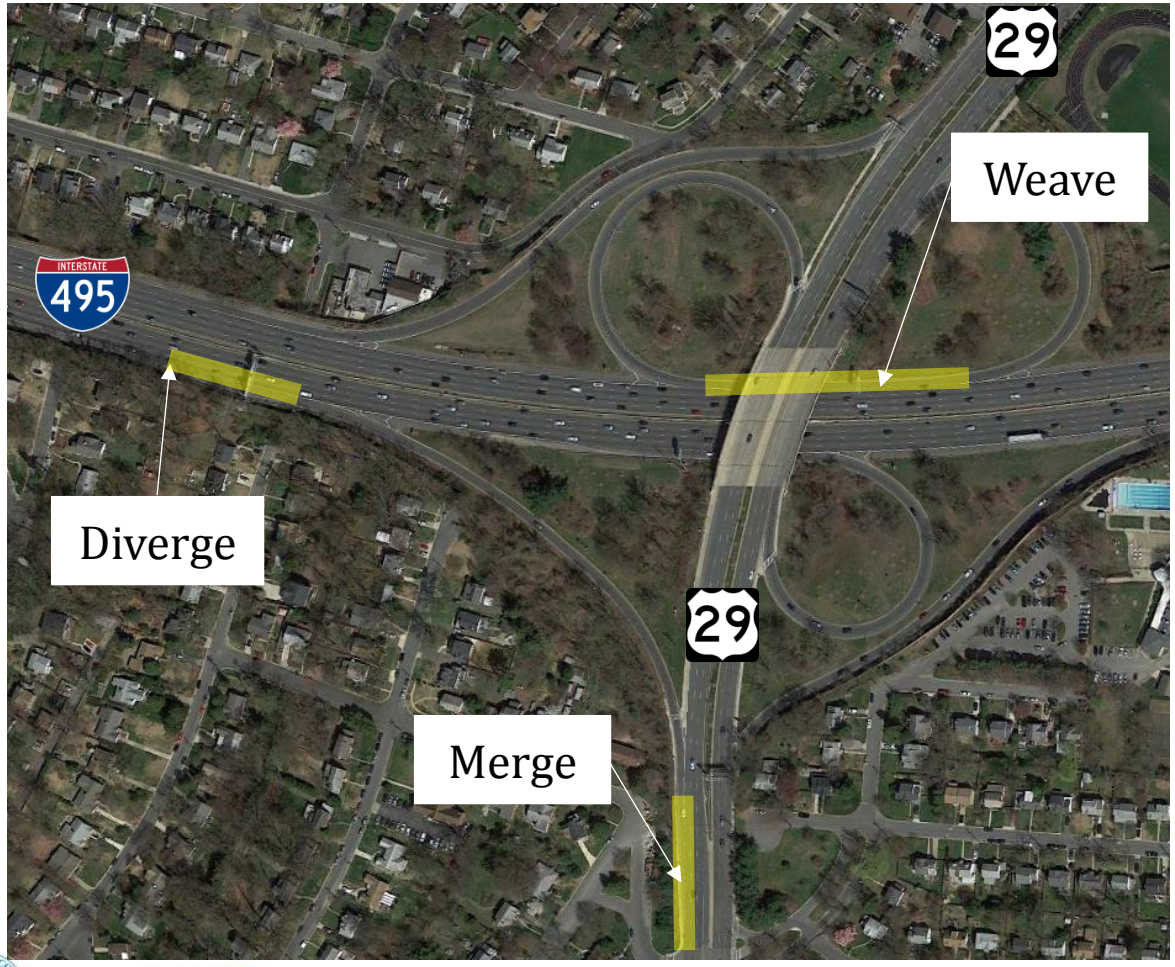
Traffic Operations – Intersection Delay



Traffic Operations – Intersection-to-Intersection Travel Times (2015 PM Example)



Traffic Operations – Weave, Diverge, & Merge Densities



Questions?

- ✓ Data Sources
- ✓ Software Used
- Traffic Operations Methodology
  - ✓ Existing Volumes and Network Inputs
  - ✓ **Calibration and Evaluation Measures**
  - Future No Build Assumptions and Results

Question and Answers after every bullet point

Traffic Operations – 2040 Future No Build Assumptions

- 2040 Future AM and PM forecasted volumes
- Existing lane geometry with the proposed Fairland Road interchange, including Musgrove Road closure
- Optimized signal timings to reflect realistic traffic operations in the future
- Z-line improvements

  (http://www.metrobus-studies.com/Z_Line/Z_Line.html)

