MD 355 South Corridor Advisory Committee Technical Meeting

Montgomery County
RAPID TRANSIT
BRT CORRIDOR STUDIES

Bethesda-Chevy Chase Regional Services Center
Bethesda, Maryland
August 31, 2015

SHA State Highway Administration
MONTGOMERY COUNTY MARYLAND
MTA Maryland

Welcome

Topics to be discussed (times approximate):

- Introduction, Background and Review – 10 minutes
  - Q&A
- Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor – 15 minutes
  - Q&A
- Regional Travel Demand Model and Forecasts – 40 minutes
  - Four (4) Q&A Sections
- 2040 No-Build Traffic Volumes for MD 355 Corridor – 15 minutes
  - Q&A
- MD 355 Traffic Operations (Existing and 2040 No-Build) – 30 minutes
  - Q&A
- MD 355 Crash History Data – 10 minutes
  - Q&A
- Additional Technical Q&A

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 based on evaluation criteria
  - 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)

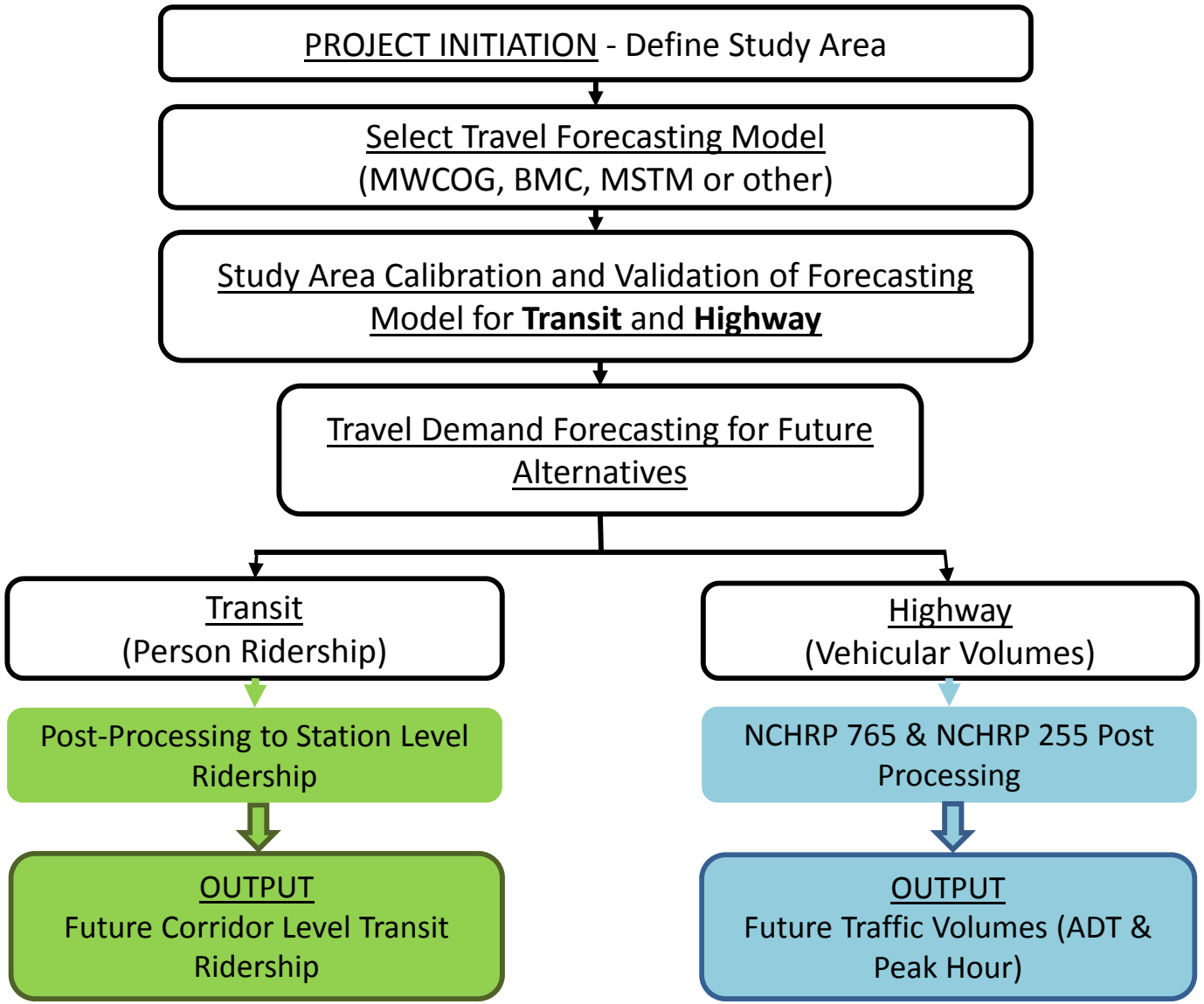
Review – Previously Discussed Topics

- Existing and forecasted 2040 No-Build traffic volumes for MD 355
- Intersection LOS and corridor travel times along MD 355
- Existing and forecasted 2040 No-Build trip patterns for MD 355 corridor
- Trends in transit ridership for the MD 355 corridor
- Overview of data and modeling processes used

Review – Feedback We Have Heard From the CAC

- Provide more background of where data comes and how it is processed
- Review the history of traffic volumes in the MD 355 corridor
- Discuss the data inputs to the modeling process, including land use and transportation network assumptions
- Explain the model processes, outputs, and analysis results in more detail
- Need more understanding of data pertaining to trip patterns (i.e. thru trips, average trip lengths)

Review – Travel Forecasting Process



Questions: Review

- ✓Introduction, Background and Review
  - Q&A
- Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor
- Regional Travel Demand Model and Forecasts
- 2040 No-Build Traffic Volumes for MD 355 Corridor
- MD 355 Traffic Operations (Existing and 2040 No-Build)
- MD 355 Crash History Data
- Additional Technical Q&A

Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor

Topics to be discussed:

- Sources of Data and SHA Methodology
- Existing Volumes for MD 355
- Comparisons to Historic Volume Data on MD 355

Sources of Traffic Count Data

Standard Practice for SHA:

- Traffic counts (cars, trucks, and pedestrians) are from the Maryland State Highway Administration's Traffic Monitoring System (TMS) (http://shagbhisdadt.mdot.state.md.us/itms_Public/default.aspx)
- Manual intersection counts are typically done for 13-hour periods (6 AM to 7 PM), and machine (tube) counts are usually done for 48 hours.
- SHA's Traffic Trends publication used for converting 13 hour and 48 hour counts into Average Annual Daily Traffic (AADT) volumes. (http://www.roads.maryland.gov/pages/hlr.aspx?PageId=832)

Sources of Volume Data – 13 Hour Intersection Count

Maryland Department of Transportation
State Highway Administration Data Services Engineering Division
Turning Movement Count Study - Field Sheet

Station ID: S1998150177 **County:** Montgomery **Comments:** LOS AM:C(0.77) PM:D(0.85)

Date: Thursday 09/18/2014 **Town:** none

Location: MD 355 at MD 547 **Weather:** Clear

Interval (dd): 15 min

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00PM	Start	End	Volume	LOS	V/C
		07:15	08:15	4276	C	0.77		17:30	18:30	5226	D	0.85

Hour Begin	MD 355 From North					MD 355 From South					MD 547 From East					Strathmore Rd From West					Grand Total
	U.Turn	Left	Through	Right	TOTAL	U.Turn	Left	Through	Right	TOTAL	U.Turn	Left	Through	RIGHT	TOTAL	U.Turn	Left	Through	Right	TOTAL	
6:00	0	5	190	0	195	0	1	168	19	188	0	11	0	17	28	1	1	0	1	2	413
6:15	0	15	214	4	233	1	2	156	14	172	0	33	3	10	46	0	1	1	0	2	453
6:30	0	15	270	3	288	1	9	153	31	193	0	60	0	17	77	0	1	1	8	10	568
6:45	0	37	297	9	343	0	5	184	49	238	0	78	1	19	98	0	3	26	8	37	716
7:00	0	39	396	12	447	0	2	219	89	310	0	151	4	26	181	0	2	2	2	6	944
7:15	0	64	383	7	464	0	12	228	143	383	0	167	8	32	207	0	3	0	6	8	1062
7:30	1	61	470	14	646	0	2	218	62	283	0	187	8	32	235	0	4	12	8	24	1087
7:45	1	48	485	16	630	1	6	288	84	369	0	174	6	38	217	0	5	3	3	11	1117
8:00	1	38	482	13	613	0	6	216	84	284	0	137	8	38	182	0	8	17	6	31	1010
8:15	2	56	344	6	406	0	1	281	70	352	0	108	0	41	149	0	0	0	3	3	910
8:30	1	28	362	3	393	1	7	271	64	342	0	115	1	34	150	0	1	0	3	4	889
8:45	2	65	340	3	408	0	8	300	48	356	0	95	0	53	148	0	2	12	30	44	956
9:00	3	47	345	6	398	0	3	295	63	361	0	114	1	65	180	0	0	9	2	11	950
9:15	4	44	281	1	326	0	1	325	39	365	0	84	0	50	134	0	2	10	6	18	843
9:30	2	35	283	4	322	0	1	348	52	401	0	54	1	38	93	0	4	11	12	27	843
9:45	2	43	263	4	310	0	3	352	50	405	0	61	2	49	112	0	5	10	7	22	849
10:00	2	28	230	1	259	0	3	291	48	342	1	55	2	27	84	0	0	1	2	3	688
10:15	4	38	185	5	228	2	0	216	39	255	0	42	2	35	79	0	1	4	6	11	573
10:30	3	48	243	0	291	1	6	230	30	266	0	51	0	40	91	0	3	0	0	3	651
10:45	2	39	203	0	242	0	2	276	17	295	0	68	0	40	108	0	1	0	4	5	650

Page 1 of 7

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Sources of Volume Data – 48 Hour Class Count

Maryland Department of Transportation
State Highway Administration
Data Services Engineering Division

Classified Count Detail Report

Location ID : B2869
Location : MD355-.50 MI S OF GUDE DR
Date Range : 10/07/2014 to 10/08/2014
County : Montgomery
Date: 10/07/2014 **Direction: Northbound**

					Single-Unit Trucks		Single-Trailer Trucks			Multi-Trailer Trucks				
Beginning Hour	Class 1 Motorcycles	Class 2 Passenger Cars	Class 3 Light Trucks	Class 4 Buses	Class 5 2 Axle 6 Tire	Class 6 3 Axle	Class 7 >=4 Axle	Class 8 <=4 Axle	Class 9 5 Axle	Class 10 >=6 Axle	Class 11 <=5 Axle	Class 12 6 Axle	Class 13 >=7 Axle	Total
0:00	0	99	12	5	3	1	0	0	1	1	0	0	0	122
1:00	0	51	3	2	1	0	0	0	1	0	0	0	0	58
2:00	0	33	5	0	2	0	0	2	1	0	0	0	0	43
3:00	0	28	2	0	3	0	0	2	0	0	0	0	0	35
4:00	0	32	7	2	3	0	0	1	0	0	0	0	0	45
5:00	0	113	18	6	6	2	0	2	0	0	0	0	0	147
6:00	1	269	36	9	21	0	0	2	1	0	0	0	0	339
7:00	4	575	64	7	19	0	0	2	0	0	0	0	0	671
8:00	4	699	106	12	36	6	0	1	2	0	0	0	1	867
9:00	5	916	102	19	35	1	0	0	0	0	0	0	0	1,078
10:00	8	885	110	13	39	4	0	2	4	0	0	0	0	1,065
11:00	5	999	120	15	29	5	0	2	0	0	0	0	0	1,175
12:00	5	1,291	137	12	33	3	0	3	1	0	0	0	0	1,485
13:00	7	1,207	146	21	47	4	0	2	1	0	0	0	0	1,435
14:00	6	1,245	139	19	41	4	0	2	0	0	0	0	0	1,456
15:00	6	1,273	130	14	30	2	0	2	1	0	0	0	0	1,458
16:00	18	1,270	122	10	27	2	0	3	0	0	0	0	0	1,452
17:00	10	874	78	10	16	1	0	6	0	0	0	0	1	996
18:00	10	897	77	7	20	0	0	9	0	0	0	0	0	1,020
19:00	5	1,009	99	6	15	0	0	0	1	0	0	0	0	1,135
20:00	3	845	61	10	13	0	0	0	0	0	0	0	0	932
21:00	3	779	54	7	8	0	0	0	1	0	0	0	0	852
22:00	2	356	23	9	5	0	0	0	1	0	0	0	0	396
23:00	1	196	15	6	4	0	0	0	2	0	0	0	0	224
Total:	103	15,941	1,666	221	456	35	0	43	18	1	0	0	2	18,486
Percentage:	0.56%	86.23%	9.01%	1.20%	2.47%	0.19%	0.00%	0.23%	0.10%	0.01%	0.00%	0.00%	0.01%	

Total Class 1-3 : 17,710 **Percent Class 1-3:** 95.80% **Total Class 4:** 221 **Percent Class 4:** 1.20% **Total Class 5-13:** 555 **Percent Class 5-13:** 3.00%

07/26/2015 Page 1 of 7

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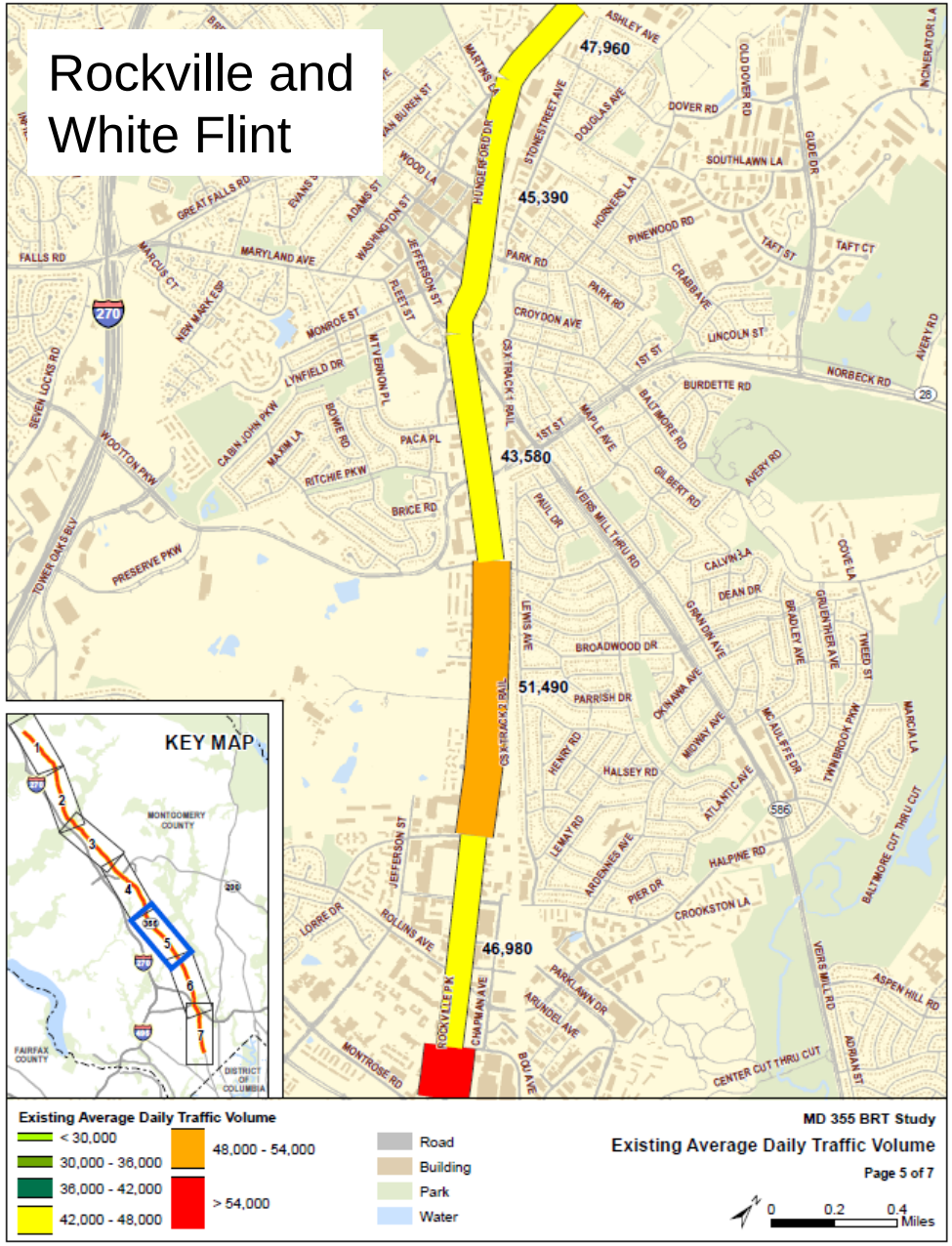
Existing Daily MD 355 Traffic Volumes



Existing Daily MD 355 Traffic Volumes

White Flint and
North Bethesda

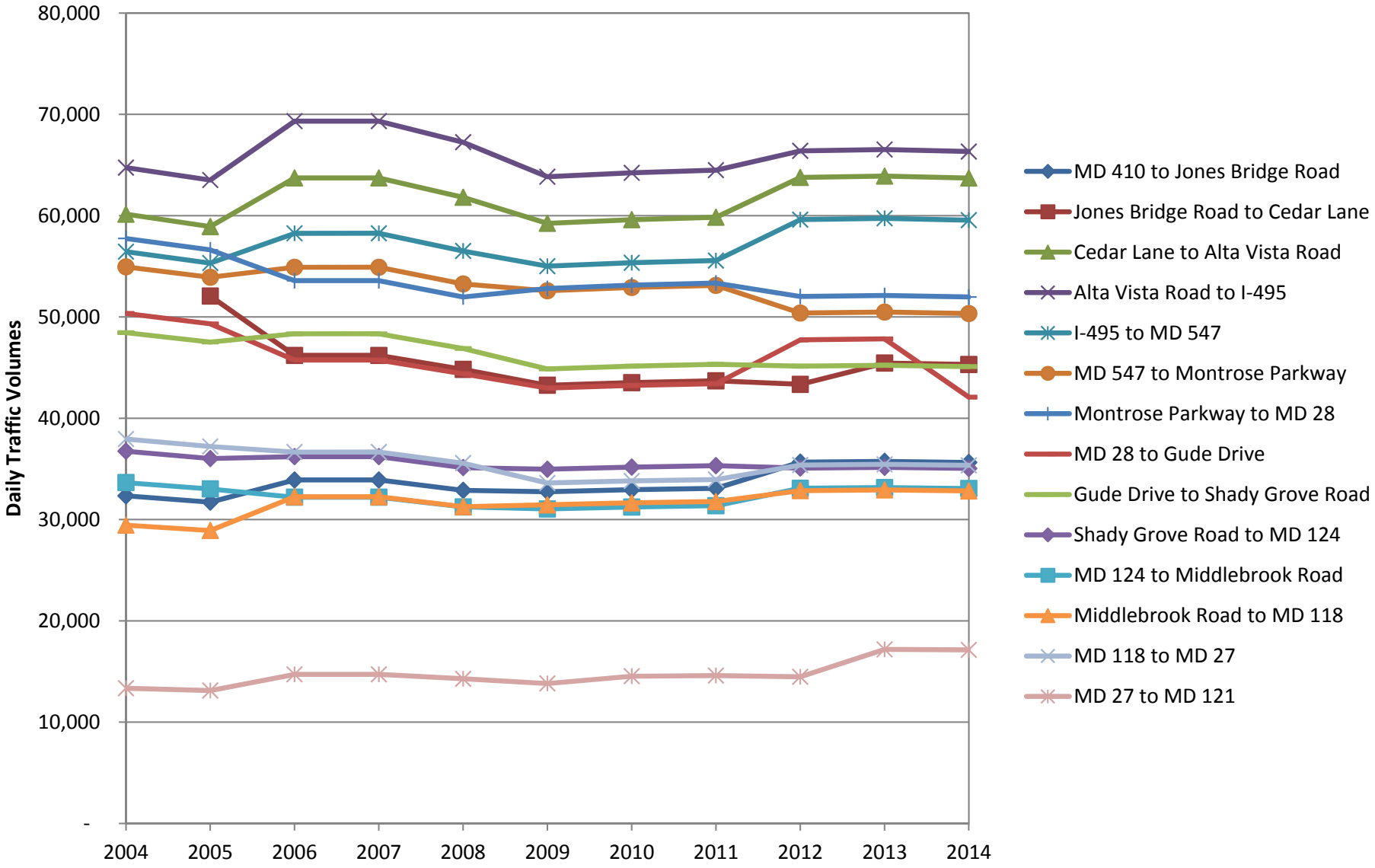
Bethesda

Existing MD 355 Traffic Volumes

Peak Hour Traffic Trends

- Traffic volumes in the peak direction range between 500-700 vehicles per hour near MD 121 to over 3,000 per hour just south of the Beltway
- AM Peak Directional Distribution –
  - 70-80% from Rockville to Clarksburg
  - 60-70% south of Rockville down through Bethesda
- PM Peak Directional Distribution –
  - 70-80% in Clarksburg
  - 60-70% in Germantown and Gaithersburg
  - 50-60% from Rockville down to Bethesda
- Time of Peaks –
  - AM Peak generally ranges from 7:00-8:00 around Clarksburg to 8:00-9:00 in Bethesda
  - PM Peak generally occurs between 5:00-6:00 for the entire project corridor

