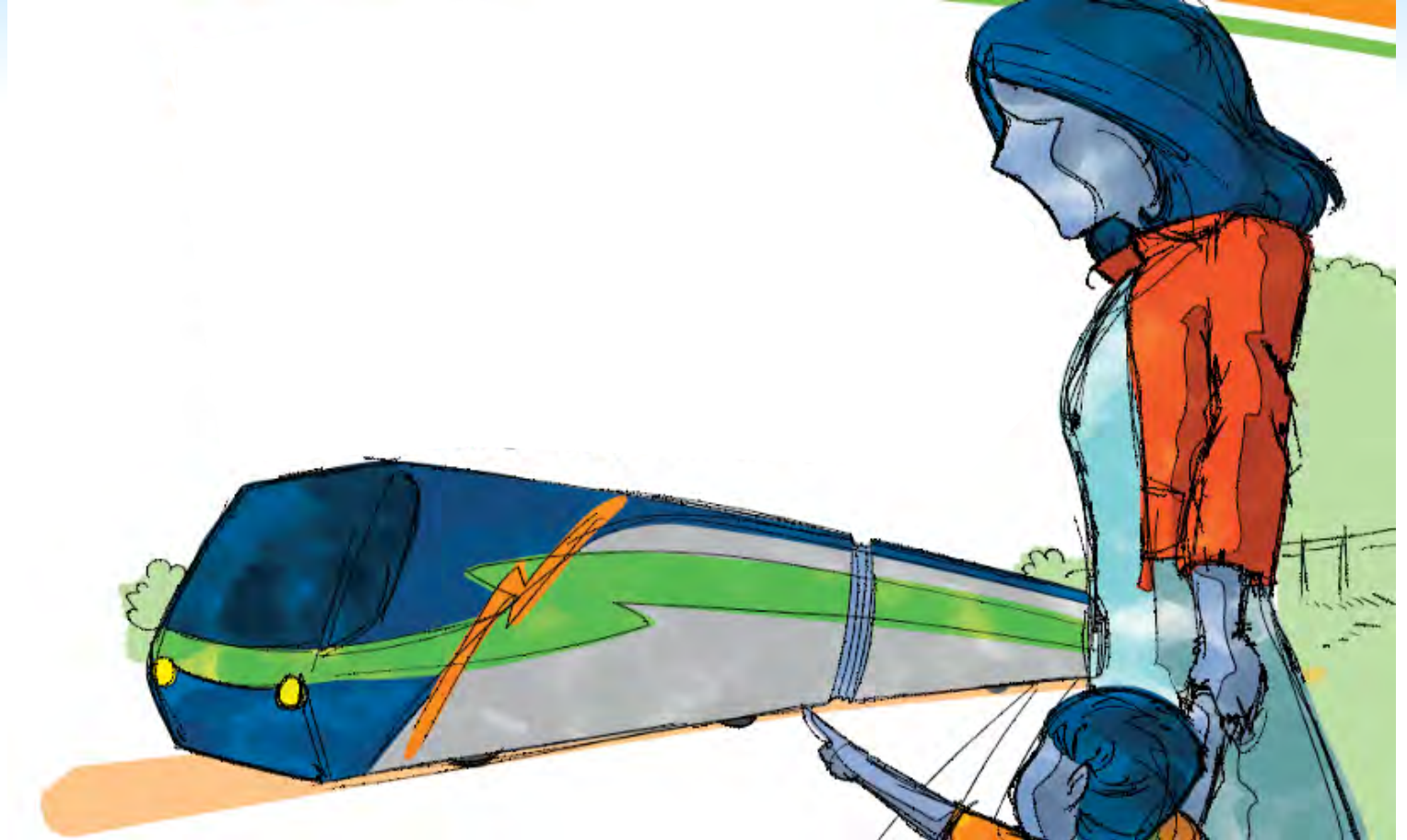


# MD 355 FLASH Phase 2 Study Results

MD 355 Corridor Advisory Committee  
June 3, 4, and 5, 2019

# Agenda

- Project Overview
- Alternatives Review
- Summary of Results
- Discussion





# Project Overview

- Identify the recommended alternative for BRT on MD 355
  - Bethesda to Clarksburg (22 miles)
- Supporting Documents
  - Countywide Bus Rapid Transit Study (2011)
  - Countywide Transit Corridors Functional Master Plan (2013)
  - Service Planning and Integration Report (2014)
  - MD 355 Conceptual Alternatives Report (2017)
  - Various small area master plans and other studies