Traffic Operations – 2040 Future No Build Traffic Forecast

- MWCOG Travel Demand Model provides Average Daily Traffic (ADT) volumes for roadway links
- Raw data from the model is post-processed using industry standard procedures and a comparison of 2015 model volumes and 2015 count data
- Peak hour volumes for links and intersection movements are grown using ADT growth percentages
- Traffic Impact Study (TIS) reports relevant to the study area are reviewed

Traffic Operations – 2040 Future No Build Model Development

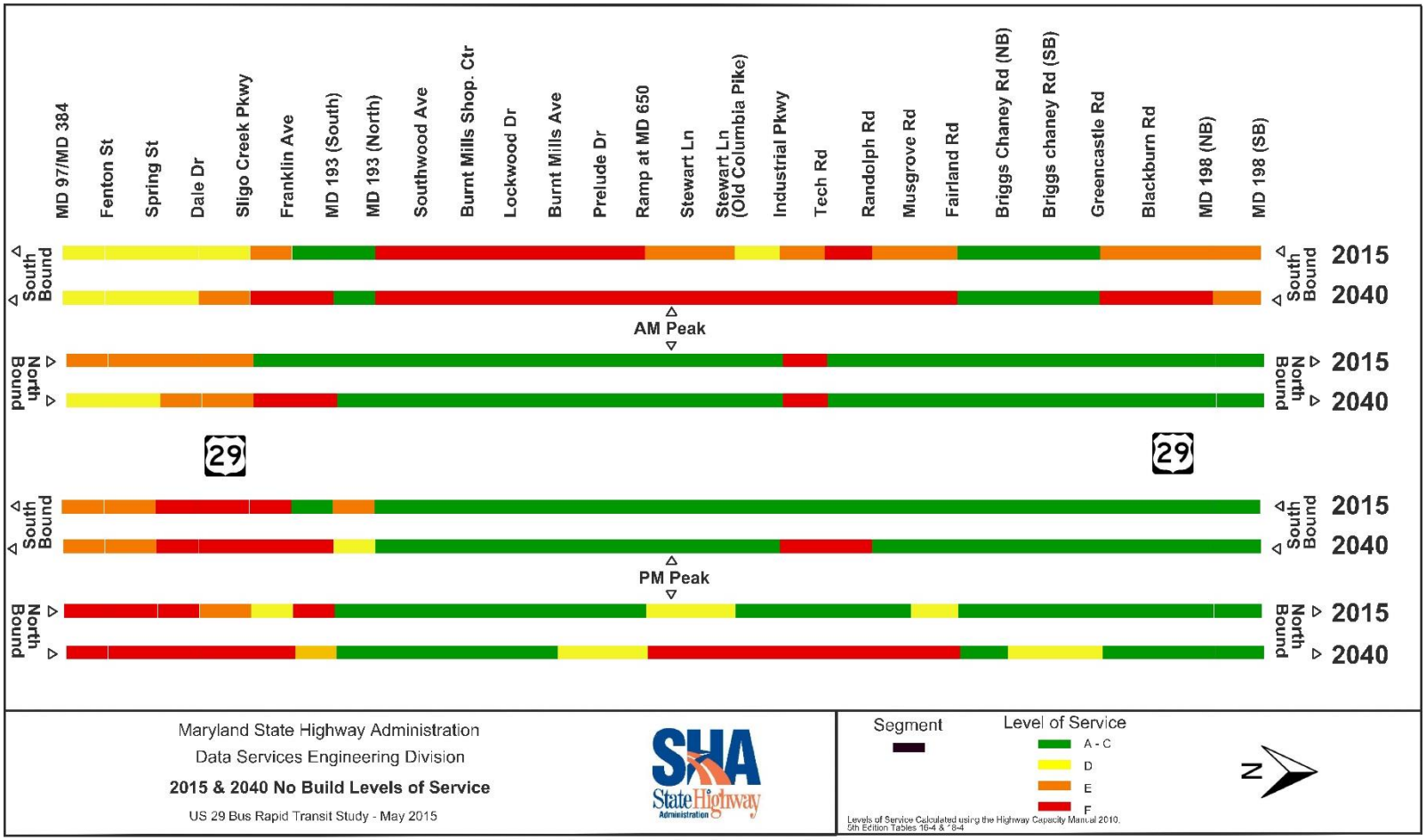
- Starting with the Existing model as a base, input all changes into the VISSIM microsimulation to reflect future No Build assumptions

- Ensure vehicular calibration
  - *What does future No Build calibration mean?*

  Due to changes in the volume flows, lane geometry (Fairland interchange), and the Z-line modifications, the model must be reviewed to confirm the traffic is operating correctly. This process involves visual identification of problems and corrections.