History of Traffic Volumes on MD 355 (2004-2014)



History of Traffic Volumes on MD 355

- Volumes for 2004 to 2014 available on SHA's Traffic Volume Maps http://www.roads.maryland.gov/Index.aspx?PageId=792
- Traffic volumes part of SHA counting program - taken every three years – estimated for years in between
- Isolated 48-hour counts – provides snapshot at specific points – can be impacted by weather, traffic incidents
- Not intended for analysis – provides a snapshot of conditions and is used for Federal system reporting
- Traffic volumes have been generally stagnant past decade
  - Graph shows decreases typically occurred in late 2000's
  - Volumes generally rebounded to pre-recession volumes (mirrors Maryland and national trend)
    - 2004-2009 traffic – average of 4.7% decrease
    - 2009-2014 traffic – average of 1.4 % increase

History of Traffic Volumes on MD 355

- 2015 MD 355 BRT study traffic volumes developed using traffic counts along entire corridor instead of spot locations
- Study volumes balanced to account for daily variations in traffic
- Study volumes are the official volumes that will be used for analyses in this process
- Will conduct new count at MD 355 / Little Seneca intersection – potential for volume changes since recent counts

Existing Traffic Volumes and Traffic Volume History

Key Takeaways:

- Existing traffic volumes are based on recent 13-hour intersection counts and 48-hour machine counts
- Traffic Volumes differ greatly for different sections of MD 355
- Directionality of peak traffic increases toward the north end of project area
- SHA Program count volumes have been stagnant the last decade along MD 355
- Volumes developed for this project are the official volumes being used for this study

Questions: Existing Traffic & Traffic History

- ✓Introduction, Background and Review
- ✓Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor
  - Q&A
- Regional Travel Demand Model and Forecasts
- 2040 No-Build Traffic Volumes for MD 355 Corridor
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Regional Travel Demand Model and Forecasts Agenda

Topics to be discussed:

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

Travel Demand Forecasting: Overview

What is Travel Demand Forecasting?

- Computer models that predict:
  - Travel Patterns
  - Traffic Volumes
  - Transit Ridership
- Based on changes to:
  - Transportation networks (highway or transit)
  - Land Use (density, intensity, mix of employment/residential)
- The prediction process can be done at a Region, Statewide, or Local level; each providing their own level of detail.
- The MD 355 corridor is being modeled using a regional model using the MWCOG model customized for the MD 355 study area

Travel Demand Forecasting: Applications

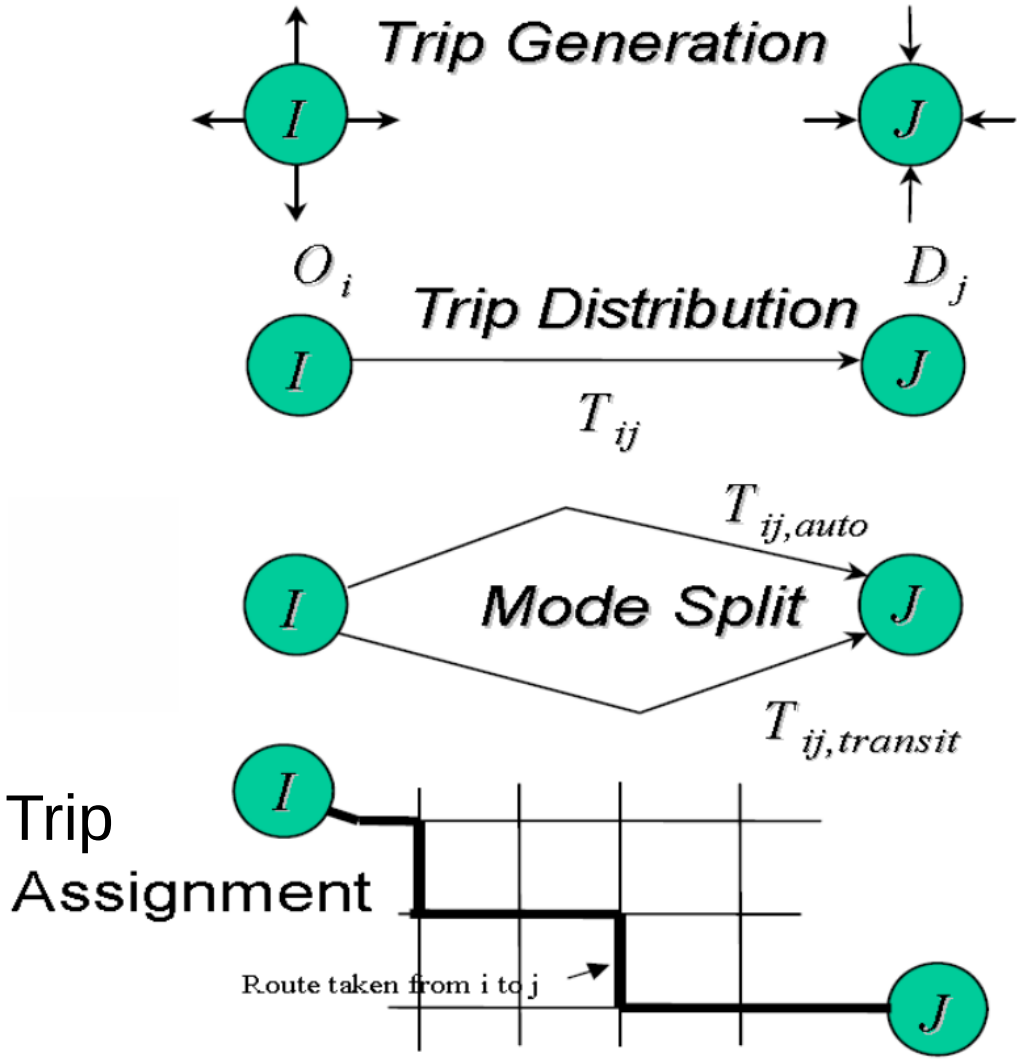
What do we use Travel Demand Forecasting for?

- 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 in the region?
- **Trip distribution** - Where do the trips go within the region as well as outside the region?
- **Mode choice** - What travel mode is used for each trip? (ex. bus or walk)
- **Trip Assignment** - What is the route of each trip?

Use of Four Step Models is Industry Standard in the Washington Region



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

Source: MWCOG

Questions: Travel Demand Forecasting Overview

- ✓Introduction, Background and Review
- ✓Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor
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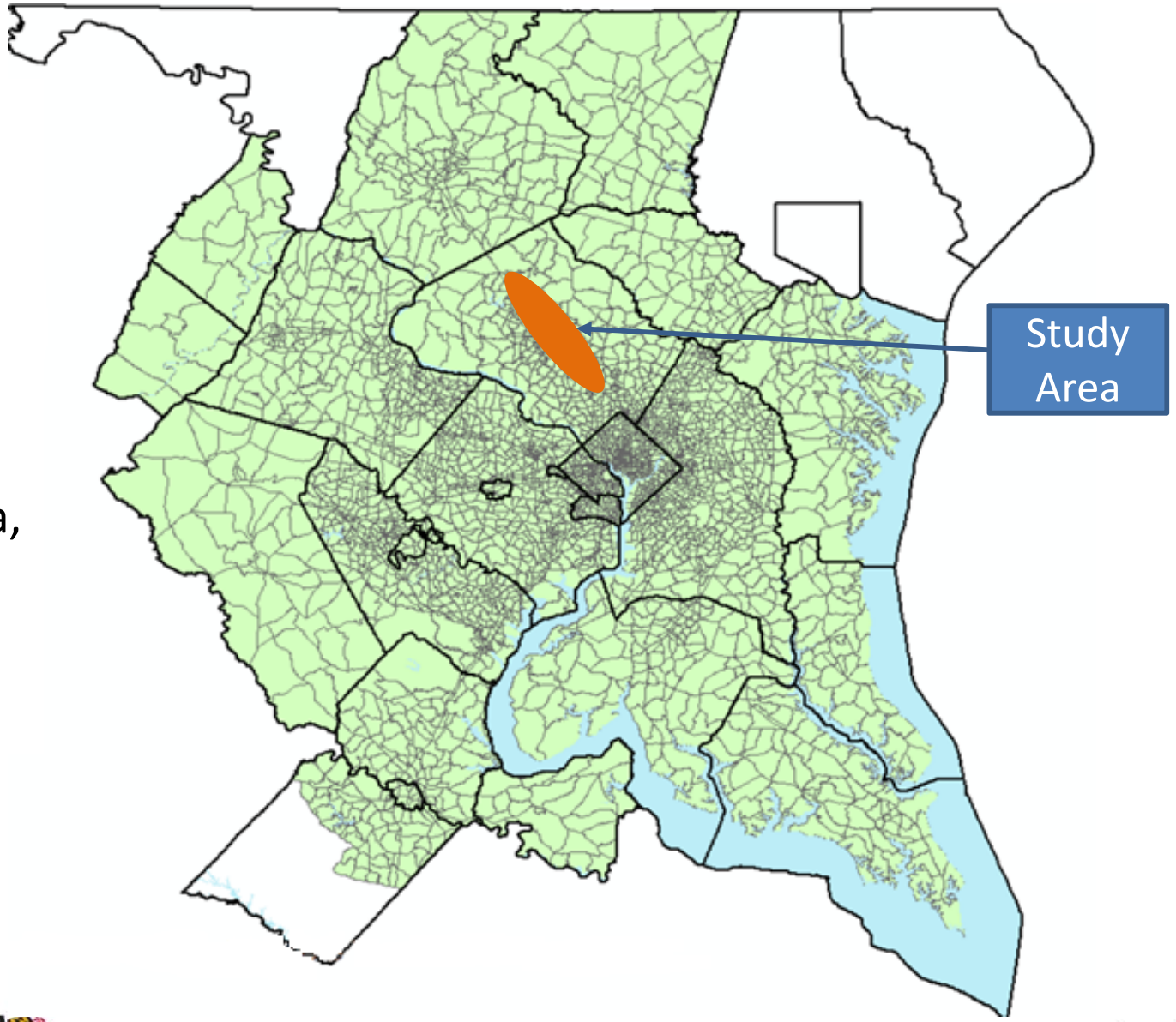
Metropolitan Washington Council of Governments Regional Demand Model

- Metropolitan Washington Council of Governments (MWCOG) regional demand model is being used in the forecasting process (http://www.mwcog.org/)
- Four-step model calibrated to replicate travel conditions in the Metropolitan region
- Additional validation conducted for conditions on the MD 355 corridor
- Latest officially adopted regional model (v 2.3.57) and planning assumptions (Round 8.3) used

Travel Demand Forecasting: Model Area

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

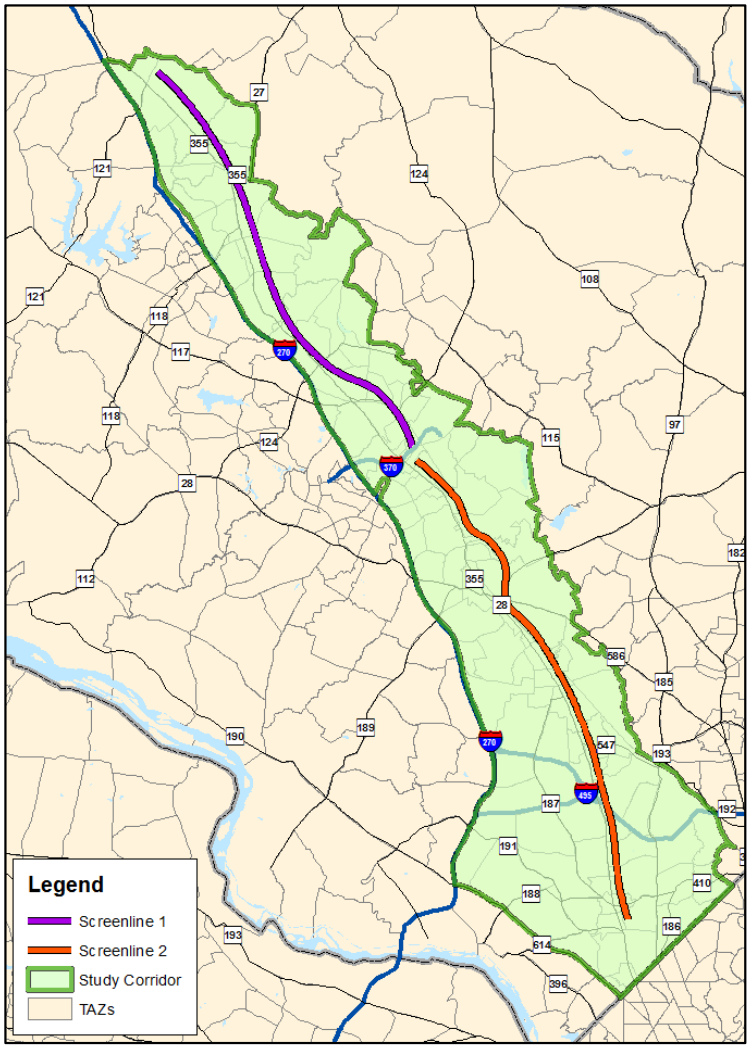


Metropolitan Washington Council of Governments Regional Demand Model

- MWCOG Round 8.3 Cooperative Land Use Forecasts (officially adopted October 2014) used as latest population and employment forecast
  - Land Use is a major input to the model – affects all four steps of the modeling process – forecasts include:
    - Population
    - Households
    - Employment by type (office, retail, industrial, other)
  - MWCOG Land Use forecasts developed using regional "top-down" and local "bottom-up" approach
  - Local projections based on Montgomery County Master Plan and Pipeline developments

Travel Demand Model: Calibration and Validation

- Calibrates and validates all steps of the model to observed data:
  - Traffic Counts
  - Transit Ridership counts
  - Census Data
  - Household Travel Surveys
- Final results validated to match
  - Traffic volumes across regional screenlines
  - Metrorail boardings by station group
  - Regional transit boardings
- MD 355 corridor specific validation
  - Traffic volumes across corridor screenlines
  - Ridership on existing corridor transit services
    - Ridership on corridor Ride On and Metrobus Routes
    - Metrorail Red Line station boardings



Source: MWCOG

Questions: MWCOG Model Overview

- ✓Introduction, Background and Review
- ✓Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor
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  - ✓Travel Demand Forecasting Overview and Four-Step Model
  - ✓Overview of the Metropolitan Washington Council of Governments (MWCOG) Regional Travel Demand Model
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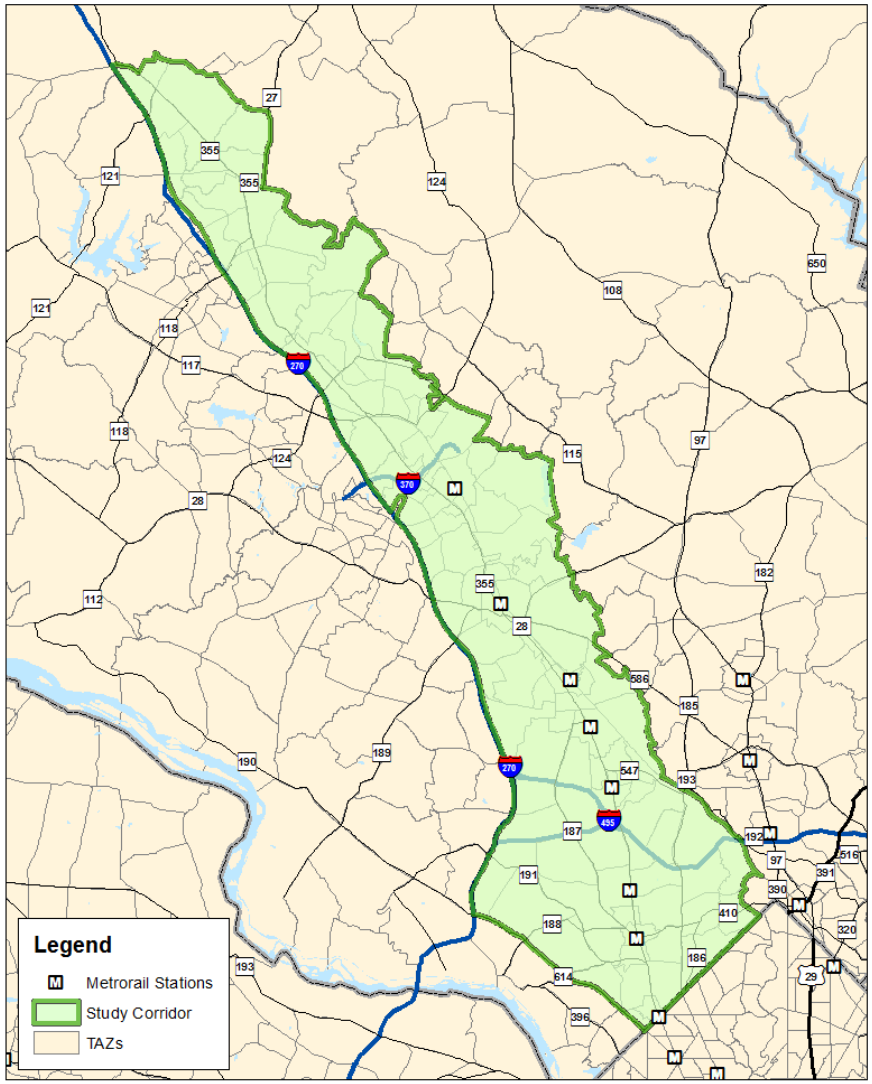
MWCOG Model Inputs and Assumptions

- Population and Employment Forecasts
  - Guides ultimate output of each step of the model
  - Dictates how many trips are generated by the model of each purpose
  - Regional growth estimated and allocated through regional cooperative process
    - Updated Cooperative Land Use Forecasts updated approximately each year (Currently Round 8.3)
    - Maryland National Capital Park and Planning Commission provides estimates within Montgomery County based on:
      - Review of building permits
      - Projects in development pipeline
      - Long-term planned developments/redevelopments