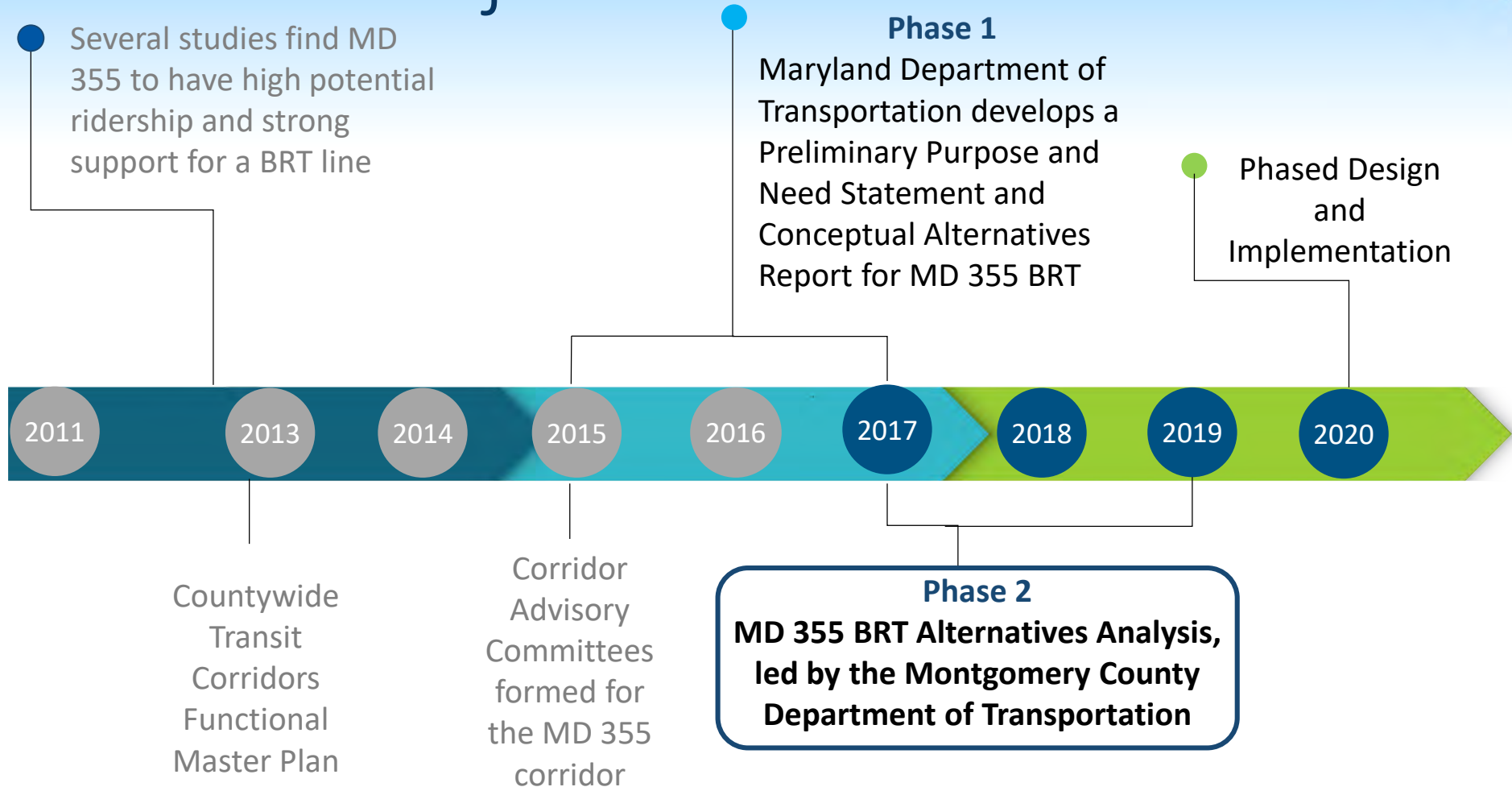


# Project Purpose

**The purpose of the project is to provide a new transit service with greater travel speed and frequency along MD 355 between Bethesda and Clarksburg that will help accomplish the following:**

- Enhance transit **connectivity** and multimodal **integration**
- Improve bus **mobility**
- Address current and future bus **ridership** demands
- Attract **new** riders and provide improved service for **existing** riders
- Support approved Master Planned **growth**
- Improve transit **access** to major employment and activity centers
- Achieve Master Planned non-auto driver **modal share**
- Provide a **sustainable** and **cost-effective** transit service
- Improve **safety** for all

# MD 355 BRT Project Timeline



# MD 355 BRT Project Process

**We are here**



Facility Planning  
Phase 1 (Planning &  
Conceptual  
Engineering)

- Existing Conditions
- Modeling
- Purpose & Need
- Conceptual Alternatives
- Preliminary Impacts
- **Identify Recommended Alternative**



Facility Planning  
Phase 2 (Preliminary  
Engineering)

- Physical investigations
- Surveys
- Right-of-way
- Traffic studies
- Environmental assessments
- Final concepts
- Detailed Scope, Schedule, and Cost Estimate



Final Design



Construction

← Corridor Advisory Committee Input →

← Public Input →

→ Funding Decision



# Briefings and Community Input

**We Are  
Here**



**Public  
Comments  
Due by  
July 11**



**Recommend  
Alternative  
Identified**



**Recommend  
Alternative  
Adopted**

# Questions for MCDOT to answer

(with help from our Stakeholders, CACs, and community-at-large)

- Preferred alternative (by segment)
- Northern alignment(s)
- Project Phasing
- Station Locations