- Generate the same Evaluation Measures as Existing conditions for comparison purposes

Traffic Operations – 2015 and 2040 Future No Build Results



Traffic Operations

Key Take Away:

- Latest available software was utilized for the operational analysis
- Recent data was used in the development of the models
- Model networks were calibrated and validated for both vehicle and transit
- Evaluation measures that are relevant to the BRT study were reported for Existing and future No Build conditions (and will be used to evaluate the alternatives)

Questions?

- ✓ Introduction and Background
- ✓ Regional Demand Model
  - ✓ Travel Demand Forecasting Review and Four-Step Model
  - ✓ Overview of the Metropolitan Washington Council of Governments (MWCOG) Regional Travel Demand Model
  - ✓ Model Inputs & Assumptions
  - ✓ Model Outputs
- ✓ Traffic Operations
  - ✓ Data Sources
  - ✓ Software Used
  - ✓ **Traffic Operations Methodology**
- Crash Data
  - Q&A
- Additional Technical Q&A Session

Crash History Agenda

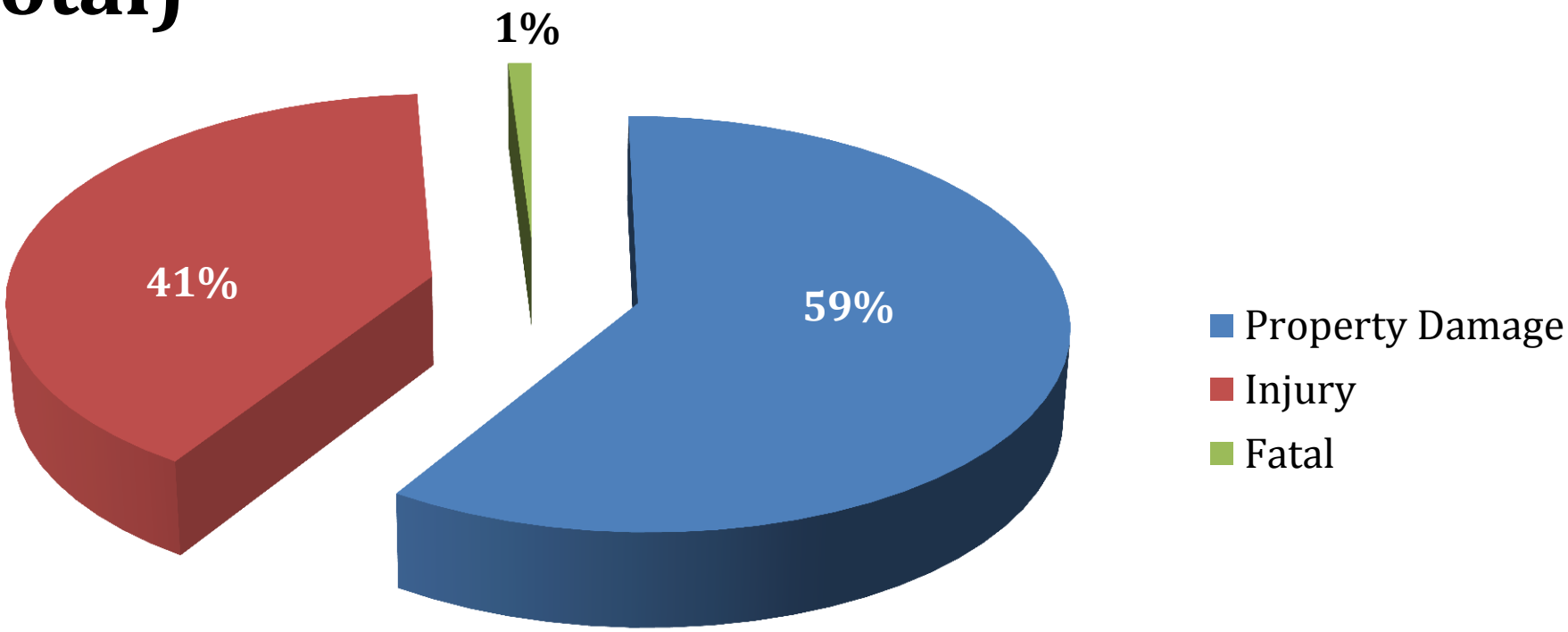
Topics to be discussed:

- Data Source
- Crash Severities and Crash Types

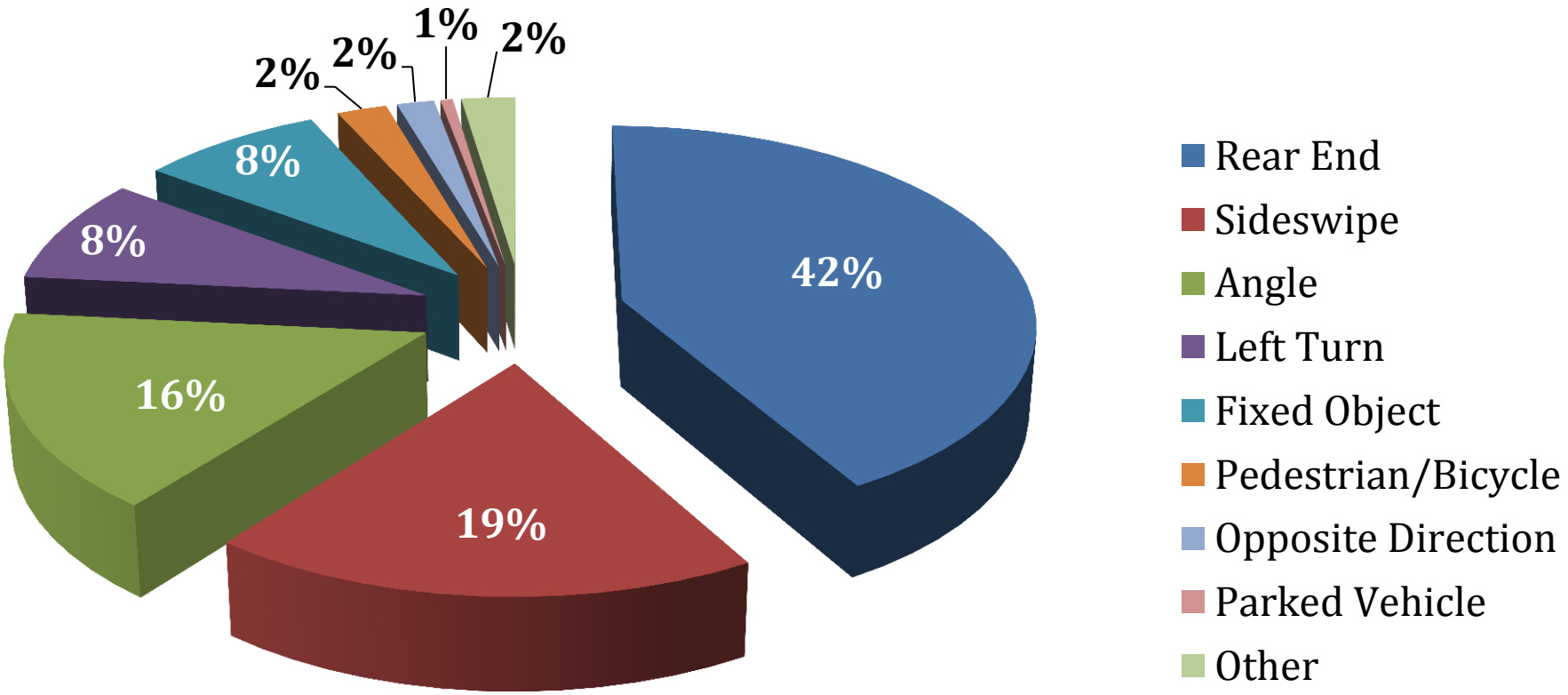
Crash History – Data Source

- Crash data is collected from the Maryland State Police
- Per Federal requirements, a three year period was reviewed along the study corridor for potential safety concerns
  - A total of 1,088 crashes were reported from 2011 to 2013
- Crash data include the corridor, intersections, and pedestrians
  - A total of 24 pedestrian/bicycle crashes were reported from 2011 to 2013
- Crashes can negatively impact the reliability of travel times
- Crash data is compared to State Highway rates to identify potentially high crash locations (i.e. above State crash rates for each roadway facility type)

US 29 Crash History – Crash Severities (Total)



US 29 Crash History – Crash Types (Total)



US 29 Crash History Summary

Roadway Sections (North to South)	Total Crashes (2011 to 2013)	3-year Crash Rate per Mile	High Crash Types
MD 97 to Spring Street (includes portions of US 29 south of MD 97)	100	200 High crash segment	Sideswipe, **pedestrian/bicycle**, property damage, & parked vehicles
Spring Street to MD 193 (University Boulevard)	308	182	Rear end & Sideswipe
MD 193 (University Boulevard) to Lockwood Drive	131	117	Opposite Direction
Lockwood Drive to Stewart Lane	126	103	Injury, Left Turn & Night time
Stewart Lane to Musgrove Road	202	95	Injury, Left Turn, Angle, & Night Time
Musgrove Road to MD 198 (Sandy Spring Road)	221	64	Night Time

Questions?

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- Additional Technical Q&A Session

Additional Technical Question & Answer Session

Adjournment