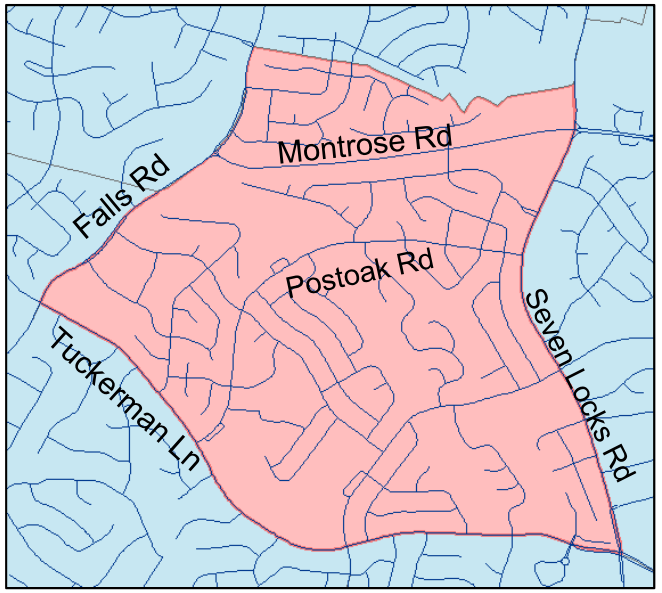
MWCOG Model Inputs: Study Area

- Study Area: Focus for analysis and results
  - Full region is modeled; study area focuses results on an area of interest
- The study area is selected to capture areas most likely to be affected by an improvement (BRT)
- MD 355 Study Area includes 127 Transportation Analysis Zones (TAZs)
  - Out of 3722 regionally
  - Out of 375 in Montgomery County



MWCOG Model Inputs: TAZs

- All model steps are aggregated to TAZs that represent relatively small geographic areas
  - MWCOG Model region includes 3722 TAZs (375 TAZs in Montgomery County)
  - TAZs smaller in denser areas, larger in less developed areas
- Land Use Forecasts developed at TAZ level
  - Population
  - Households
  - Employment by Type

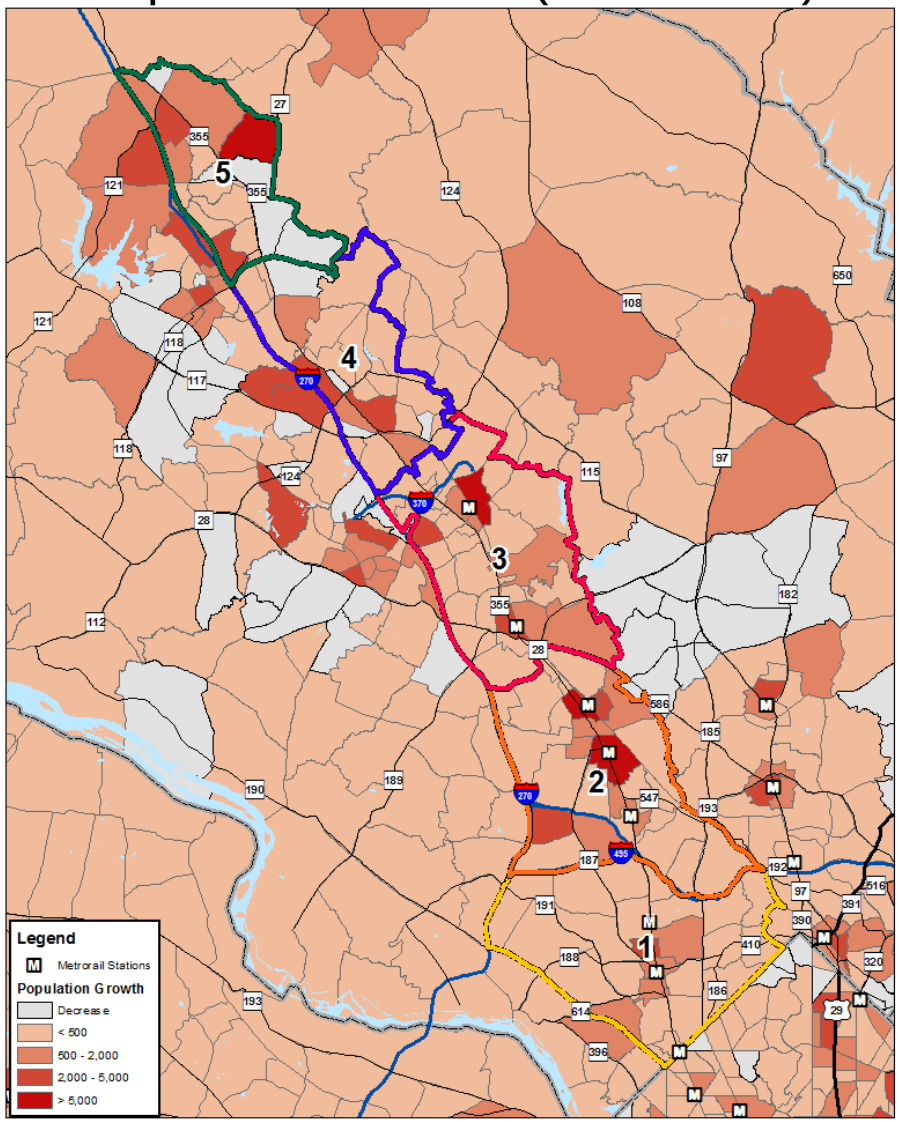


MWCOG Model Inputs: Population Growth

- Study Area:
  - 308,100 residents in 2014 (30% of County Total)
  - 409,300 residents in 2040 (34% of County Total)
- 33 percent population increase in Study Area
  - Largest increase in District 2 (around White Flint area)
  - Most districts show higher growth than County average

District	2014	2040	Growth	Percent Growth
1	87,900	101,800	13,900	15.9%
2	80,200	122,700	42,500	53.0%
3	48,000	68,000	20,000	41.5%
4	66,000	76,200	10,200	15.5%
5	26,000	40,600	14,600	56.2%
Total	308,100	409,300	101,200	32.9%
County Total	1,011,000	1,213,000	202,000	20.0%

Population Growth (2014-2040)

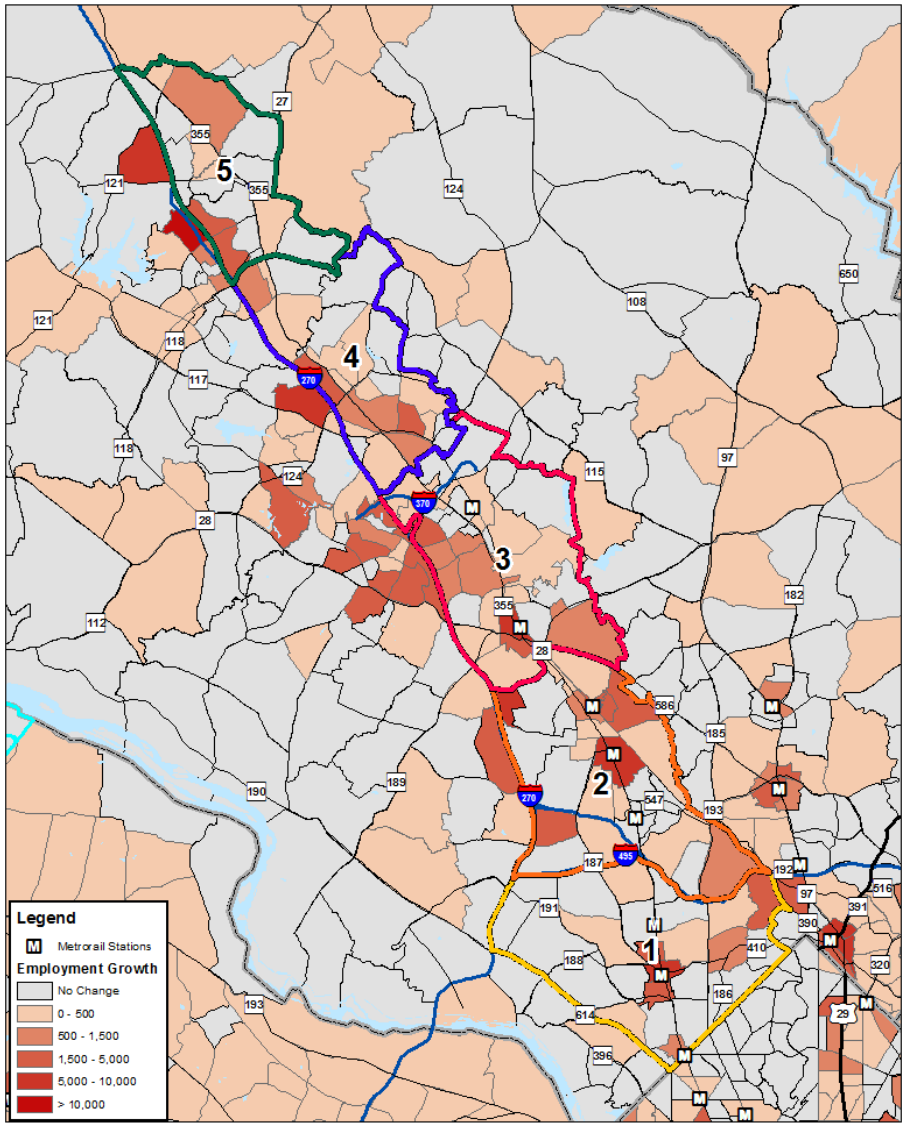


MWCOG Model Inputs: Employment Growth

- Study Area:
  - 282,800 jobs in 2014 (54% of County Total)
  - 369,200 jobs in 2040 (50% of County Total)
- 28 percent increase in Study Area
  - Largest increase in District 2 (around White Flint area)
  - Only District 2 shows higher growth rate than County average

District	2014	2040	Growth	Percent Growth
1	94,500	114,100	17,600	20.1%
2	84,600	122,100	37,500	46.7%
3	61,300	78,700	17,400	36.3%
4	30,600	39,500	8,900	13.4%
5	9,800	14,800	5,000	19.4%
Total	282,800	369,200	86,300	28.0%
County Total	528,000	738,000	210,000	39.8%

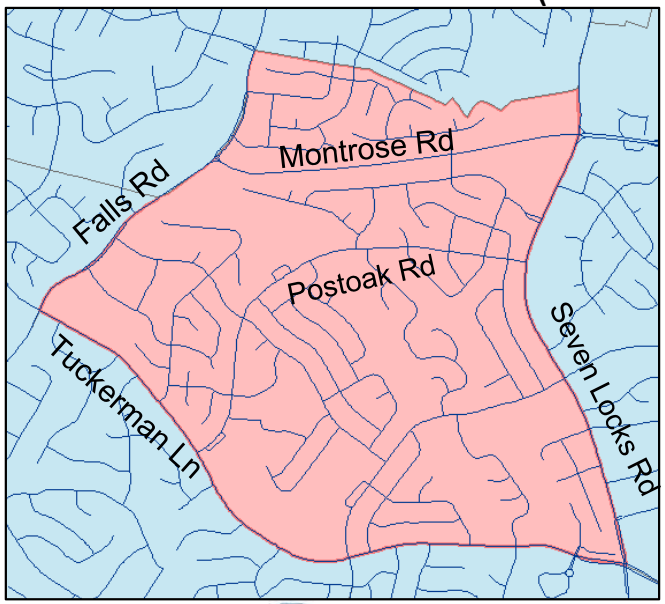
Employment Growth (2014-2040)

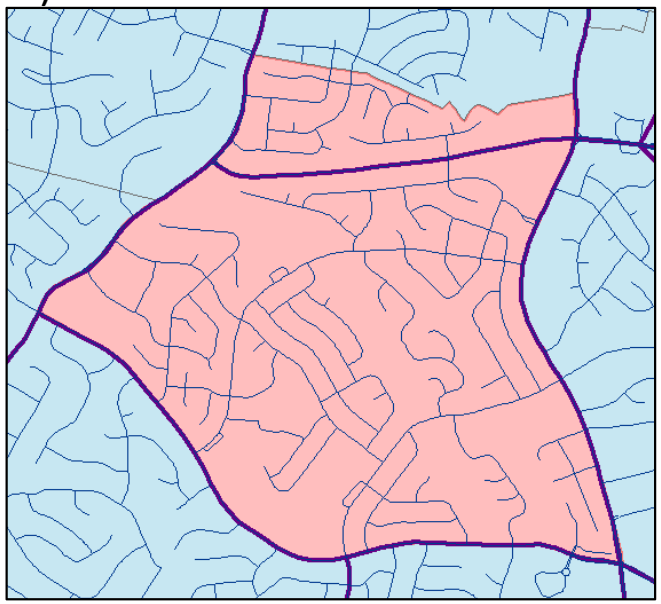


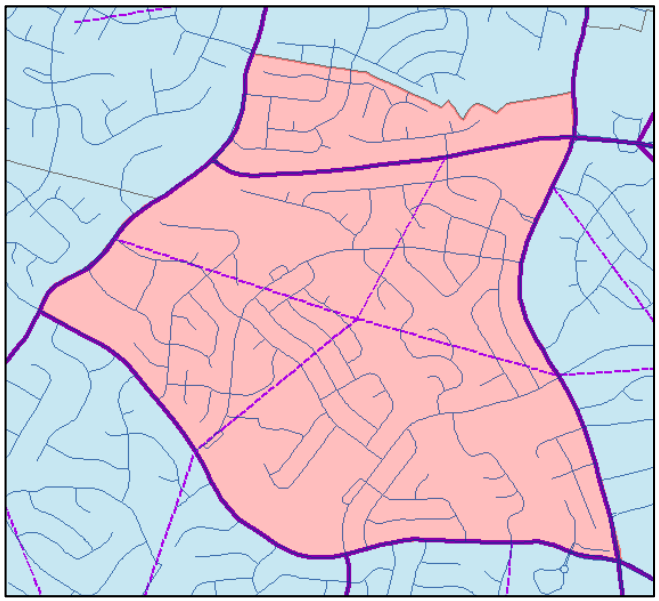
montgomerycountymd.gov/rts

MWCOG Model Inputs: Networks

- Highway Network replicates Regional Roadway system
  - Includes facilities that accommodate regional traffic: freeways, arterials, collectors, etc.
- Local roadways within TAZs not included in model
  - Replaced by representative connections neighborhood streets to highway network (centroid connectors)
- Each roadway includes important attributes used to make routing decisions:
  - Capacity
  - Distance
  - Cost (i.e. tolls)
  - Use restrictions (i.e. HOV2)

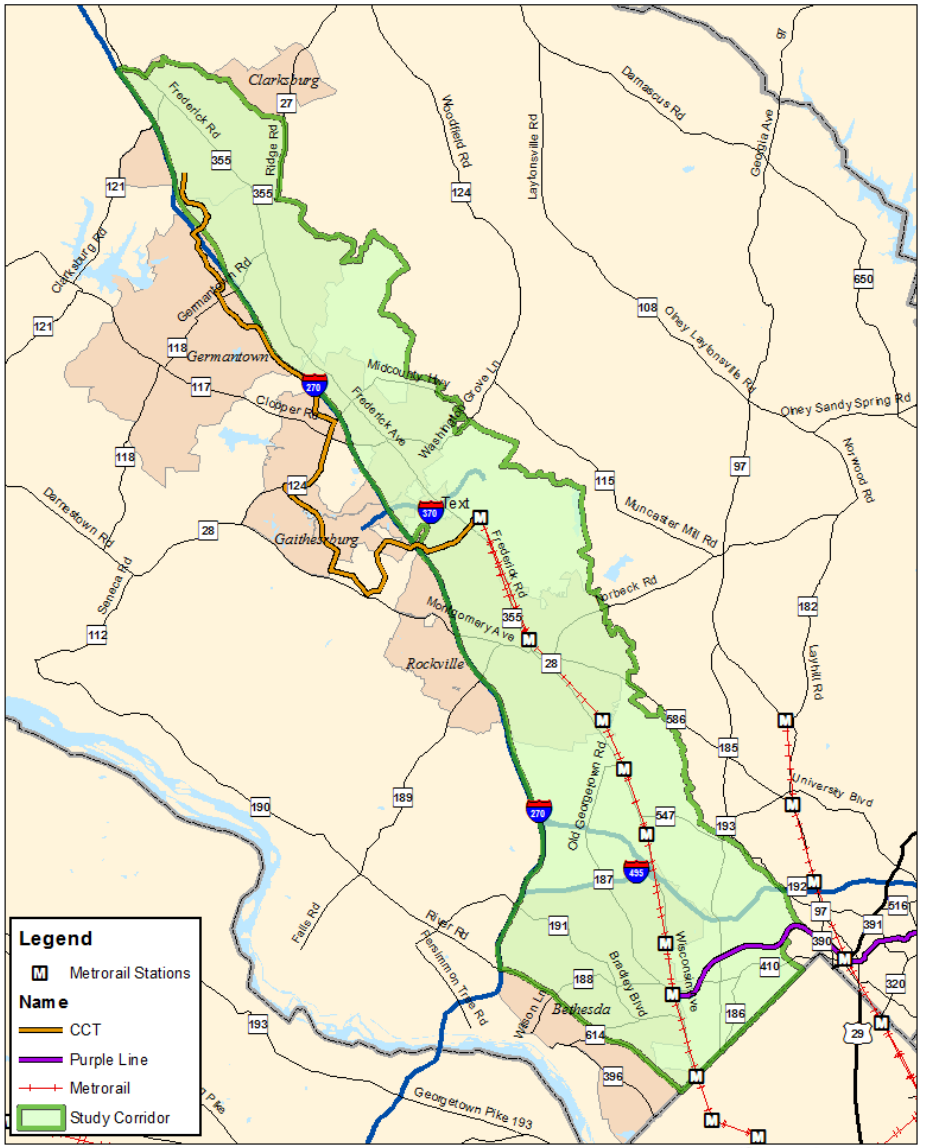






MWCOG Model Inputs: Networks

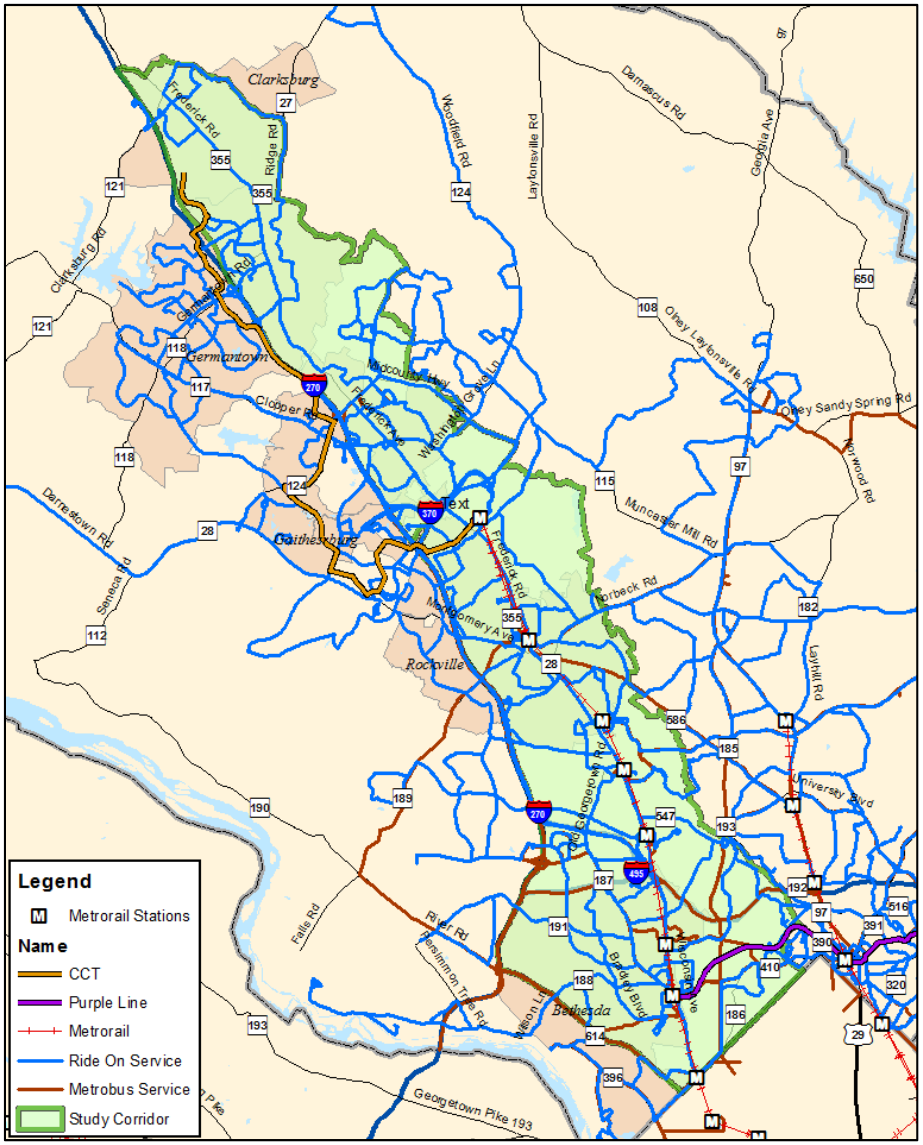
- Future Transportation Networks
  - Include all existing facilities and services
  - Adds key facilities for 2040 based on 2014 MWCOG Constrained Long Range Plan (CLRP), including:
    - Purple Line from Bethesda to New Carrollton
    - Corridor Cities Transitway (CCT) from Shady Grove to COMSAT
    - I-270/US 15 HOV Lanes Extension
    - I-270/Watkins Mill Road Interchange
    - Mid-County Highway Extension from MD 27 to Montgomery Village Avenue
    - Connection of Little Seneca Parkway with Observation Drive
    - Construct Snowden Farm Parkway from MD 355 to MD 27