# Project Design Segments

Segment	Geographic Description
7	Clarksburg to Middlebrook Road
6	Middlebrook Road to MD 124
5	MD 124 to Summit Avenue
4	Summit Avenue to College Parkway
3	College Parkway to Dodge Street
2	Dodge Street to Grosvenor Metrorail
1	Grosvenor Metrorail to Bethesda Metrorail



# MD 355 BRT Alternatives

## No Build

- Ride On extRa service, including Transit Signal Priority (TSP), implemented in October 2017

## Transportation Systems Management (TSM) Alternative

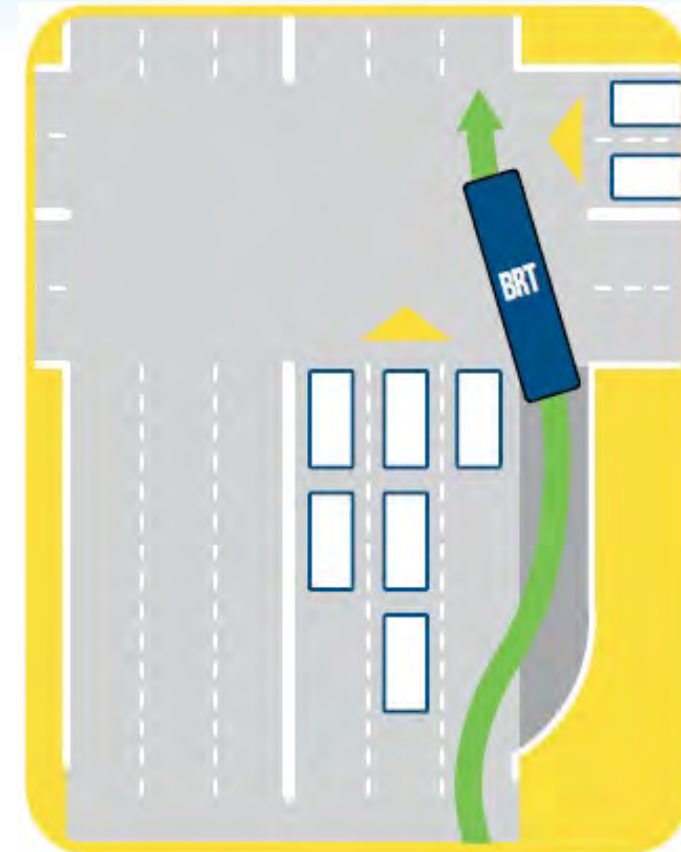
- Ride On extRa service extended to Bethesda to Clarksburg
- Extension of TSP
- Additional stops
- All-day service



# MD 355 BRT Alternatives

## Queue Jump and Mixed Traffic Alternative (A)

- FLASH in mixed traffic
- Queue jumps (20)
- Additional TSP
- Upgraded stations
  - Off-board fare collection
  - Level boarding
- FLASH vehicles and branding

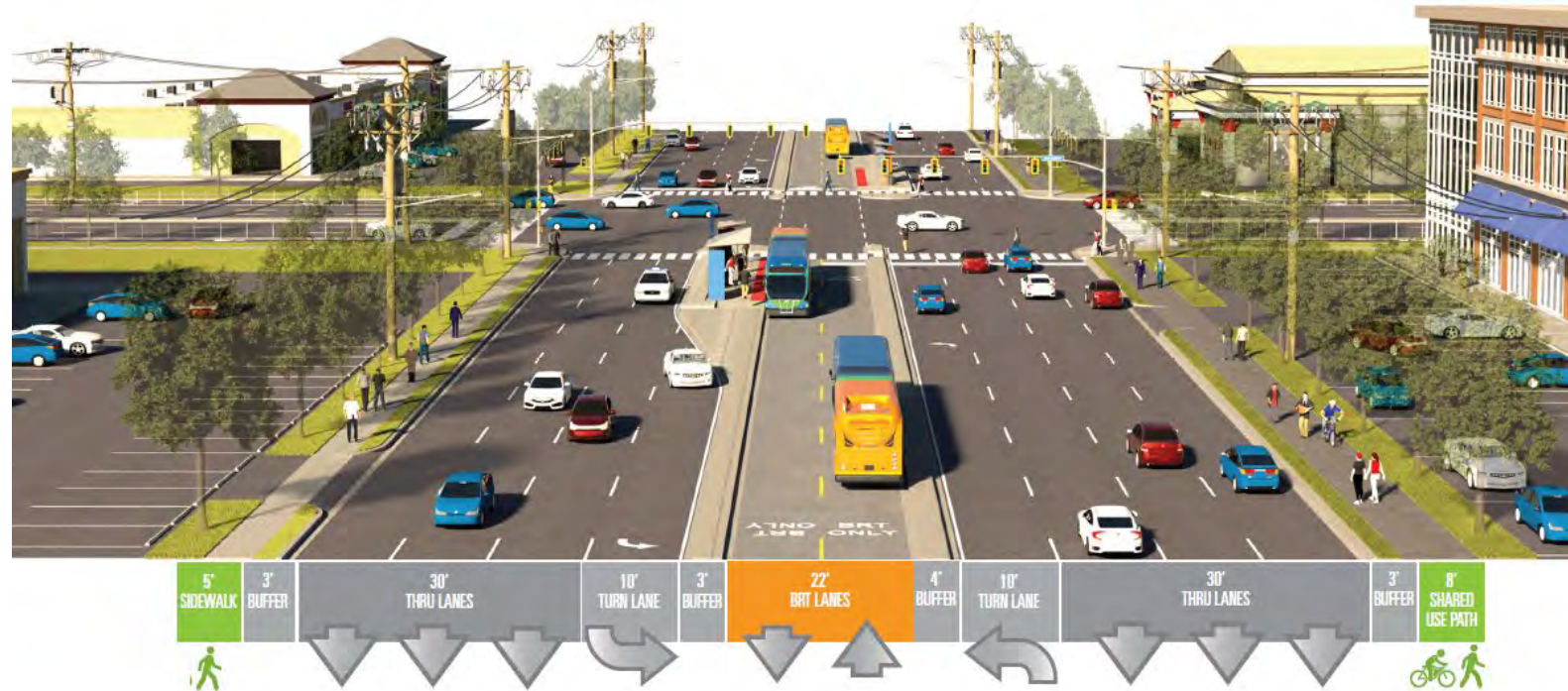




# MD 355 BRT Alternatives

## Median Alternative (B)

- FLASH in dedicated **Median** lanes *where feasible*
- Additional TSP
- Upgraded stations
  - Off-board fare collection
  - Level boarding
- FLASH vehicles and branding

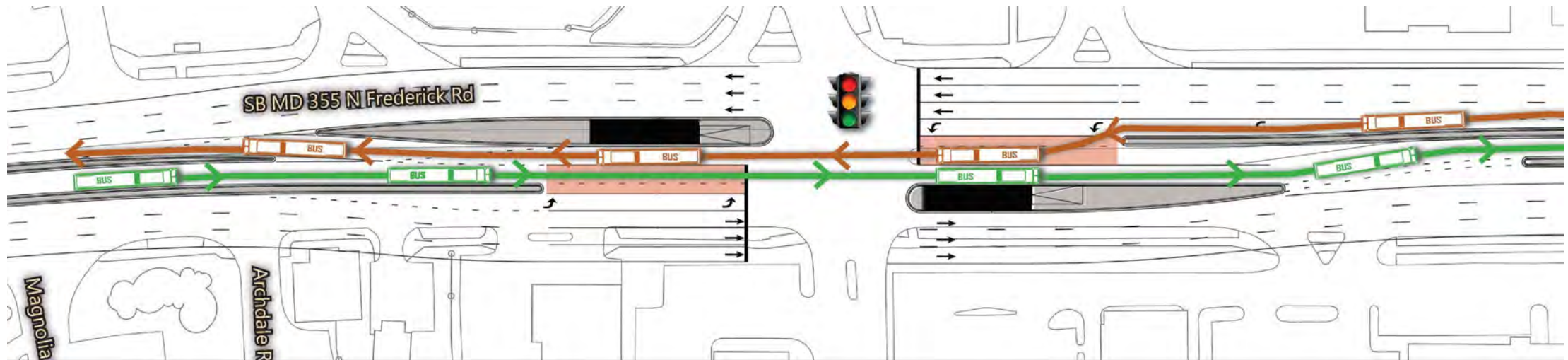
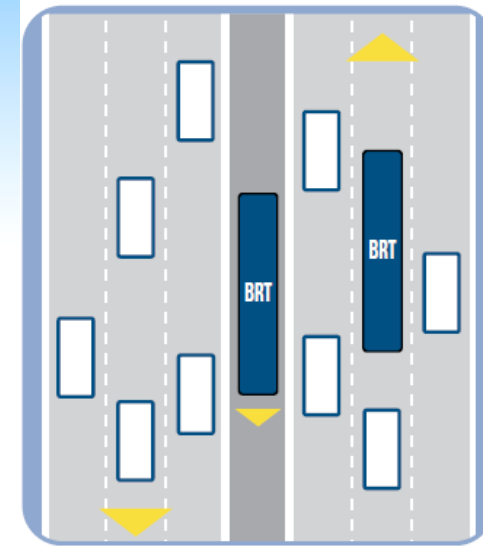