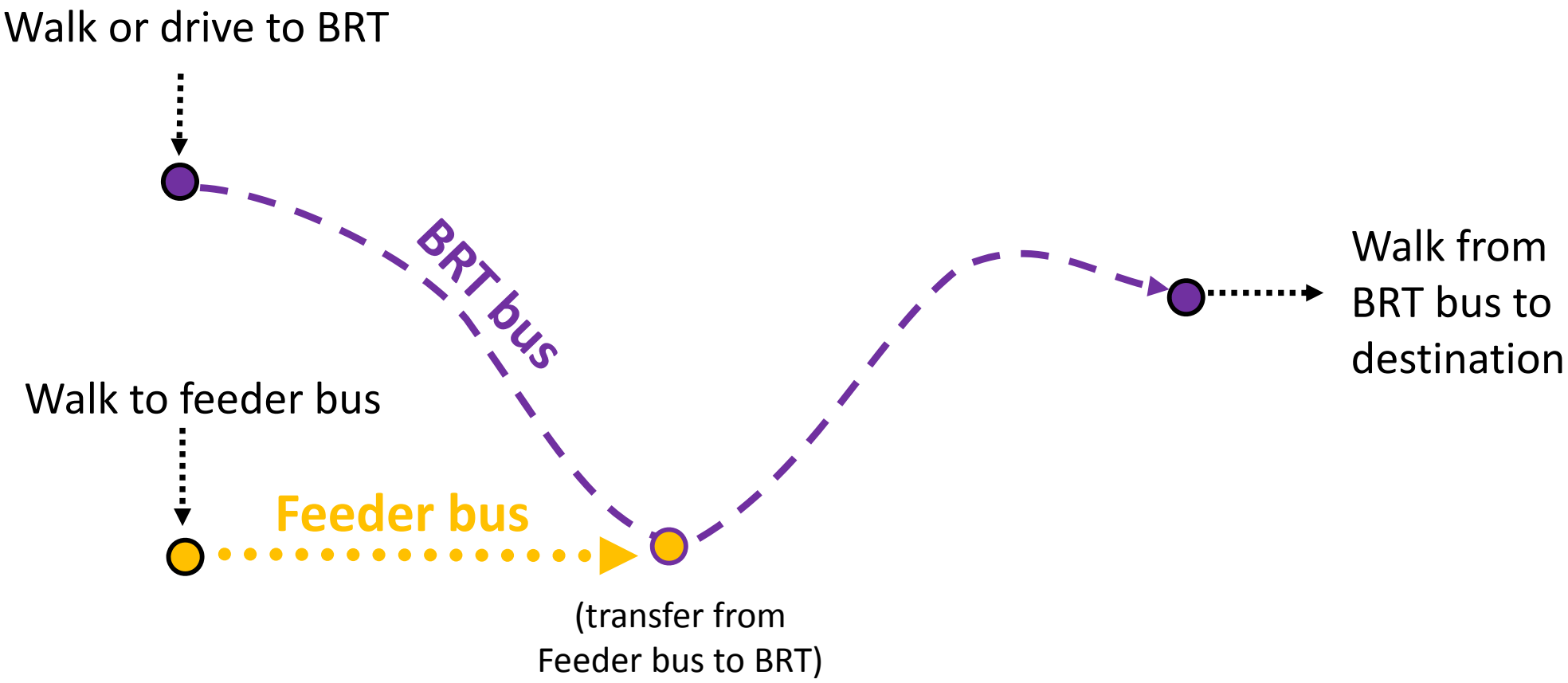
Source: MWCOG CLRP

MWCOG Model Inputs: Networks

- Transit Network includes all public transportation modes
  - Metrorail, Commuter Rail, Metrobus, Ride-On
    - Physical transit facilities (stops/stations, dedicated runningways)
    - Travel times including wait times, transfer times, station access times, etc.)
    - Costs (Fares, parking costs)
  - Attributes used to calculate travel time by time of day for use in mode choice and trip assignment



Model Inputs: Representation of Transit Systems



Questions: Model Inputs and Assumptions

- ✓Introduction, Background and Review
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  - Model Outputs
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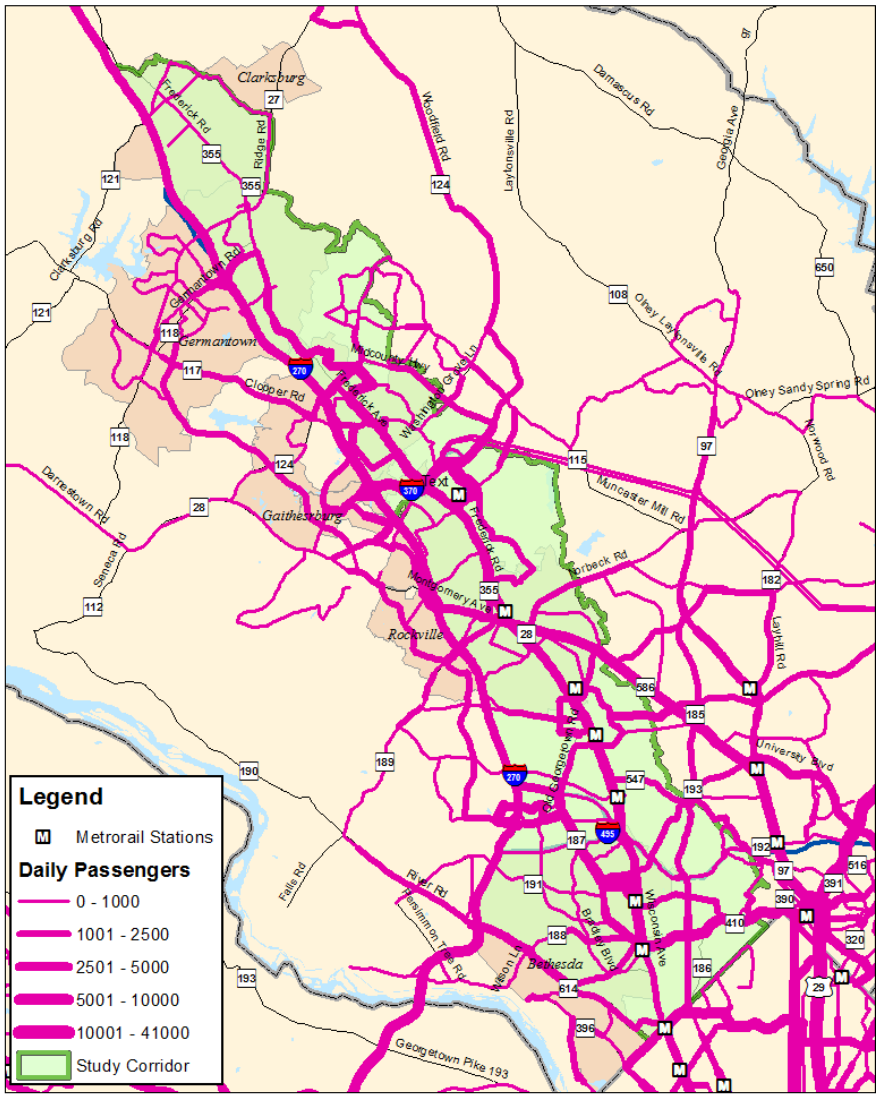
- MD 355 Crash History Data
- Additional Technical Q&A

MWCOG Model Outputs

- Overall
  - Trip productions and attractions
  - Trip origins and destinations
  - Trips by mode
- Roadway
  - Roadway volumes by time of day
- Transit
  - Total daily ridership on Build Alternative BRT
    - Boardings and Alightings by Stop
    - Mode of Access at Stations
    - Park-and-Ride usage
  - Passenger loads
  - New transit trips/change in transit mode share

Future Bus Ridership (2040)



montgomerycountymd.gov/rts

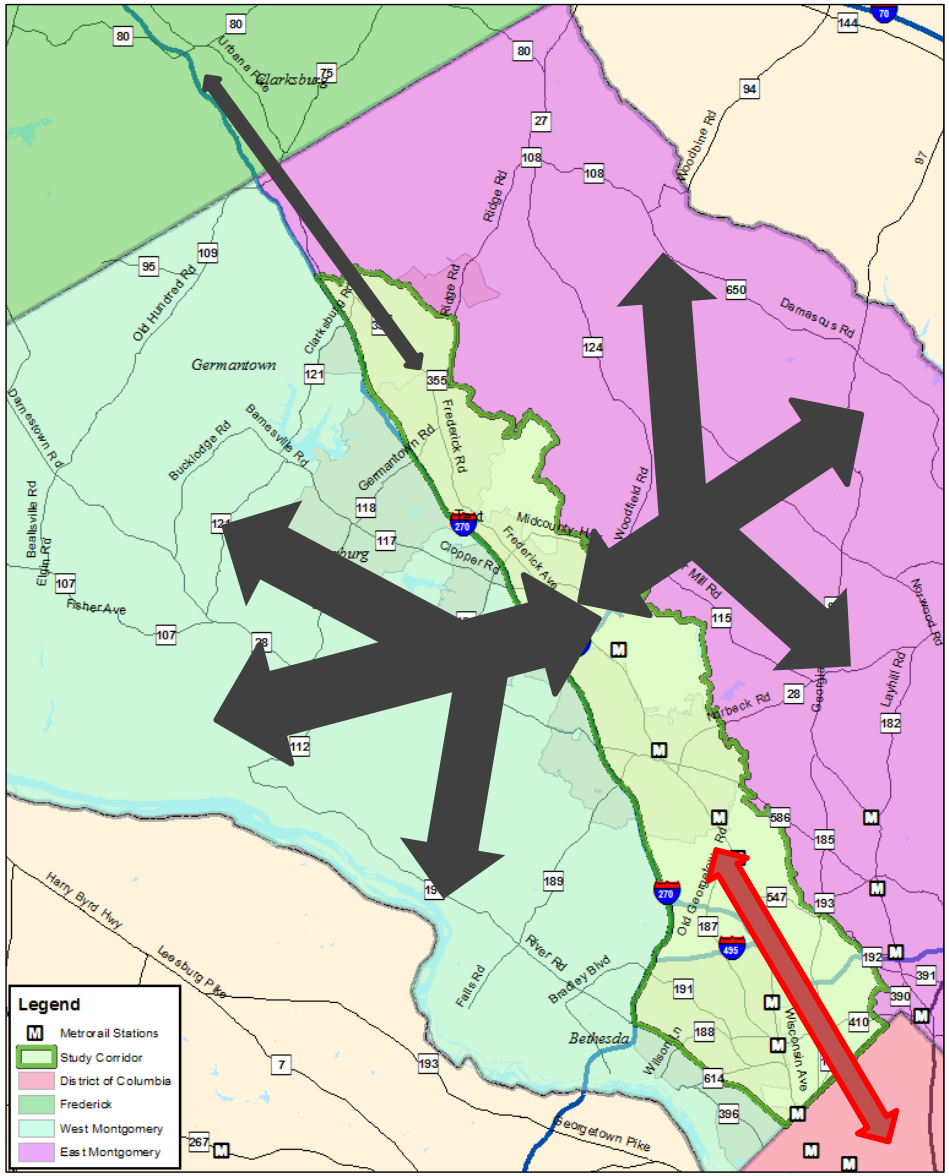
Study Area Travel Markets

- Travel to/from the Study Area
- Travel through the Study Area
- Travel within the Study Area

Travel Markets: To/From Study Area

- Daily Trips to/from the Study Corridor (2040):

	Total Daily Trips	Percent Transit
DC	178,900	38%
Frederick County	59,900	4%
West Montgomery	437,700	7%
East Montgomery	390,900	8%



Source: 2040 No-Build Analysis, MWCOG

Travel Markets: To/From Study Area

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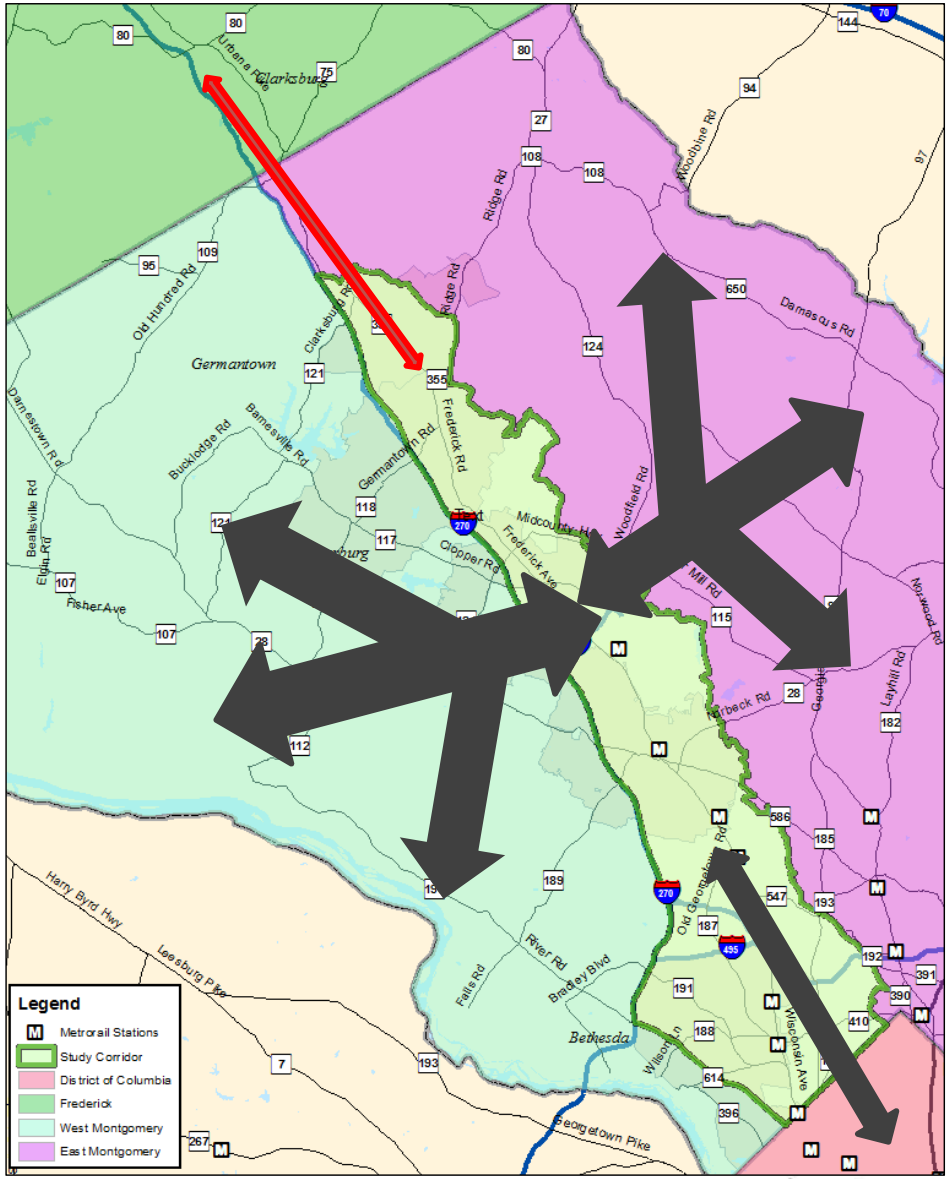


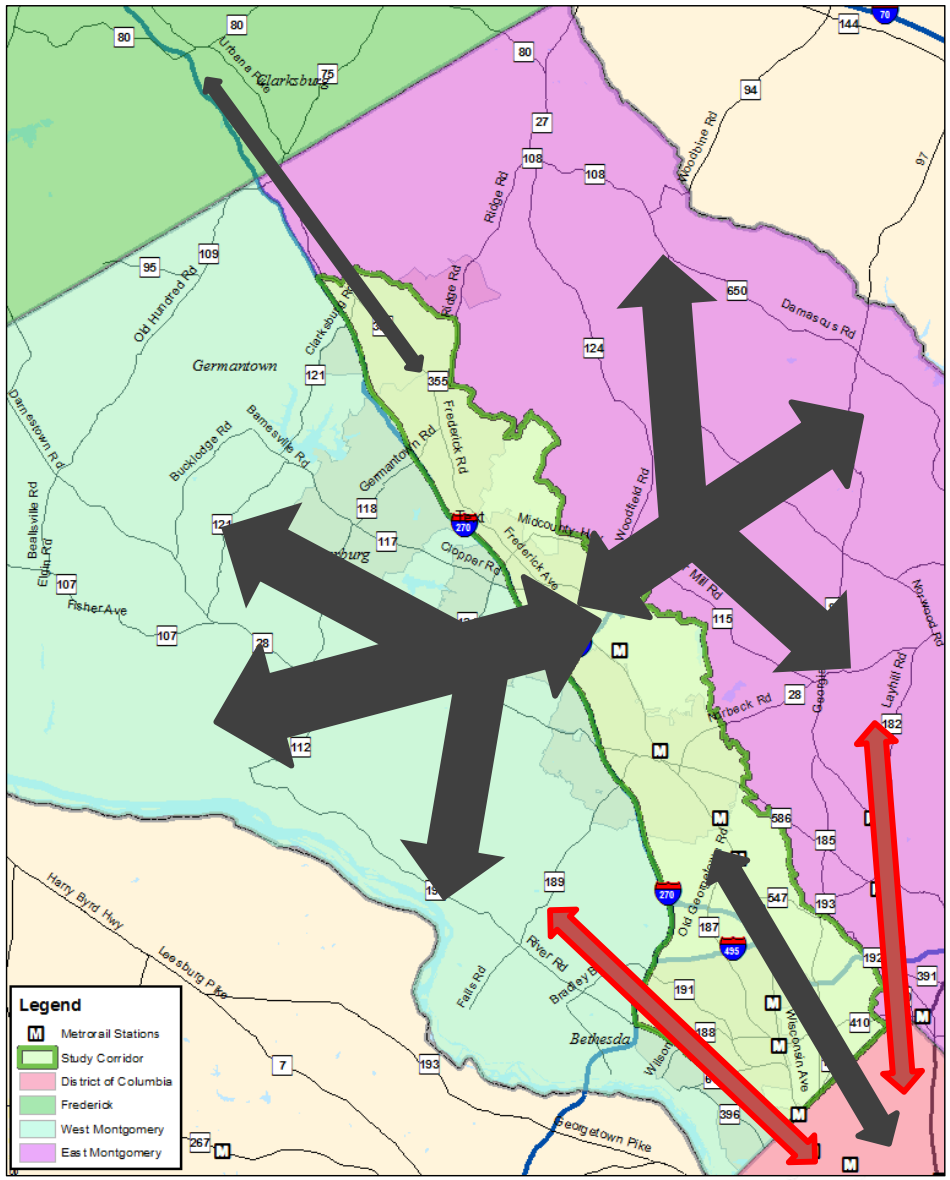
Source: 2040 No-Build Analysis, MWCOG

Travel Markets: To/From Study Area

- Daily Trips to/from the Study Corridor (2040):