# MD 355 BRT Alternatives

## Median Alternative *Modified* (B Modified)

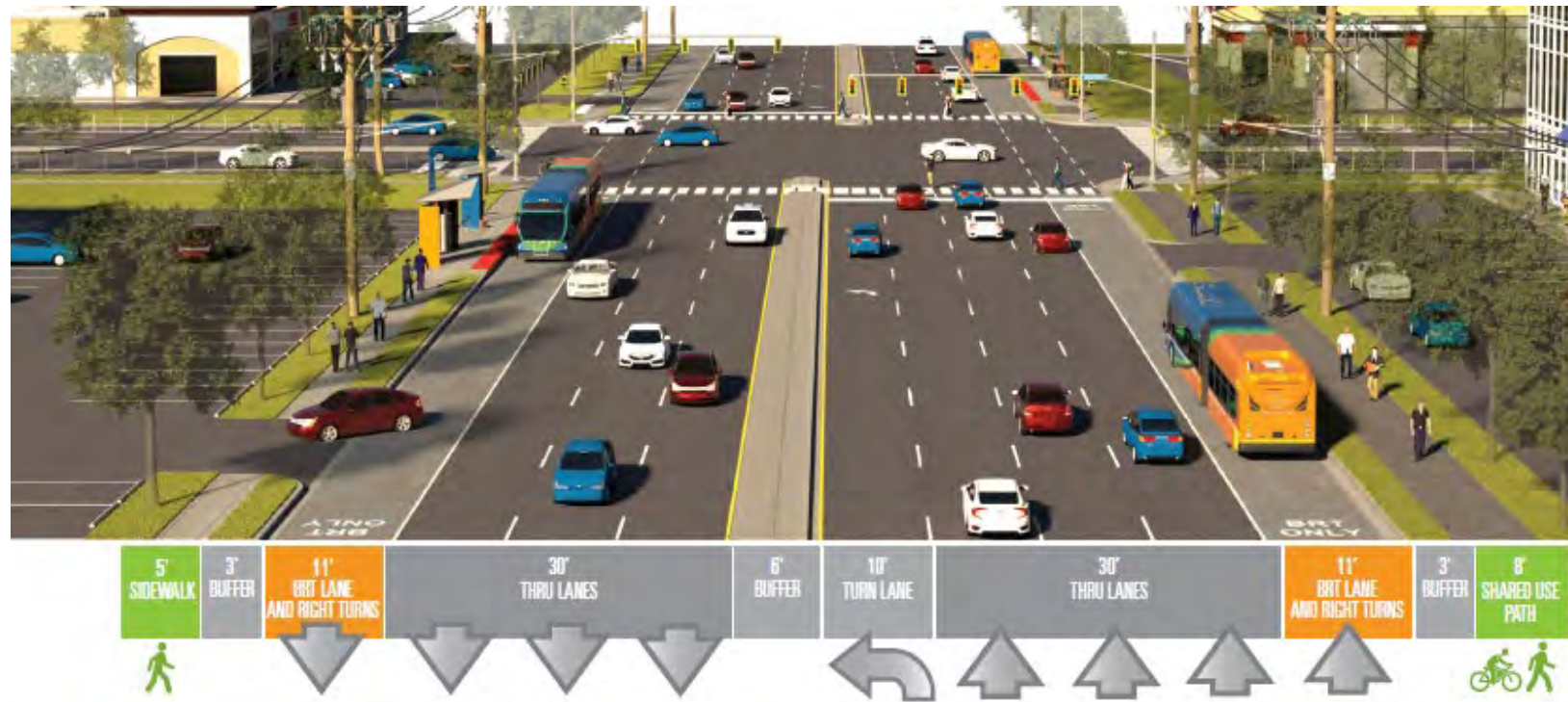
- FLASH in dedicated **Median** lanes *where feasible*
  - Single, reversible, peak direction dedicated lane north of Rockville (Segments 4-6)



# MD 355 BRT Alternatives

## Curb Alternative (C)

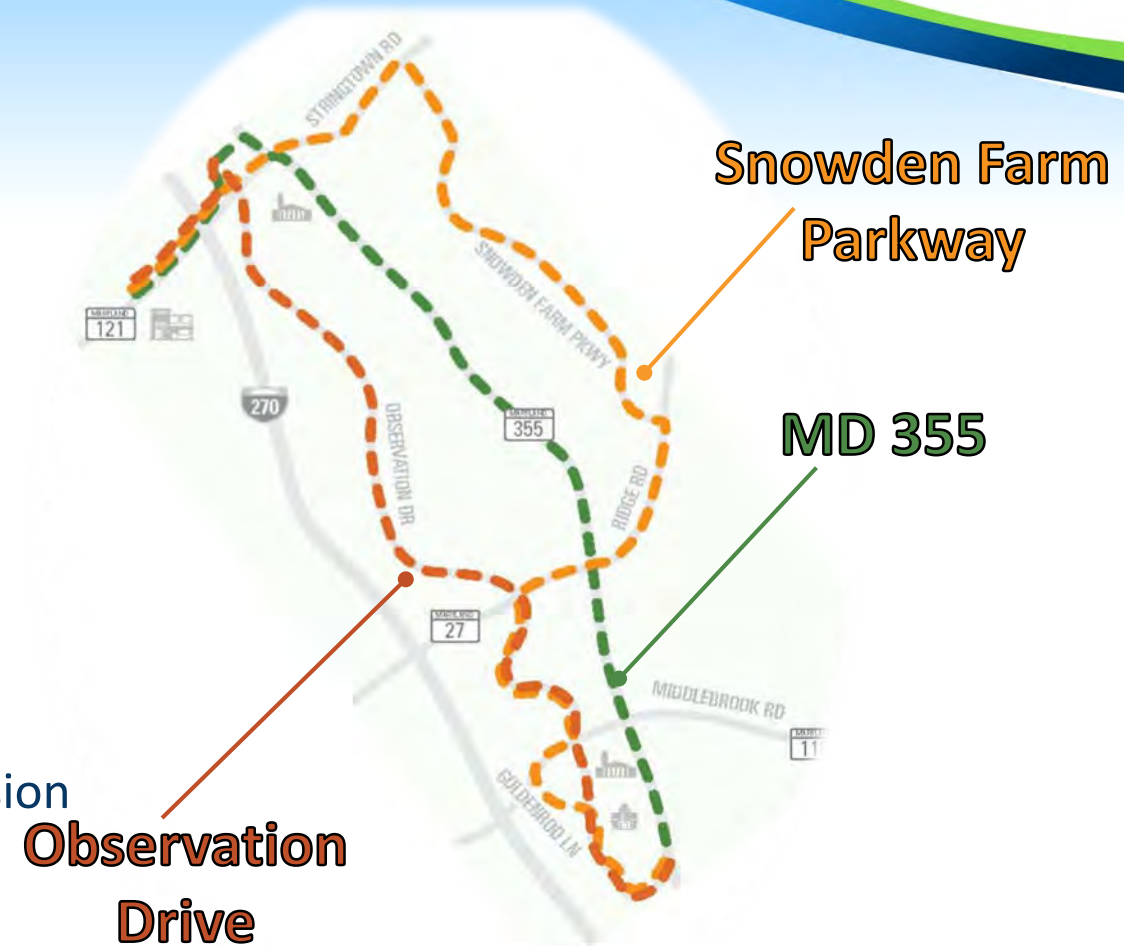
- FLASH in dedicated **Curb** lanes *where feasible*
- Queue jumps
- Additional TSP
- Upgraded stations
  - Off-board fare collection
  - Level boarding
- FLASH vehicles and branding