	Total Daily Trips	Percent Transit
DC	178,900	38%
Frederick County	59,900	4%
West Montgomery	437,700	7%
East Montgomery	390,900	8%

- An additional 300,000 trips are made between other portions of Montgomery County and DC



Source: 2040 No-Build Analysis, MWCOG

Travel Markets: Through Trips

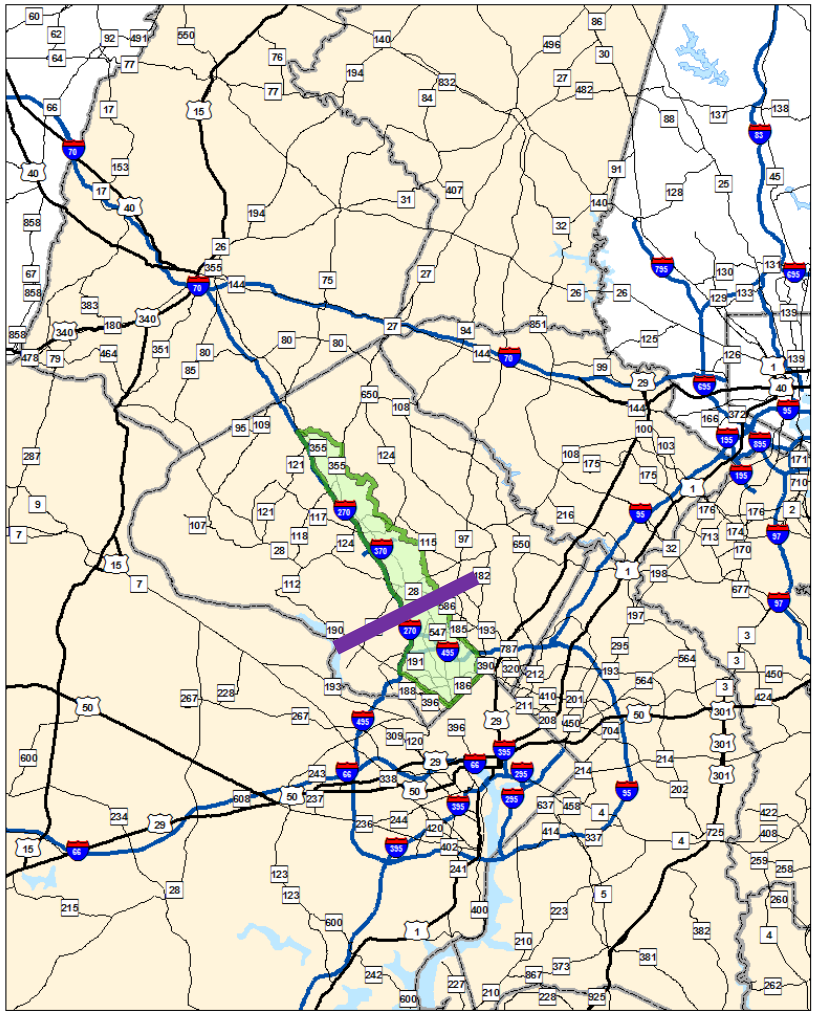
- Commute Trips from Frederick County to DC make up a small portion of commute trips in the region
  - Less than 4% of commuters from Frederick County commute to DC
  - More than 25% of commuters from Frederick County commute to Montgomery County
  - Approximately 24% of Montgomery County commuters travel to DC

From/To	District of Columbia	Frederick, MD	Howard, MD	Montgomery, MD	Prince George's, MD	Other	Grand Total
District of Columbia	160,090	35	570	20,930	15,015	28,330	224,970
Frederick, MD	4,080	60,050	2,300	26,045	1,590	9,063	103,128
Howard, MD	9,930	935	48,684	13,945	13,515	19,699	106,708
Montgomery, MD	105,595	4,715	6,750	259,395	28,475	39,277	444,207
Prince George's, MD	135,285	700	8,620	43,530	152,075	54,393	394,603
Other	213,483	4,690	27,843	42,253	70,229	1,046,886	1,404,384
Grand Total	628,463	71,125	94,767	406,098	280,899	720,054	2,679,000

Source: 2006 – 2010 CTPP

Travel Markets: Through Trips

- How do through trips affect traffic…?



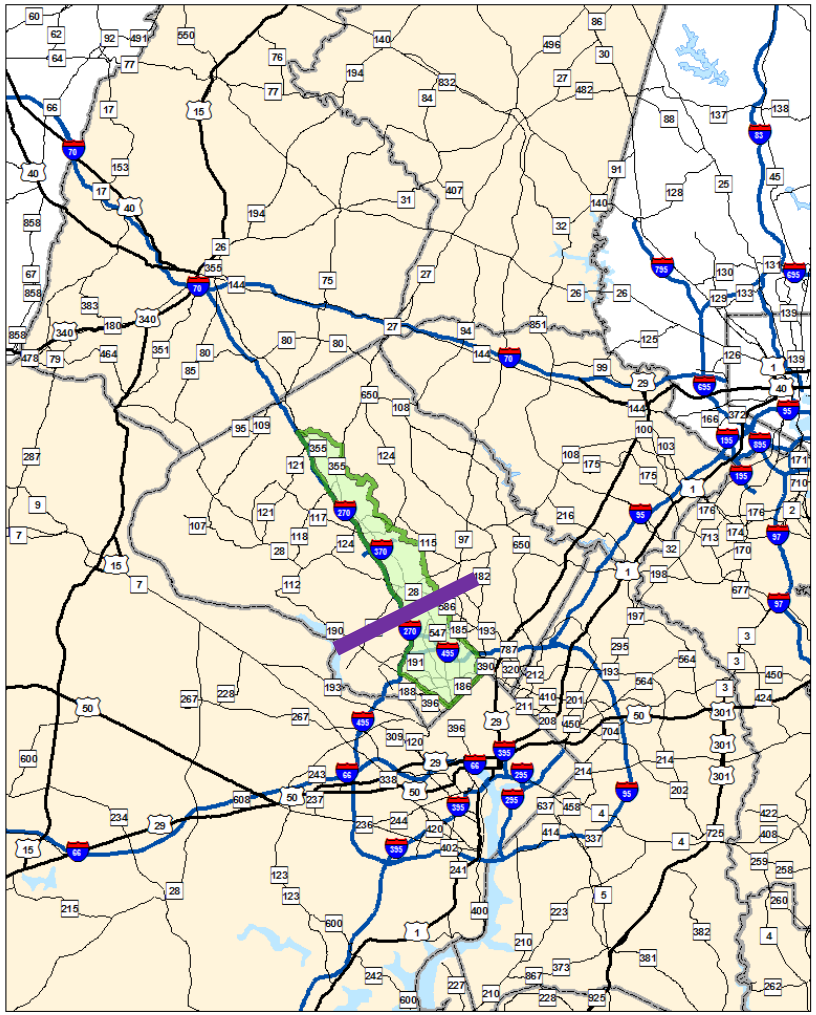
In North Bethesda

- MD 355 and I-270 serve different travel markets
- Long distance trips are better served by I-270:
  - Travel from Clarksburg to Bethesda during the morning peak is 66% faster via I-270 than MD 355
- In North Bethesda:

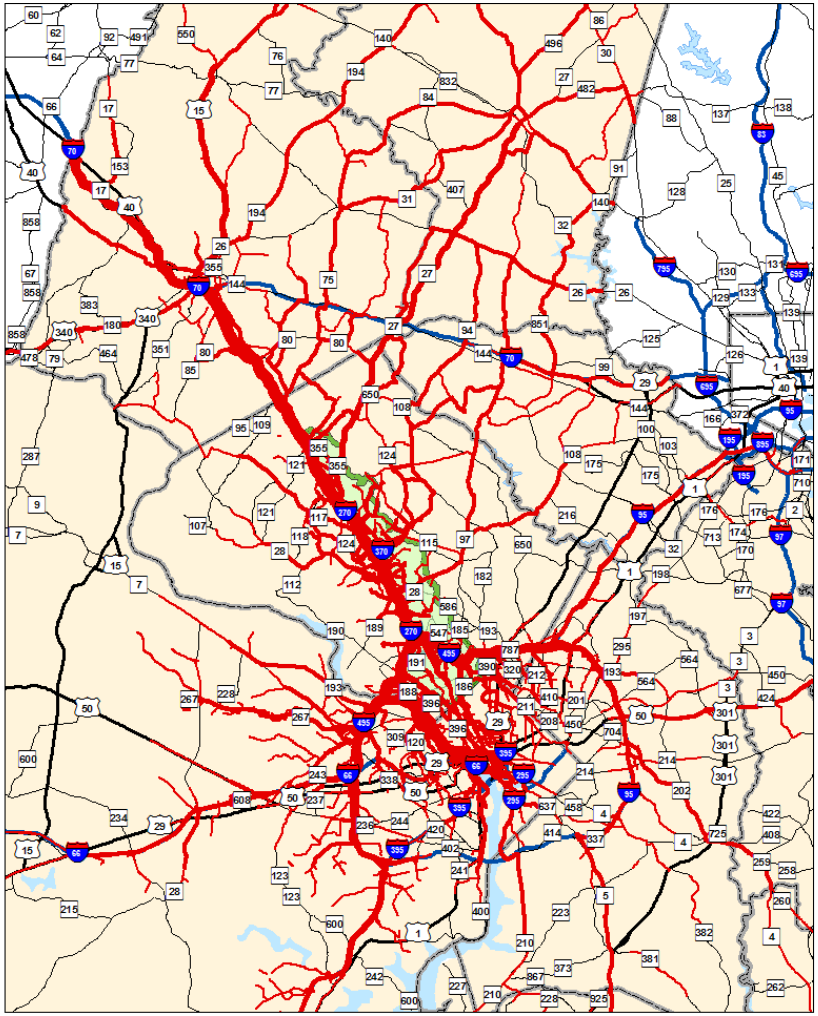
	% Traffic Starting or Ending in Montgomery County
MD 355	83%
I-270	49%

Travel Markets: Through Trips

- How do through trips affect traffic…?



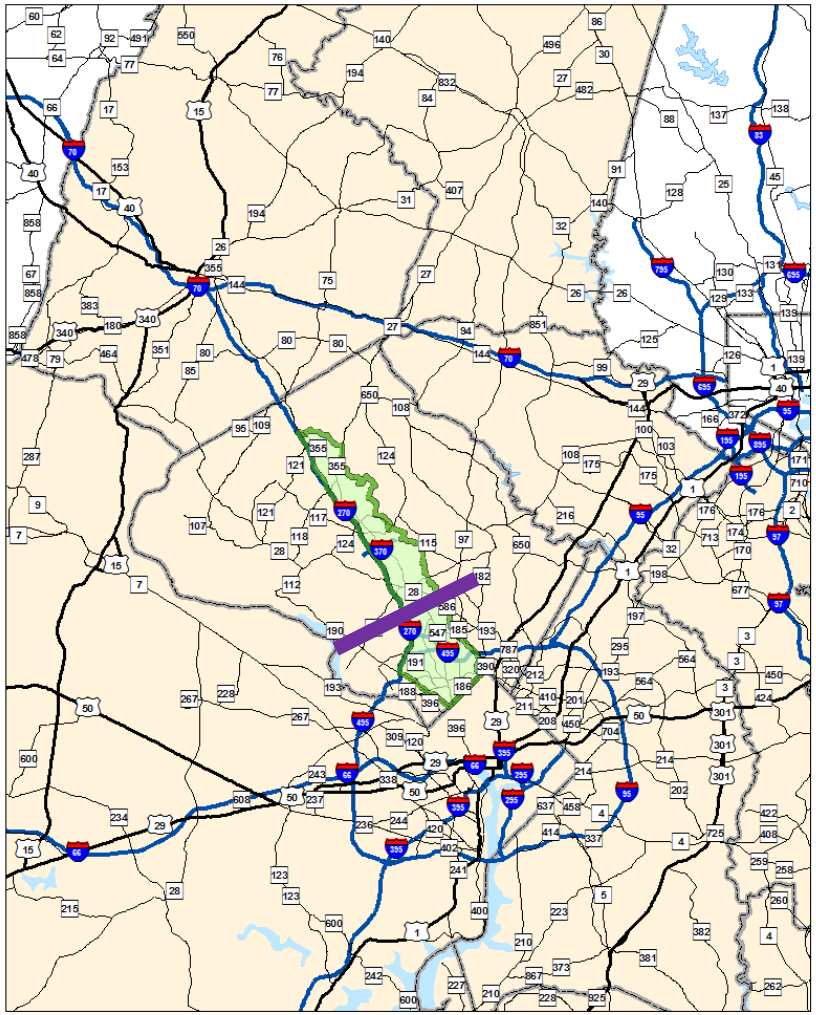
In North Bethesda



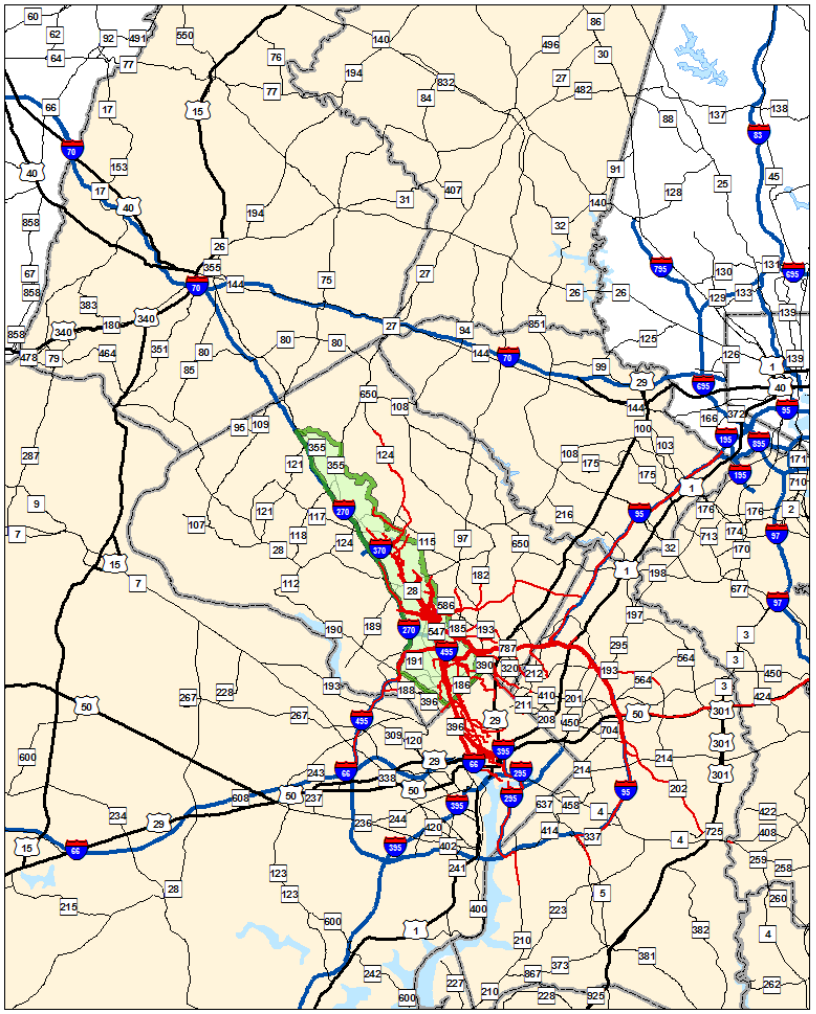
On I-270

Travel Markets: Through Trips

- How do through trips affect traffic…?



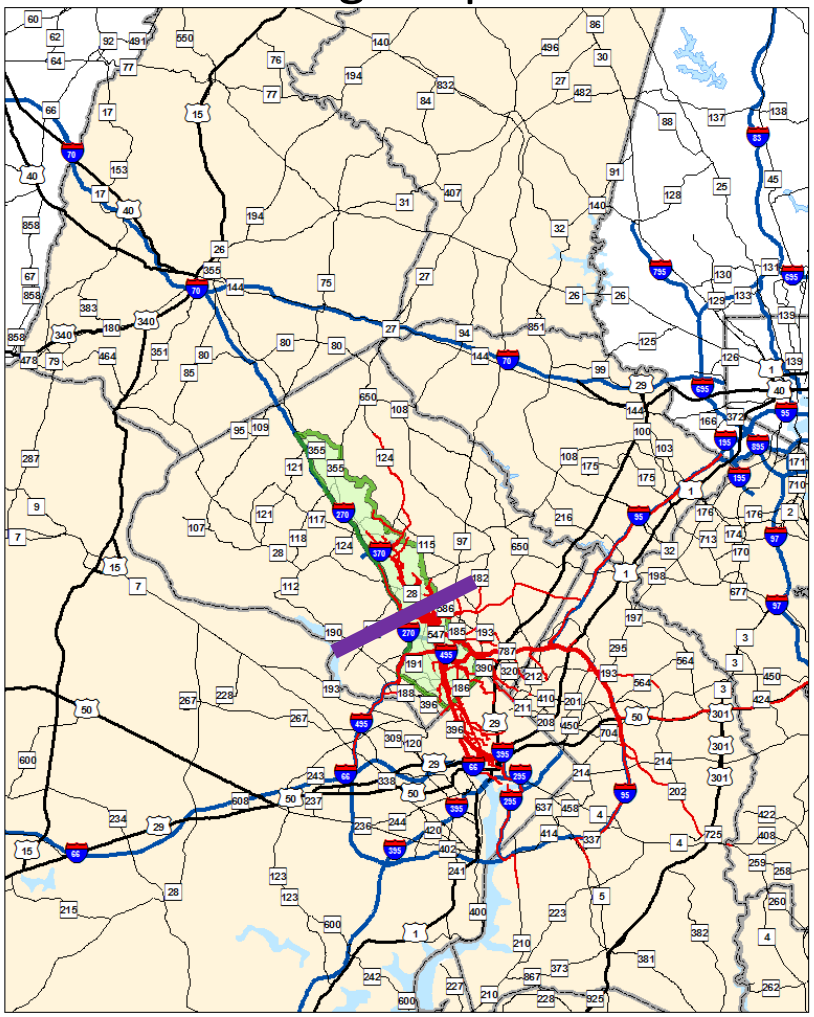
In North Bethesda



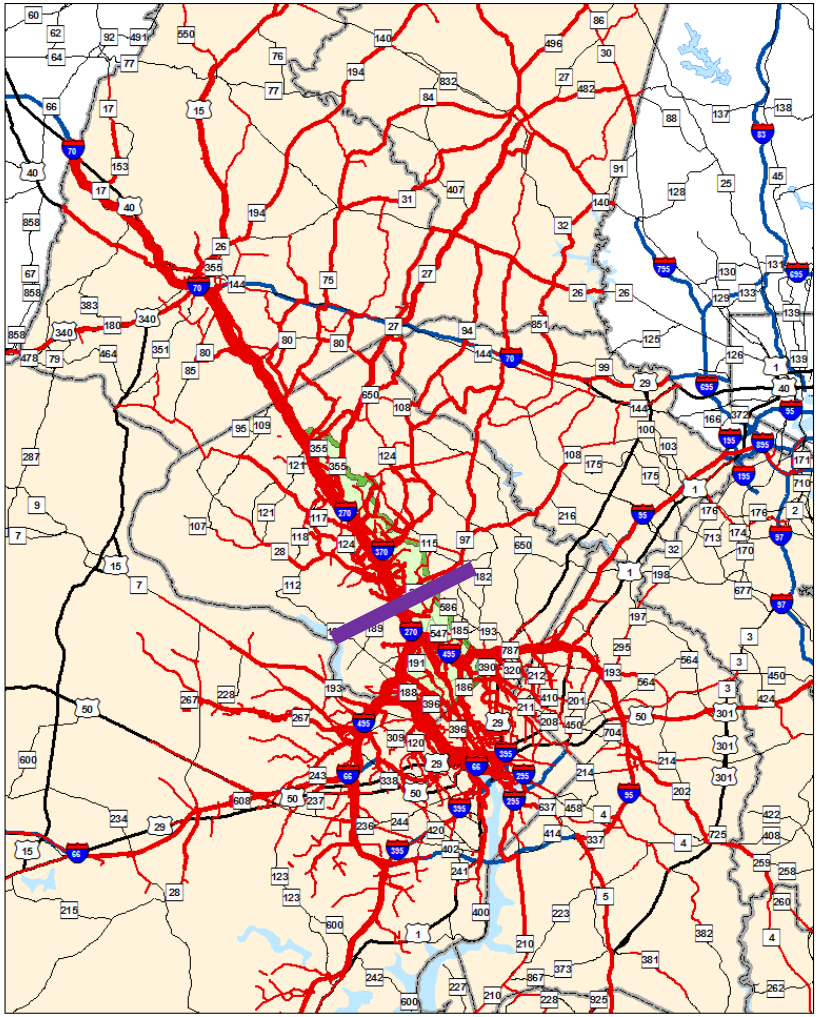
On MD 355

Travel Markets: Through Trips

- How do through trips affect traffic…?



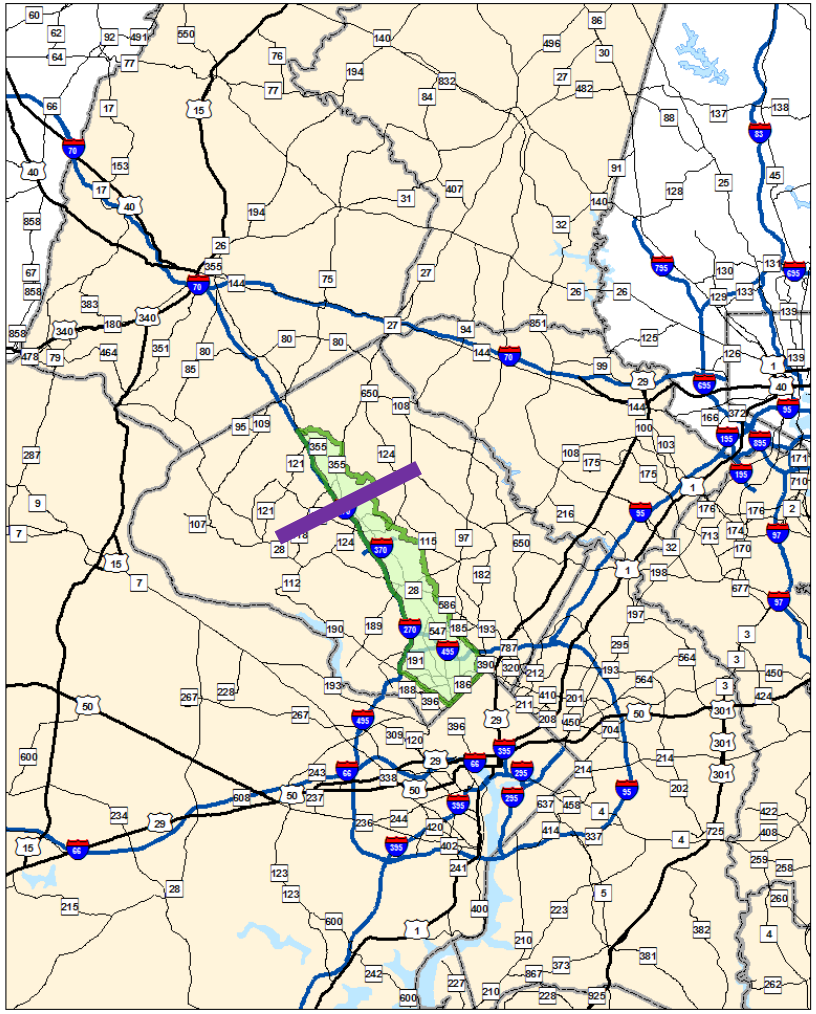
On MD 355



On I-270

Travel Markets: Through Trips

- How do through trips affect traffic…?



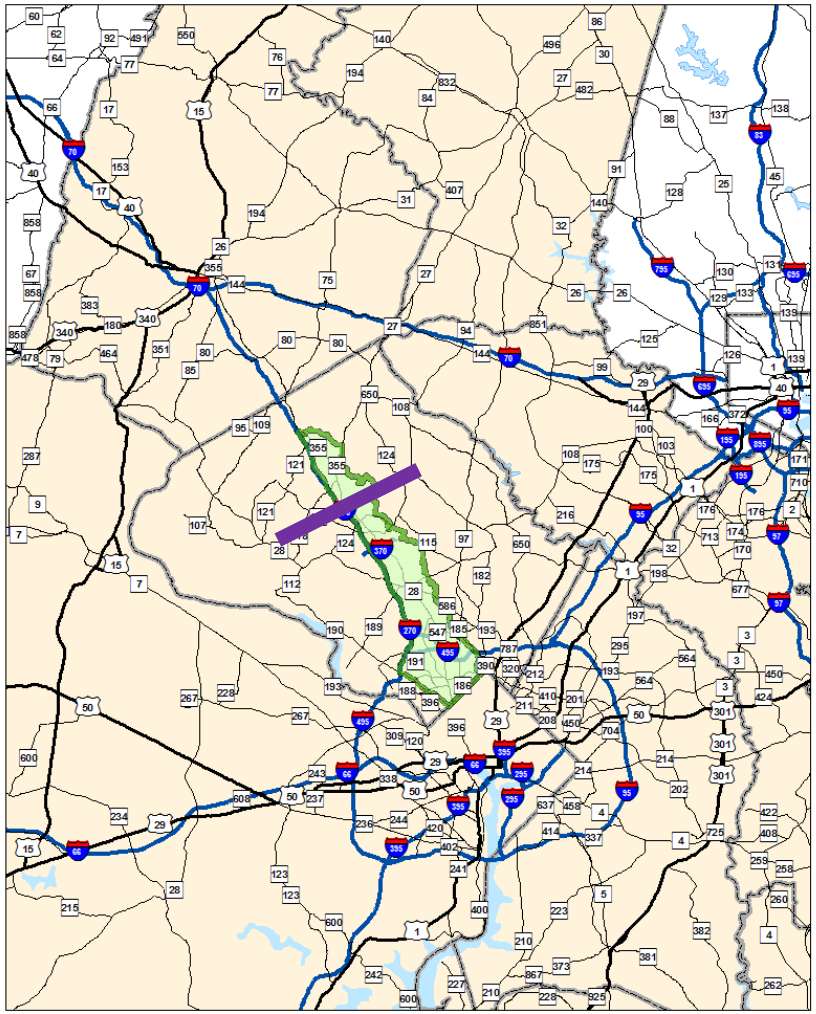
In Germantown

- MD 355 and I-270 serve different travel markets
- Long distance trips are better served by I-270:
  - Travel from Clarksburg to Bethesda during the morning peak is 66% faster via I-270 than MD 355
- In Germantown:

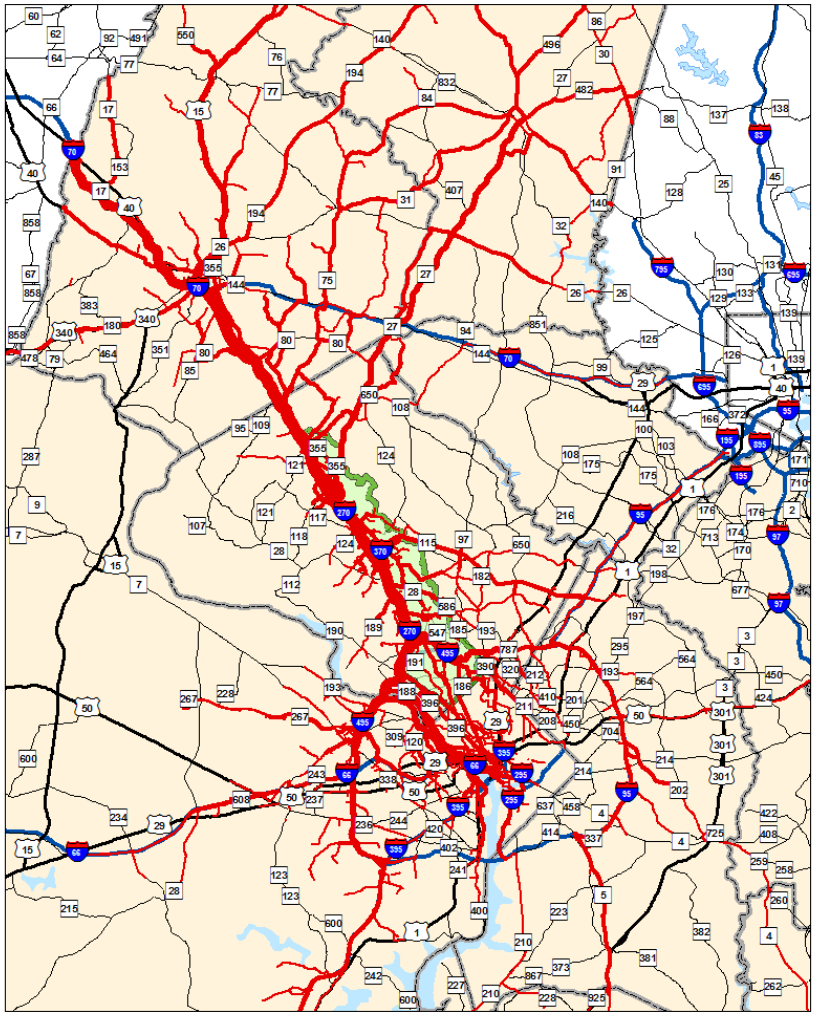
	% Traffic Starting or Ending in Montgomery County
MD 355	85%
I-270	42%

Travel Markets: Through Trips

- How do through trips affect traffic…?



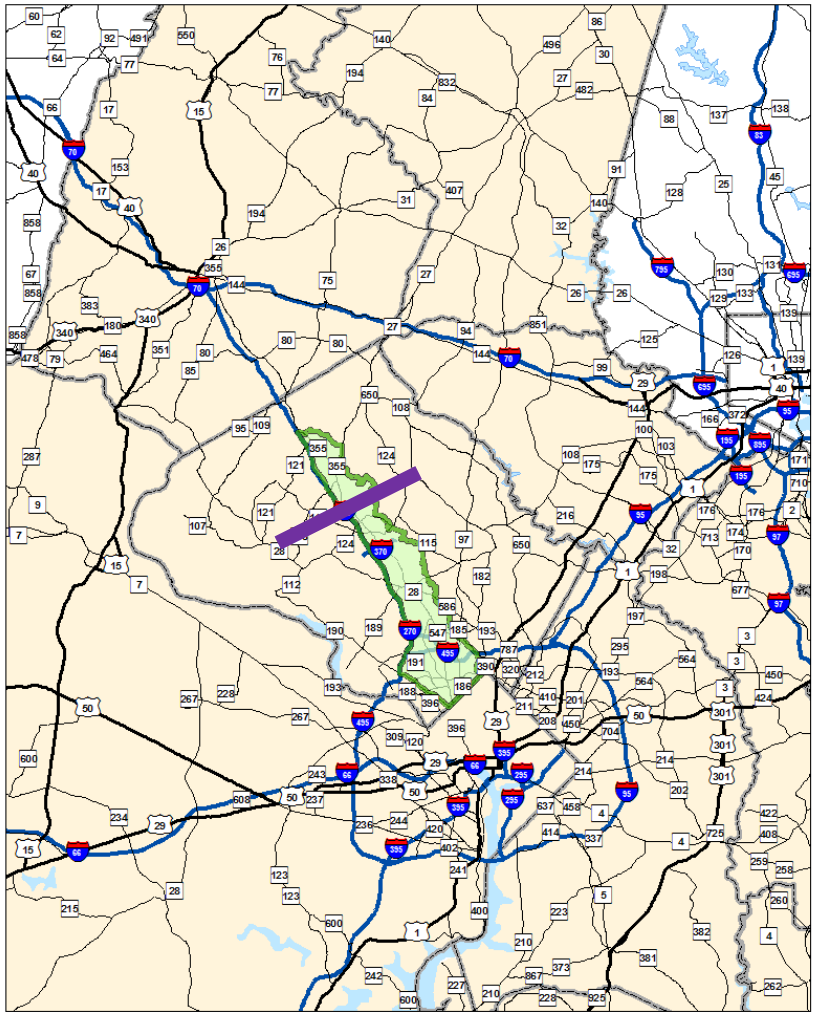
In Germantown



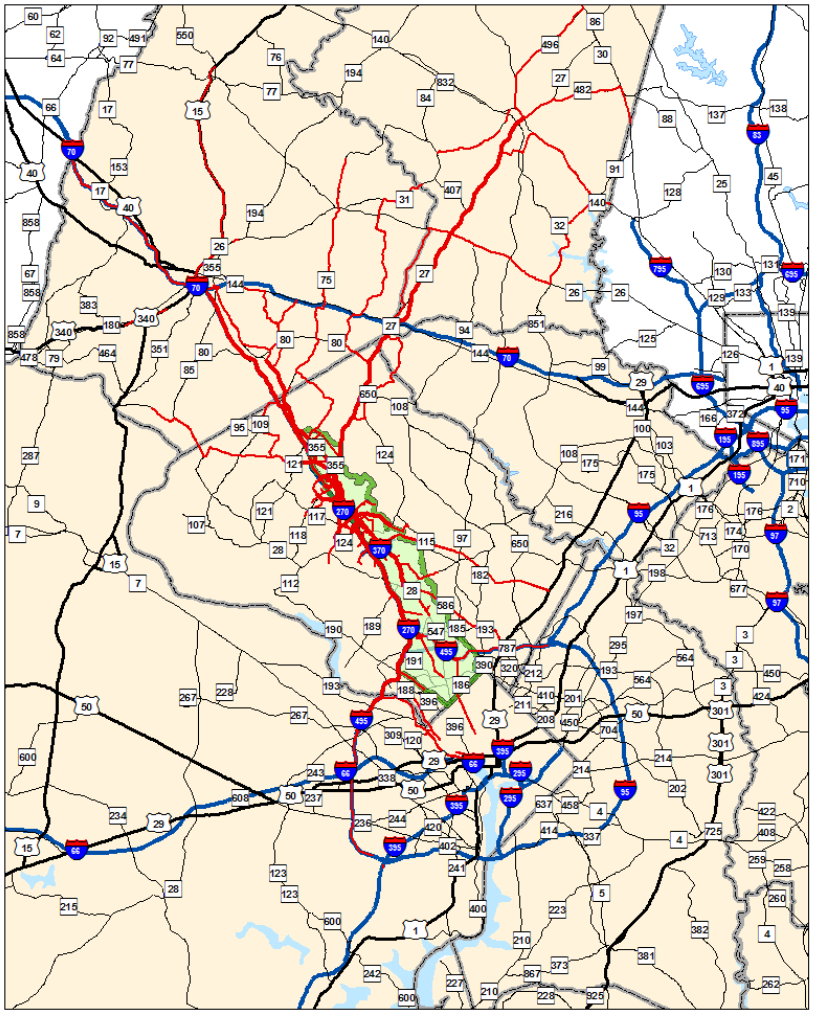
On I-270

Travel Markets: Through Trips

- How do through trips affect traffic…?



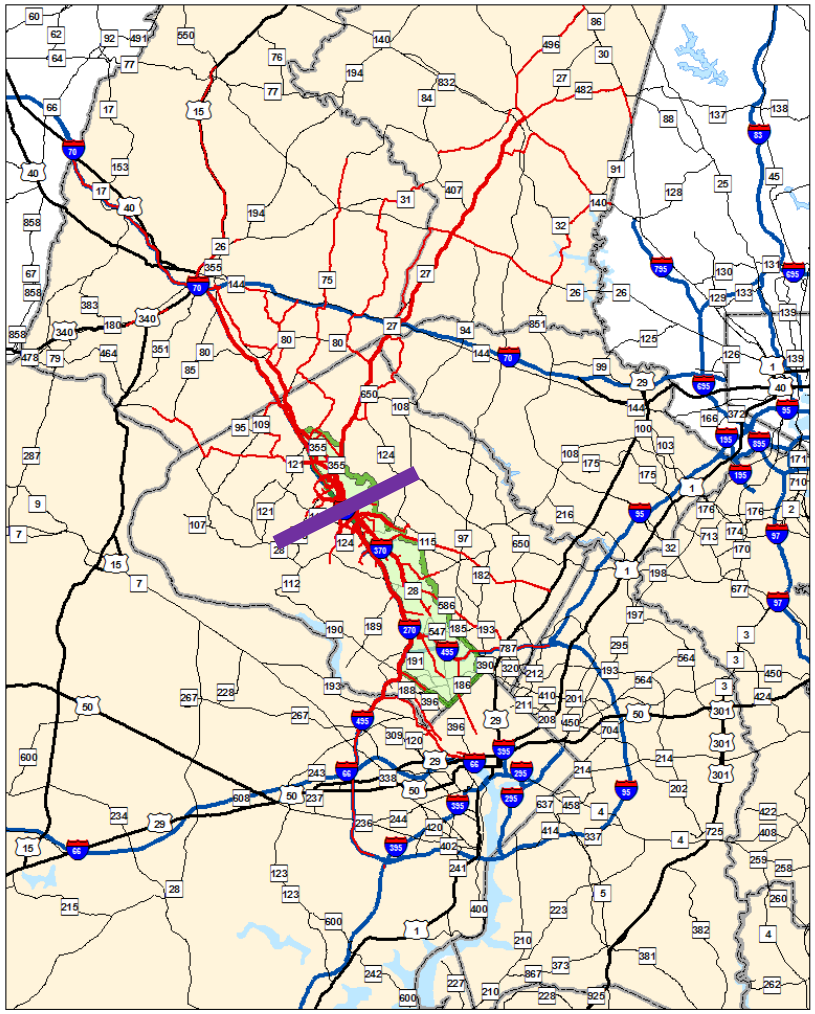
In Germantown



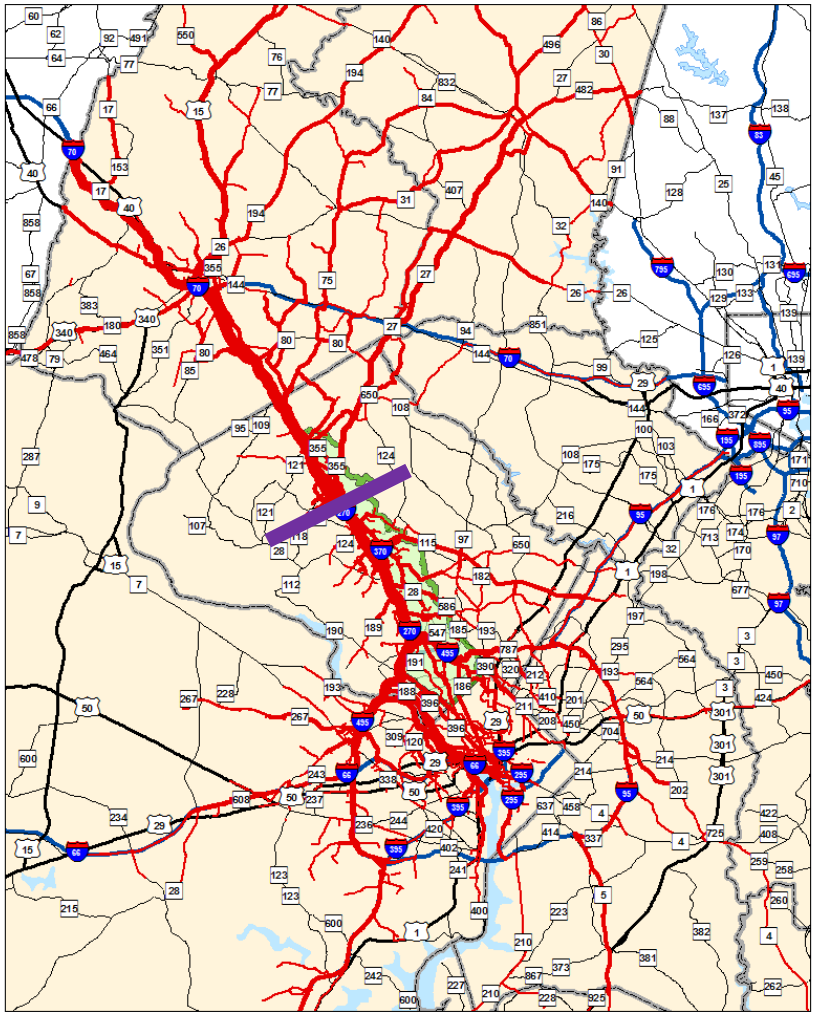
On MD 355

Travel Markets: Through Trips

- How do through trips affect traffic…?