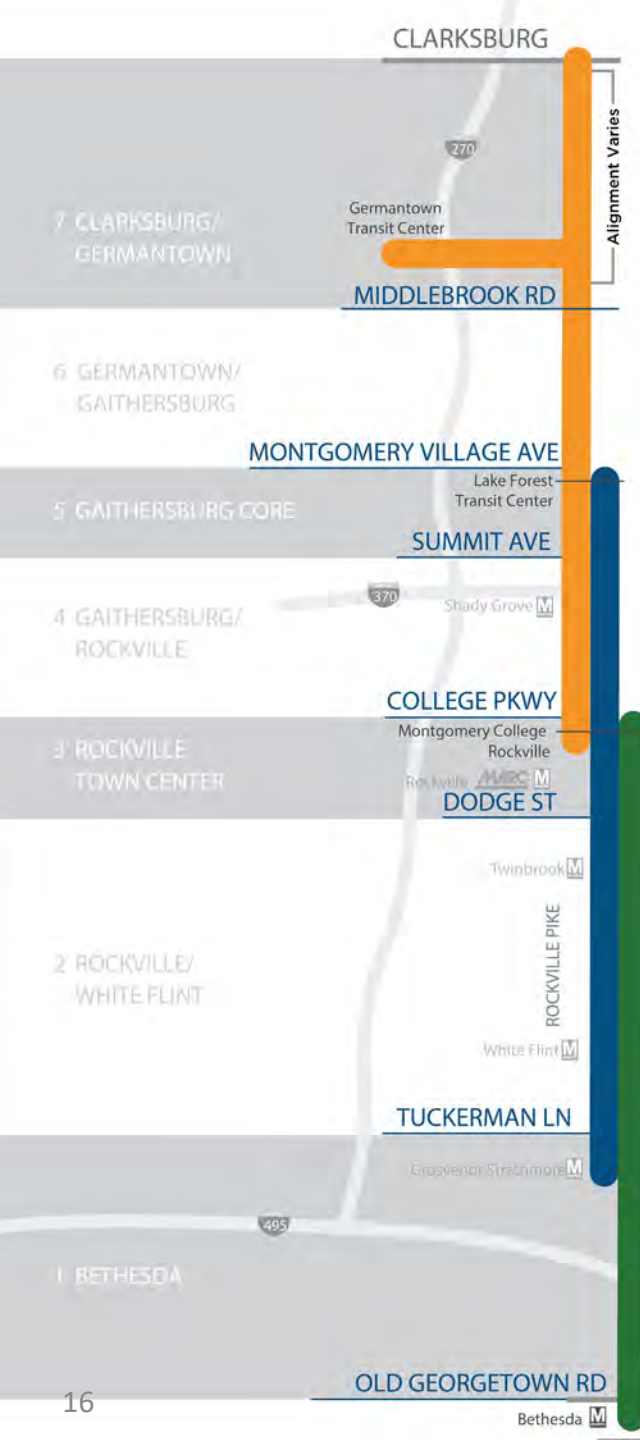
# MD 355 BRT Alignments

- Three different alignments studied for Segment 7 (Middlebrook Rd. to Clarksburg)
  - MD 355
    - Assumes future widening **by MDOT SHA**
  - Observation Drive
    - Assumes future extension **by MCDOT**
  - Snowden Farm Parkway
    - **Only** alignment that does not require extension or widening
    - Current “center” of Clarksburg



# BRT Operations on MD 355

- There are four route patterns
  - Clarksburg to Montgomery College – Rockville
  - Germantown to Montgomery College – Rockville
  - Lakeforest Transit Center to Grosvenor Metro
  - Montgomery College – Rockville to Bethesda
- Each service pattern would operate every **10 minutes**

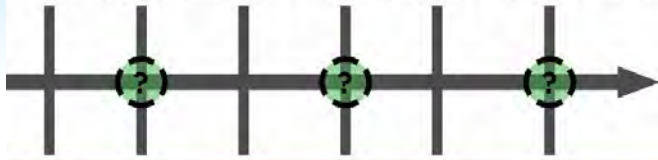




# STATION SCREENING PROCESS

## Potential Stations

Multiple studies have identified potential locations.