On MD 355



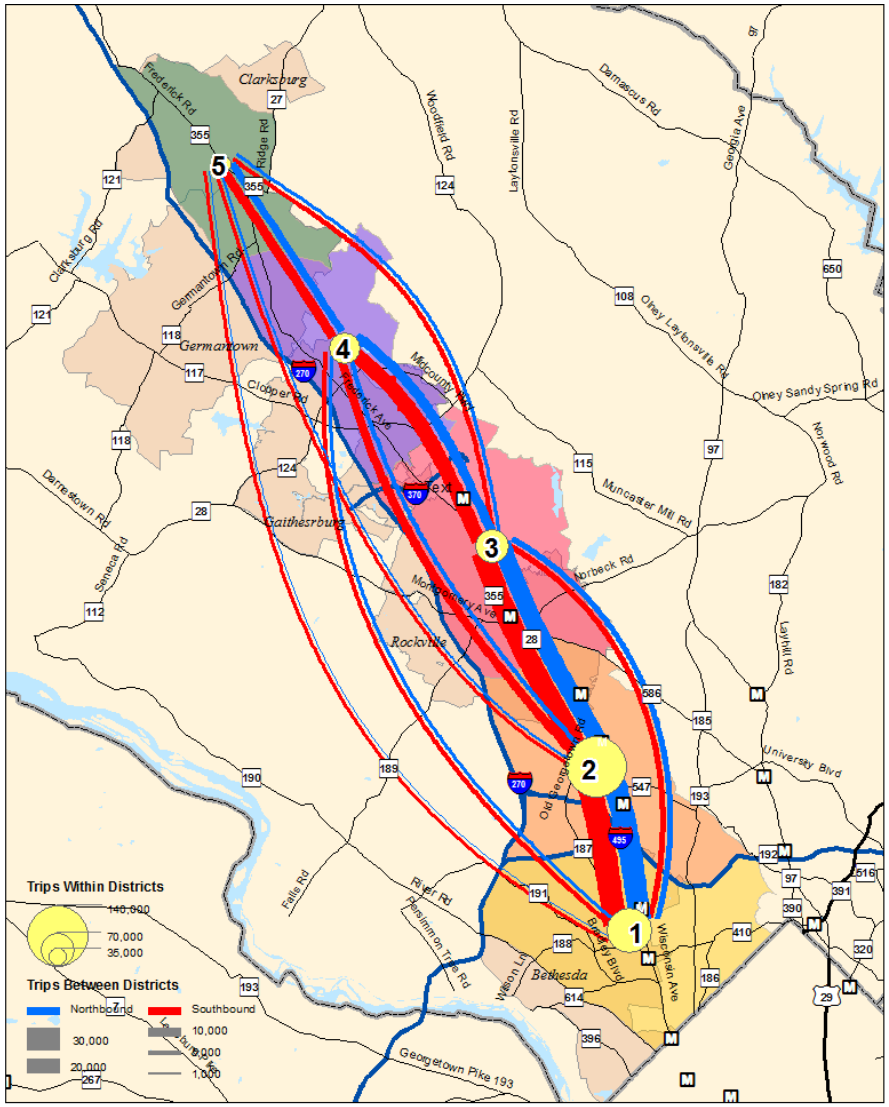
On I-270

Travel Markets: Within Study Area

- Intra-Study Area Trips forecast to grow by 27% by 2040
  - 504,000 in 2014
  - 639,000 in 2040
- Short trips prevalent: Largest numbers of trips within districts, or between adjacent districts
- Major market for future trips within the corridor is non-Commute trips
- Most trips in 2040 are associated with District 2

From/To District	1	2	3	4	5	Corridor Total
1	101,942	29,794	6,134	2,086	471	140,427
2	33,964	143,191	25,101	5,405	1,112	208,773
3	7,852	28,843	68,343	13,512	1,863	120,413
4	5,002	10,635	20,008	66,741	7,901	110,287
5	2,081	3,642	4,662	13,000	35,890	59,275
Corridor Total	150,841	216,105	124,248	100,744	47,237	639,175

Source: 2040 No-Build Analysis, MWCOG



Questions: Mode Outputs

- ✓Introduction, Background and Review
- ✓Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor
- ✓Regional Travel Demand Model and Forecasts
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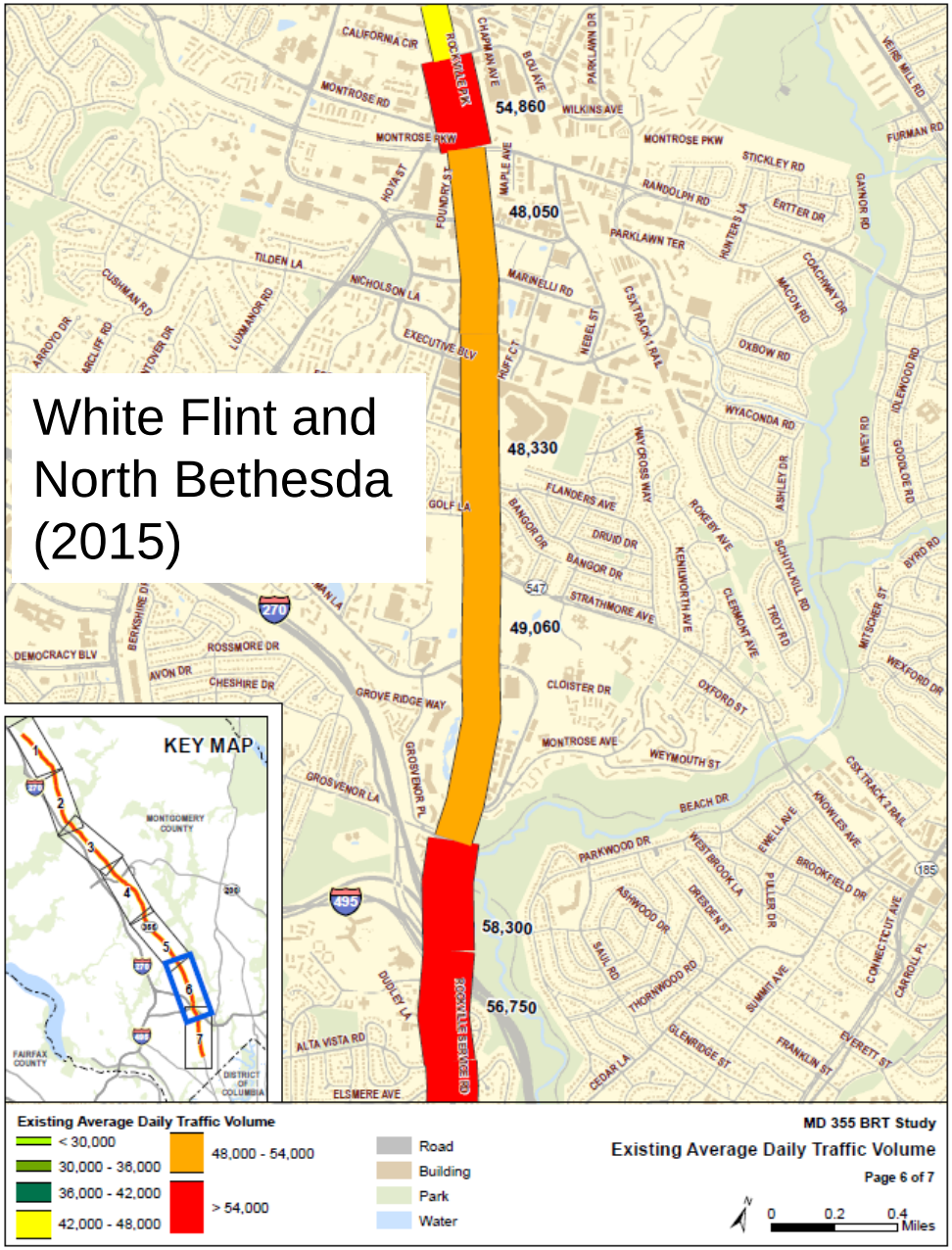
2040 Future No Build Traffic Forecasts

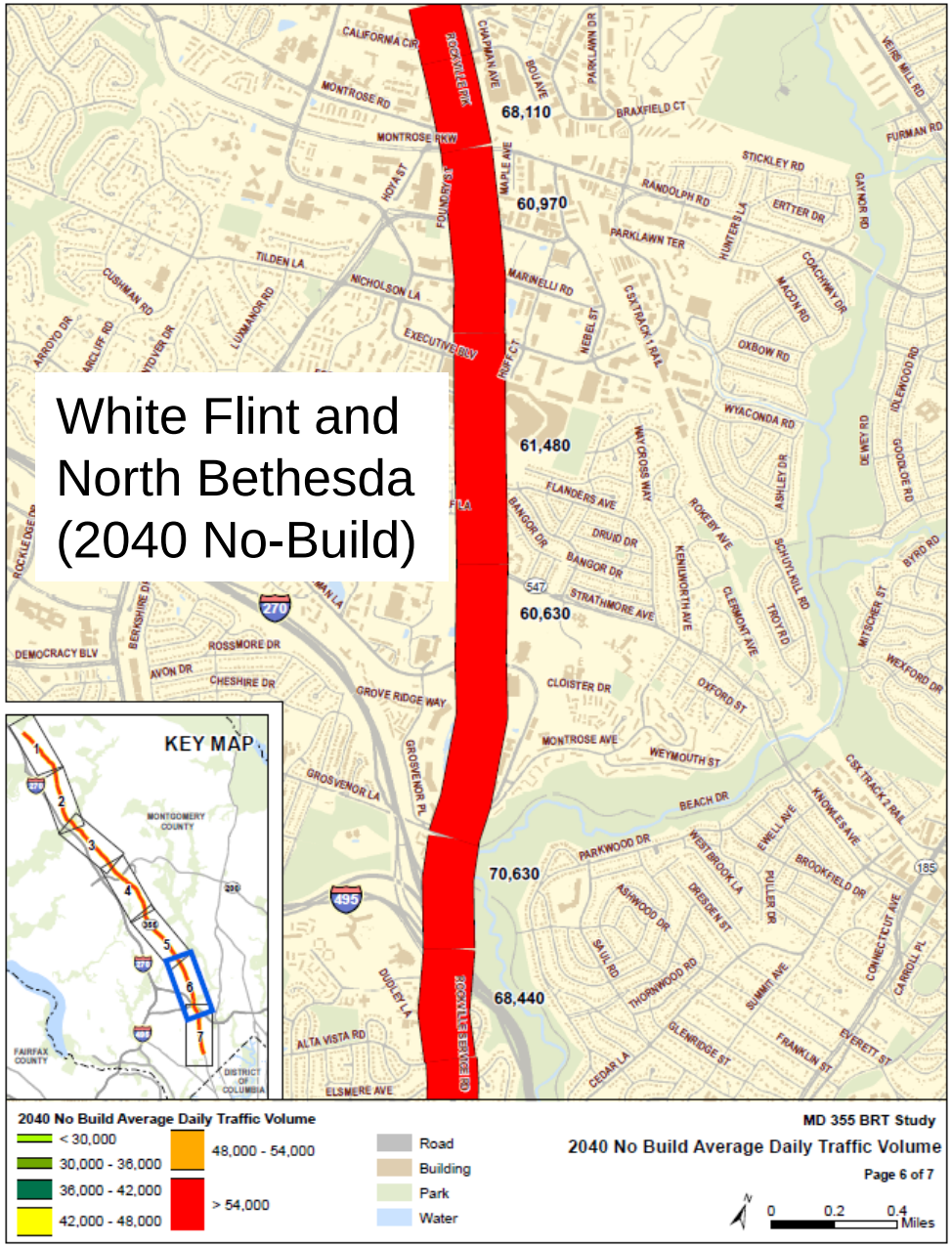
- MWCOG Travel Demand Model provides Average Daily Traffic (ADT) volumes for roadway links
- Raw data from model post processed using industry standard procedures
- **NCHRP Report 765** - methodology for converting future raw model ADTs to usable ADTs based on comparison of 2015 model volumes versus 2015 counts
- Grow peak hour volumes for links and intersection movements based on percentage of ADT growth
- Review area Traffic Impact Study reports for additional data points

Traffic Forecasts – 2040 No-Build Results

White Flint and North Bethesda (2015)



White Flint and North Bethesda (2040 No-Build)



Regional Travel Demand Model and 2040 No-Build Forecasts

Key Takeaways:

- Use Industry Standard Methodologies
- Latest Planning Assumptions
- Latest Regional Travel Demand Model
- Corridor-focused Approach
- Calibrated & Validated Network for both vehicles and transit
- Travel Markets
  - Short trips
  - Trips within the Study Corridor
  - Many non-commute trips along the corridor

Questions: Review

- ✓Introduction, Background and Review
- ✓Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor
- ✓Regional Travel Demand Model and Forecasts
- ✓2040 No-Build Traffic Volumes for MD 355 Corridor
- ✓Q&A
- MD 355 Traffic Operations (Existing and 2040 No-Build)
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Traffic Operations Agenda

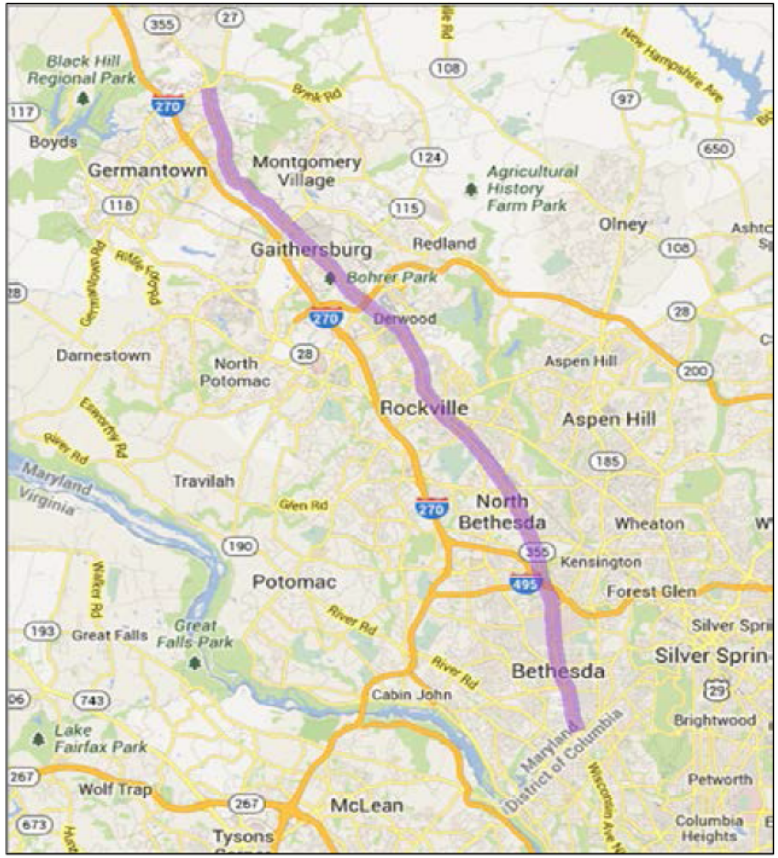
- Data Sources
- Software Used
- Traffic Operations Methodology
  - Existing Volumes and Network Inputs
  - Calibration and Evaluation Measures
  - Future No Build Assumptions and Results

Traffic Operations – Data Sources

- Existing traffic (cars, trucks, and pedestrian) counts are from the Maryland State Highway Administration's Traffic Monitoring System (TMS) (*previously discussed in Existing Traffic slides*) (http://shagbhisdadt.mdot.state.md.us/itms_Public/default.aspx)
- Signal timing were the latest available from Montgomery County's Division of Traffic Engineering and Operations
- Bus travel time & boarding/alighting from WMATA, Ride On, and MTA
- Field Observations (7:00-9:00am and 4:00-6:00pm)
  - Vehicle and Bus Travel Times by segment
  - Intersection queuing, driver behaviors, lane configurations, signal timing and phasing data
  - Congestion patterns using the Maryland SHA Mobility Report for validation of simulation model (page III.B.23) http://apps.roads.maryland.gov/SHAServices/mapsBrochures/brochuresAndPublications/SHA_Mobility_Report.pdf
- MWCOG model growth (*previously discussed in the Travel Demand Forecasting slides*)

Traffic Operations – Data Sources (MD SHA Mobility Report – MD 355)

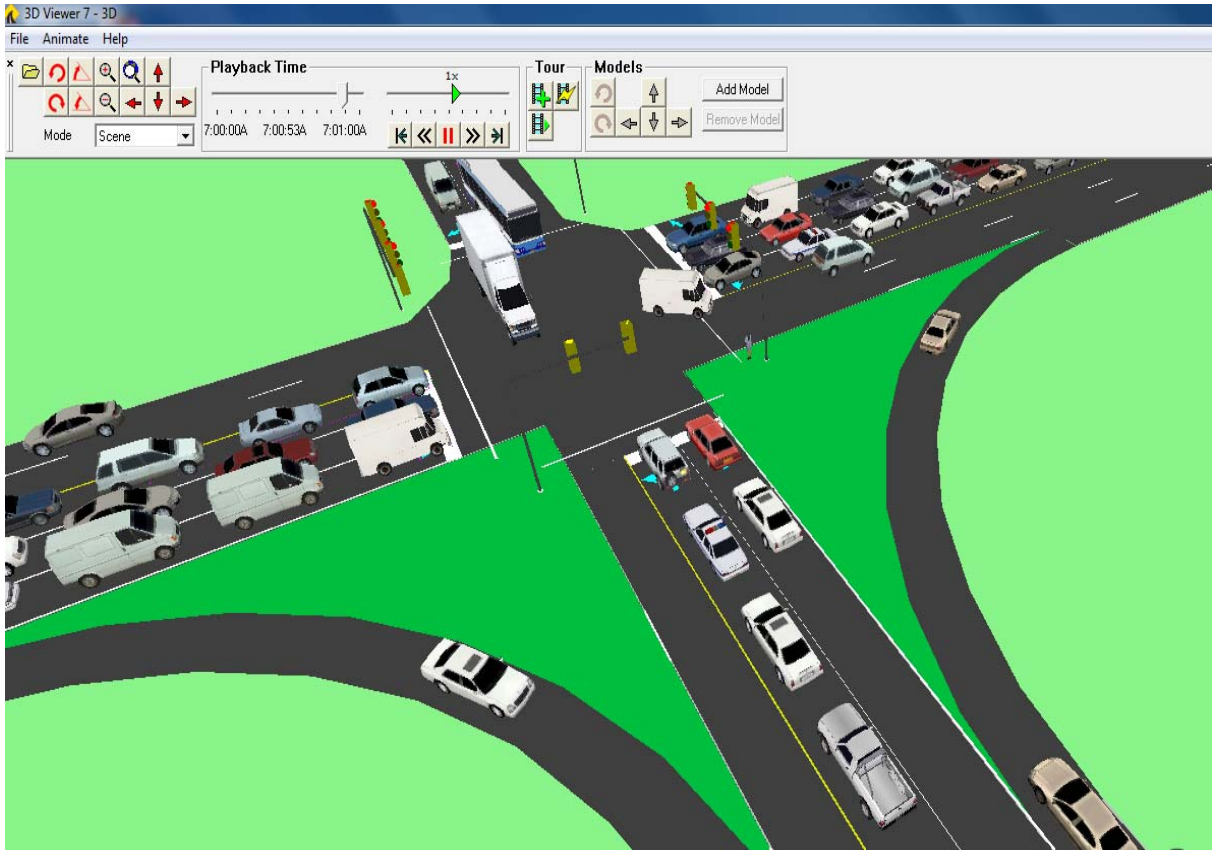
Limits:	Washington DC Line to MD 27			
Corridor Length:	19.7 miles			
Speed Limit:	25 MPH – 45 MPH			
Travel Lanes:	(2-4) Northbound (2-4) Southbound			
Signal Controlled Intersections:	80			
Grade Separated Interchanges:	3			
Major Cross Streets:	MD 191, MD 410, MD 547, MD 187, Montrose Pkwy, MD 28, Shady Grove Rd, I-370, MD 117, MD 124, Middlebrook Rd, MD 118, MD 27			
Routes and Ridership:	Ride On Routes	Avg Daily Ridership	Red Line Routes	Avg Daily Ridership
	Ride On 46	3,683	Shady Grove	13,444
			Rockville	4,900
	Ride On 55	7,920	Twinbrook	4,569
			White Flint	3,951
			Grosvenor	5,857
	Ride On 75	479	Medical Center	6,221
			Bethesda	10,608



2012 AADT	Truck Percentage	Peak Hour Traffic Percentage
33,000 - 64,000	2 - 6	7.5% - 9%

Traffic Operations – Software Used

- **Synchro/SimTraffic 9.0**
  - Macroscopic/microsimulation software
  - Inputs
    - Existing AM and PM peak hour traffic volumes
    - Projected 2040 peak hour volumes
    - Includes trucks
    - Lanes, speed, signal timings
  - Able to optimize signal timing – Future Build
  - Limited ability to model complex operations such as BRT
  - Used for No Build and Purpose and Need



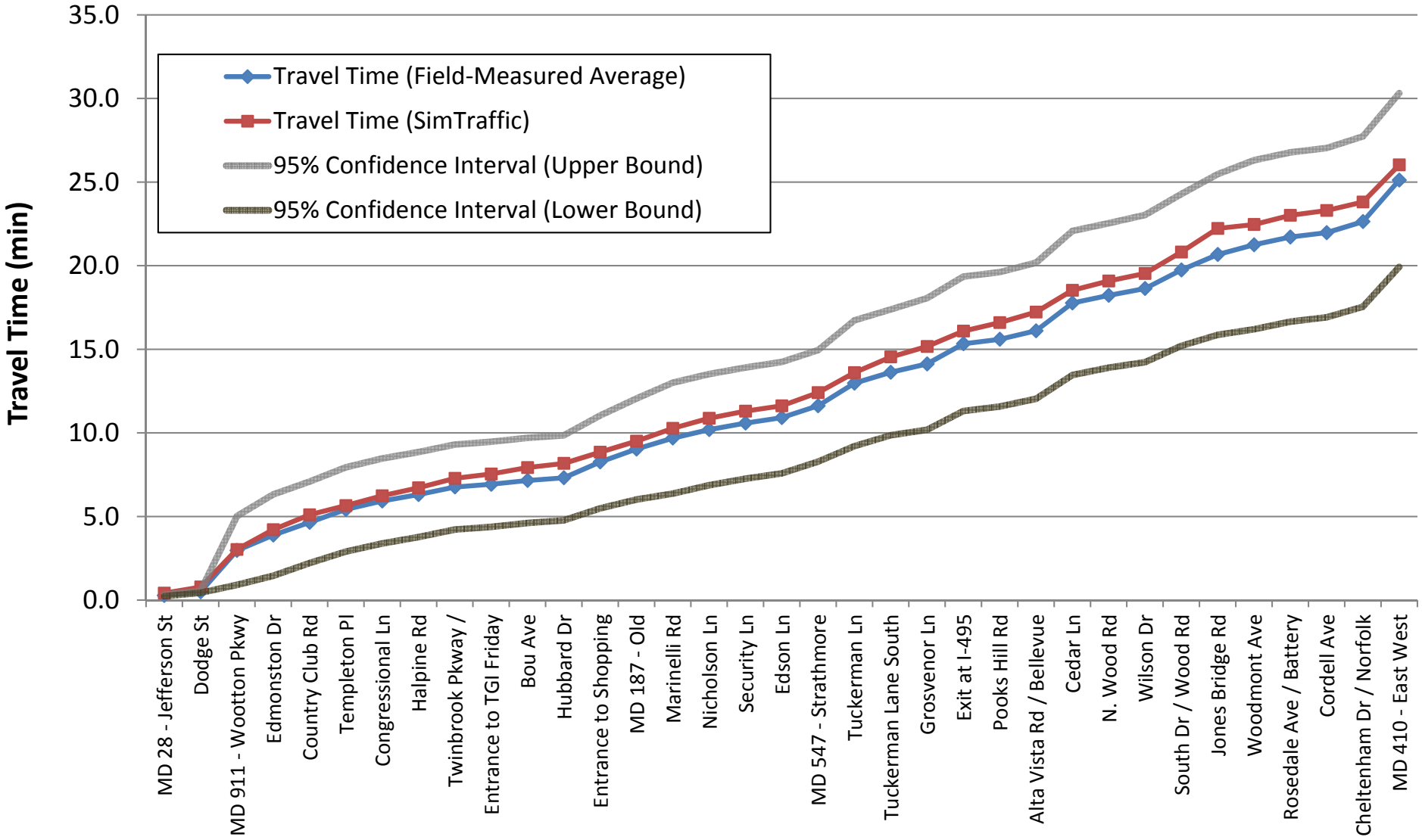
Traffic Operations – Software Used

- **VISSIM 7.0 (In Preparation)**
  - Microscopic simulation software
  - Dynamic interaction of
    - Vehicles,
    - Pedestrians/bicycles,
    - Transit;
  - Model complex operations (e.g., transit signal priority, BRT, streetcar)
  - Inputs
    - Existing AM and PM peak hour volumes
    - Projected 2040 peak hour volumes
    - Includes trucks
    - Lane, speed, signal timings
    - Transit routes/schedules, stops, and boarding and alighting data
  - Benefits
    - More refined analysis of screened alternatives
    - Report the traffic operations results for all modes including transit and pedestrian

Questions: Travel Operations Data and Software Used

- ✓Introduction, Background and Review
- ✓Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor
- ✓Regional Travel Demand Model and Forecasts
- ✓2040 No-Build Traffic Volumes for MD 355 Corridor
- ✓MD 355 Traffic Operations (Existing and 2040 No-Build)
  - ✓Data and Software Used
  - Model Calibration
  - Model Outputs
- MD 355 Crash History Data
- Additional Technical Q&A

Traffic Operations – Calibration Example



MD 355 AM Peak Hour
Southbound

Cross Streets / Direction of Traffic Flow →

Questions: Traffic Operations Model Calibration

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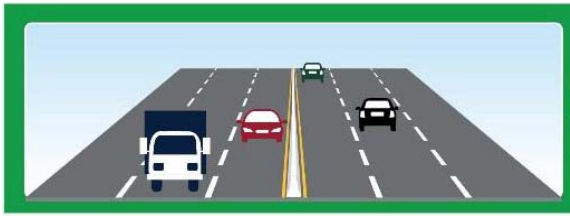
Traffic Operations – Model Outputs

- Vehicle delays per approach/intersection:
  - Level of Service (LOS) grade based on Highway Capacity Manual (HCM)
- Intersection-to-intersection car travel times (SimTraffic and VISSIM)
- Transit travel times and reliability measures (VISSIM)
- Pedestrian delays at certain intersections (BRT Station Areas – VISSIM)

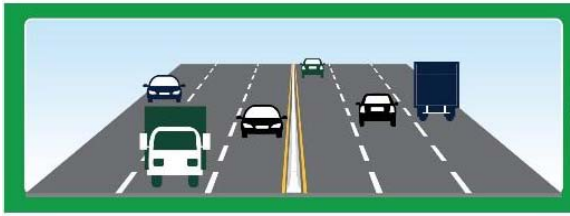
Why are these Model Outputs important?

- Show operational change over time –2015 versus 2040
- Compare future alternative scenarios analysis results
- Help identify potential issues with future scenarios

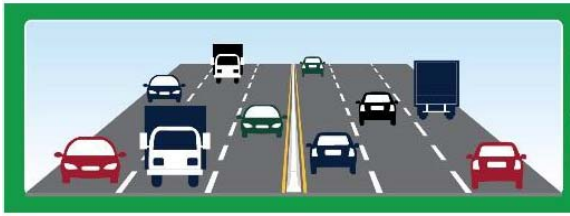
Traffic Operations – Level of Service



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



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



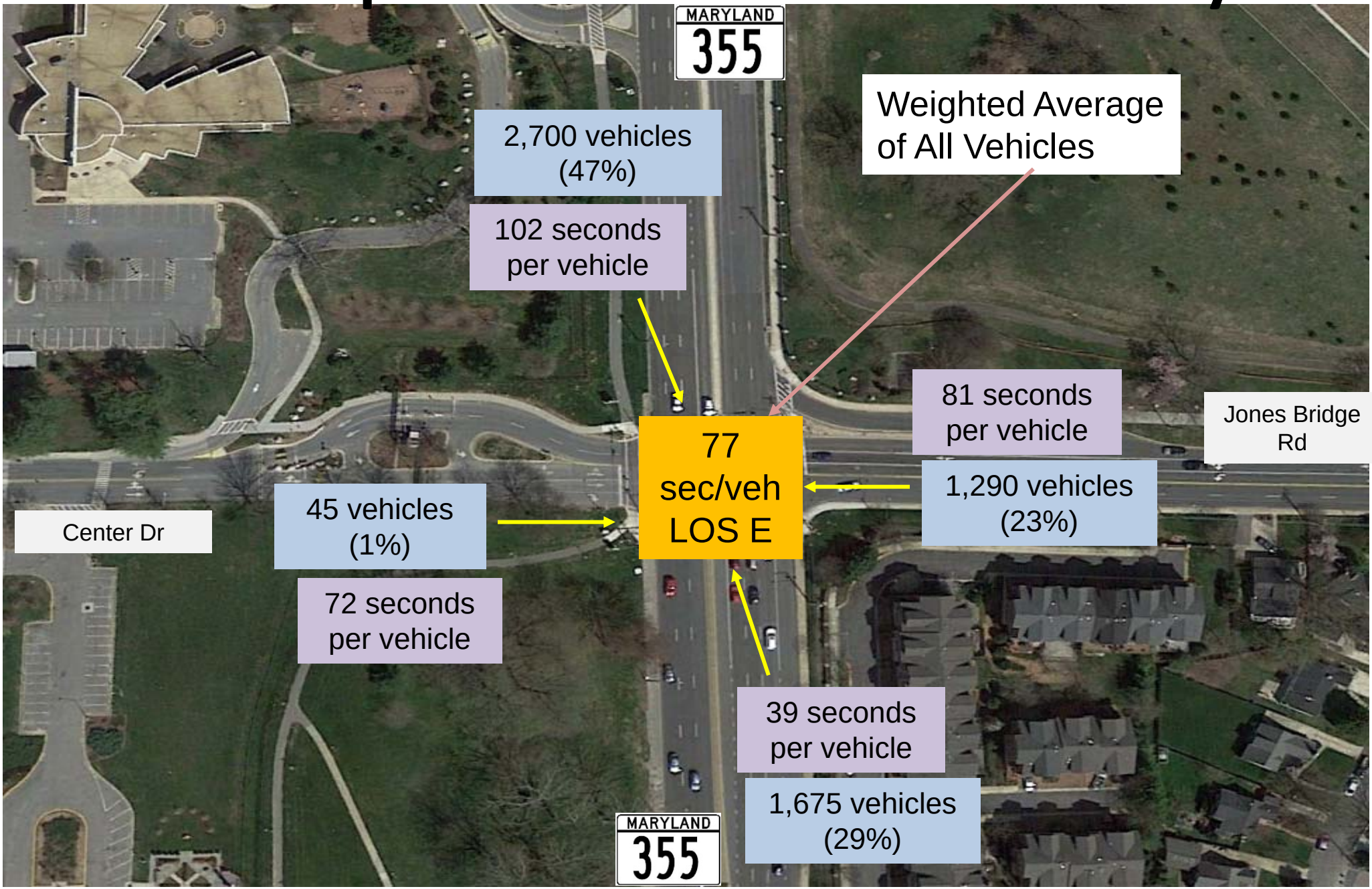
LOS C | Stable Flow
Segment: Travel speed as a % of free flow speed > 50 to 67%
Intersection: Delay between 20 to 35 seconds/vehicle

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

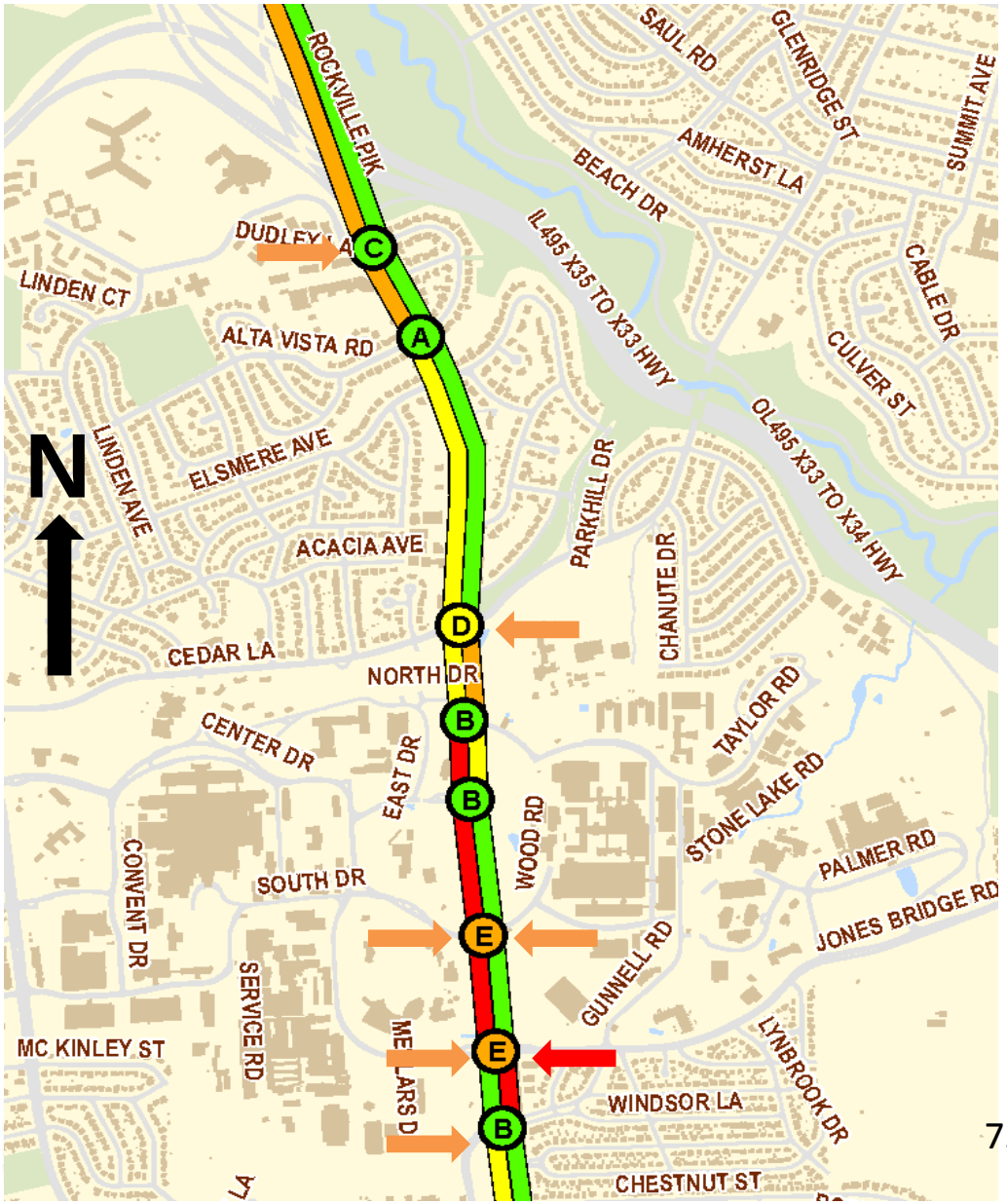
LOS E | Unstable Flow
Segment: Travel speed as a % of free flow speed > 30 to 40%
Intersection: Delay between 55 to 80 seconds/vehicle

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

Traffic Operations – Intersection Delay



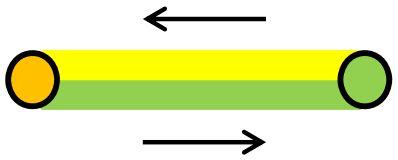
Traffic Operations – Intersection LOS and Corridor Speed (Synchro/SimTraffic: 2040 No Build AM Example)



Overall Intersection LOS (based on Synchro delay)

- LOS A, B, C
- LOS D
- LOS E
- LOS F

Link LOS (based on SimTraffic speeds)



Approach LOS (based on Synchro delay)

- LOS E
- LOS F

Traffic Operations

Key Takeaways:

- Latest software used for operational analysis
- Recent data used in the development of the models
- Calibrated & Validated Networks for both vehicle and transit
- Model outputs relevant to the bus rapid transit study

Questions: Traffic Operations Model Outputs

- ✓Introduction, Background and Review
- ✓Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor
- ✓Regional Travel Demand Model and Forecasts
- ✓2040 No-Build Traffic Volumes for MD 355 Corridor
- ✓MD 355 Traffic Operations (Existing and 2040 No-Build)
  - ✓Data and Software Used
  - ✓Model Calibration
  - ✓Model Outputs
- MD 355 Crash History Data
- Additional Technical Q&A

Crash History Data

- Crash Data is collected from the Maryland State Police
- Per Federal requirements, a three year period is reviewed for potential safety concerns
  - Approximately 1,900 recorded from 2011 to 2013 for MD 355 study corridor (including 5 fatal crashes)
- Data is compared to State Highway rates for potentially high crash locations (i.e. above State crash rates for each roadway facility type)
- Not just safety issue - crashes negatively impact reliability of travel times
- Pedestrian crashes of particular concern in this study due to the need for access proposed to BRT station locations

Crash History Data - Pedestrians

- Four sections had high pedestrian crash rates
- Total of 65 pedestrian crashes in corridor
- Number of pedestrian crashes noted in parentheses below

Roadway Sections (North to South)	Total Crashes (2011 to 2013)	Crashes Per Mile	Significantly High Crash Types
MD 121 to MD 27	109	33	Opposite Direction, Rear End, Left Turn
MD 27 to Great Seneca Creek	193	66	Left Turn, Angle
Great Seneca Creek to I-370	382	94	Opposite Direction, Left Turn, **Pedestrian (13)**
I-370 to MD 28	339	97	Left Turn, **Pedestrian (15)**
MD 28 to MD 547	444	114	Left Turn, Angle
MD 547 to I-495	132	101	Opposite Direction
I-495 to Cedar Lane	94	127	Sideswipe
Cedar Lane to Woodmont Ave	112	144	Rear End, Left Turn, **Pedestrian (8)**
Woodmont Ave to MD 410	112	122	Rear End, Sideswipe, Left Turn, Angle, **Pedestrian (8)**

Questions: Crash History

- ✓Introduction, Background and Review
- ✓Existing Traffic Volumes and Traffic Volume History for MD 355 Corridor
- ✓Regional Travel Demand Model and Forecasts
- ✓2040 No-Build Traffic Volumes for MD 355 Corridor
- ✓MD 355 Traffic Operations (Existing and 2040 No-Build)
- ✓MD 355 Crash History Data
  - ✓Q&A
- Additional Technical Q&A

Additional Technical Q&A