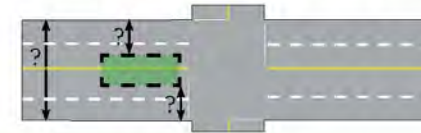
## Level 1 Screening

Does this location have the elements of a successful station?



## Level 2 Screening

Would a station fit in this location and where should it be sited?



### STUDIES

- Countywide Transit Corridor Functional Master Plan
- City of Gaithersburg MD 355 BRT Study
- Rockville BRT Town Center Integration Study
- MD 355 BRT Phase I Study

### STAKEHOLDER SUGGESTIONS

- Corridor Advisory Committees
- Open Houses
- Agency Comments

### RIDERSHIP

- Existing bus ridership and forecasted BRT ridership

### LAND USE

- Existing land use and master planned development

### PEDESTRIAN AND BICYCLE CONNECTIONS

- Proximity to infrastructure, existing and planned

### TRANSIT CONNECTIONS

- Proximity to other services, existing and planned

### STREET NETWORK

- Signalization, volumes, crash data, stop spacing

### GEOMETRY

- Adequate street design, horizontal curvature, vertical grades

### SPACE CONSTRAINTS

- Sufficient roadway width and length for station (right of way)

### TYPE OF STATION AND PLACEMENT

- Median or curbside, stop spacing

### TRANSIT CONNECTIONS

- Ability to accommodate transfers or layovers

### PEDESTRIAN AND BICYCLE CONNECTIONS

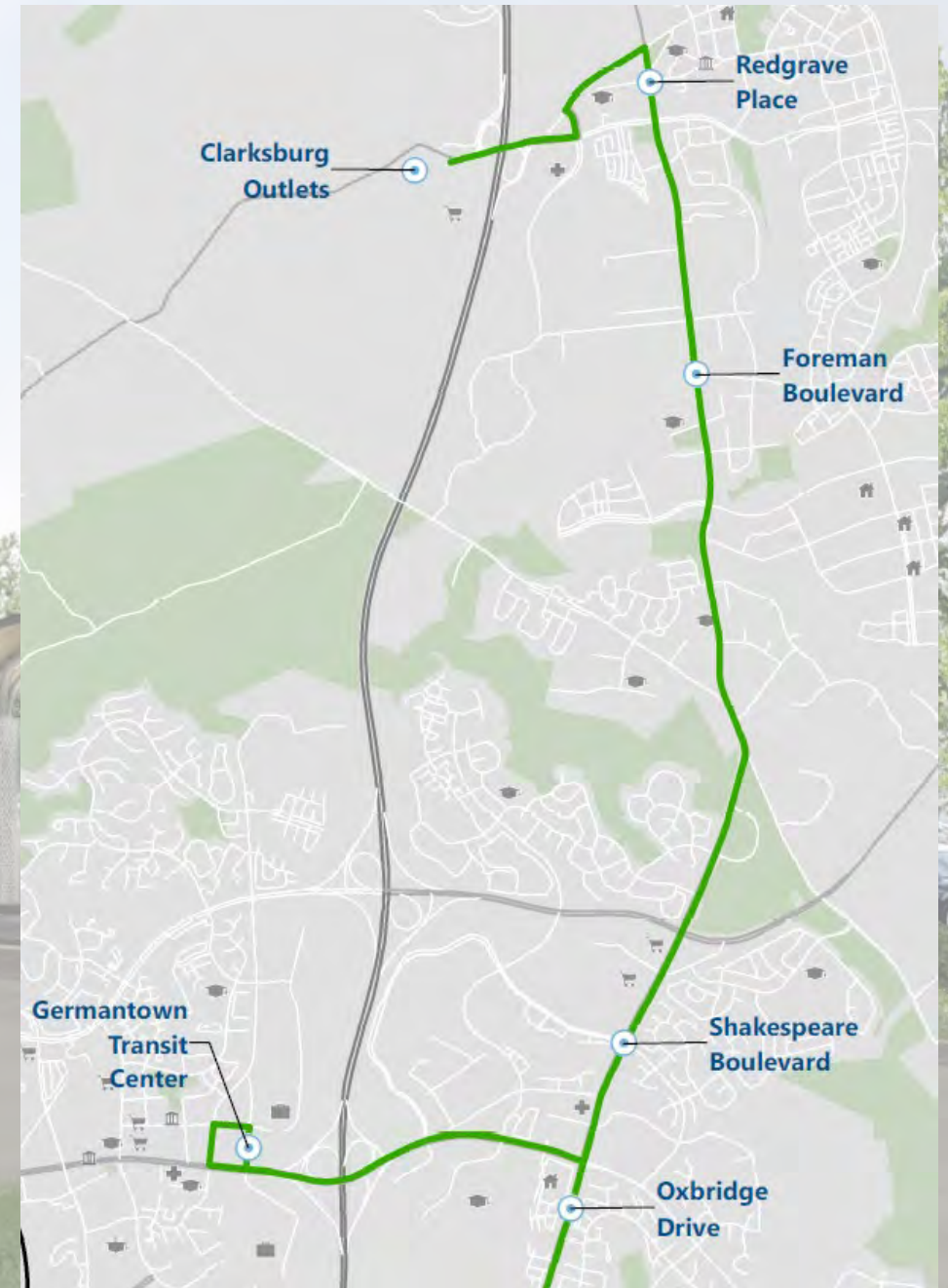
- Quality of infrastructure, existing and planned

## STATION SELECTION



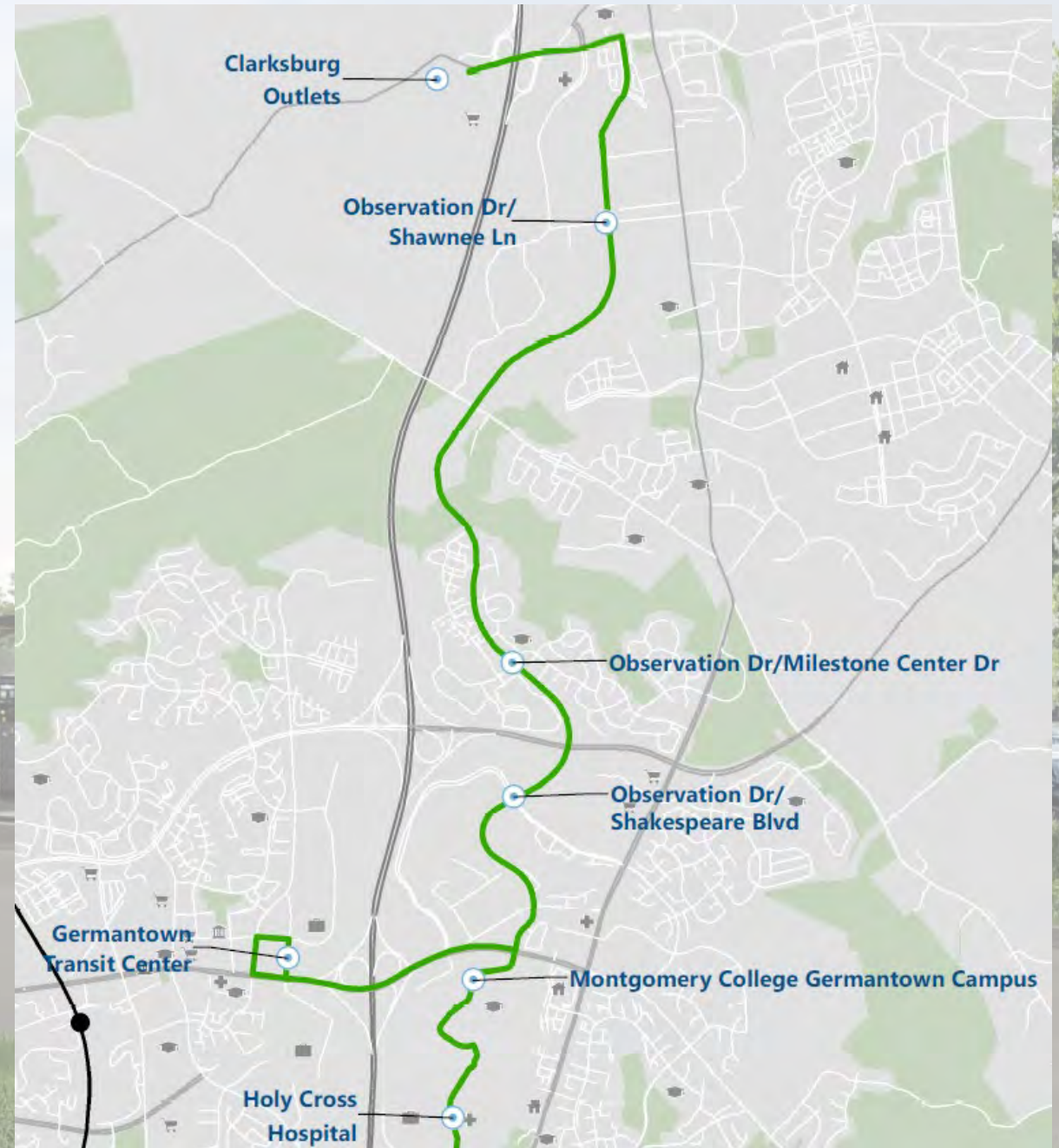
# Proposed Station Locations in Segment 7 along MD 355

- Clarksburg Outlets
- Redgrave Place
- Foreman Boulevard
- Milestone Center
- Oxbridge Drive
- Germantown Transit Center



# Proposed Station Locations in Segment 7 along Observation Drive

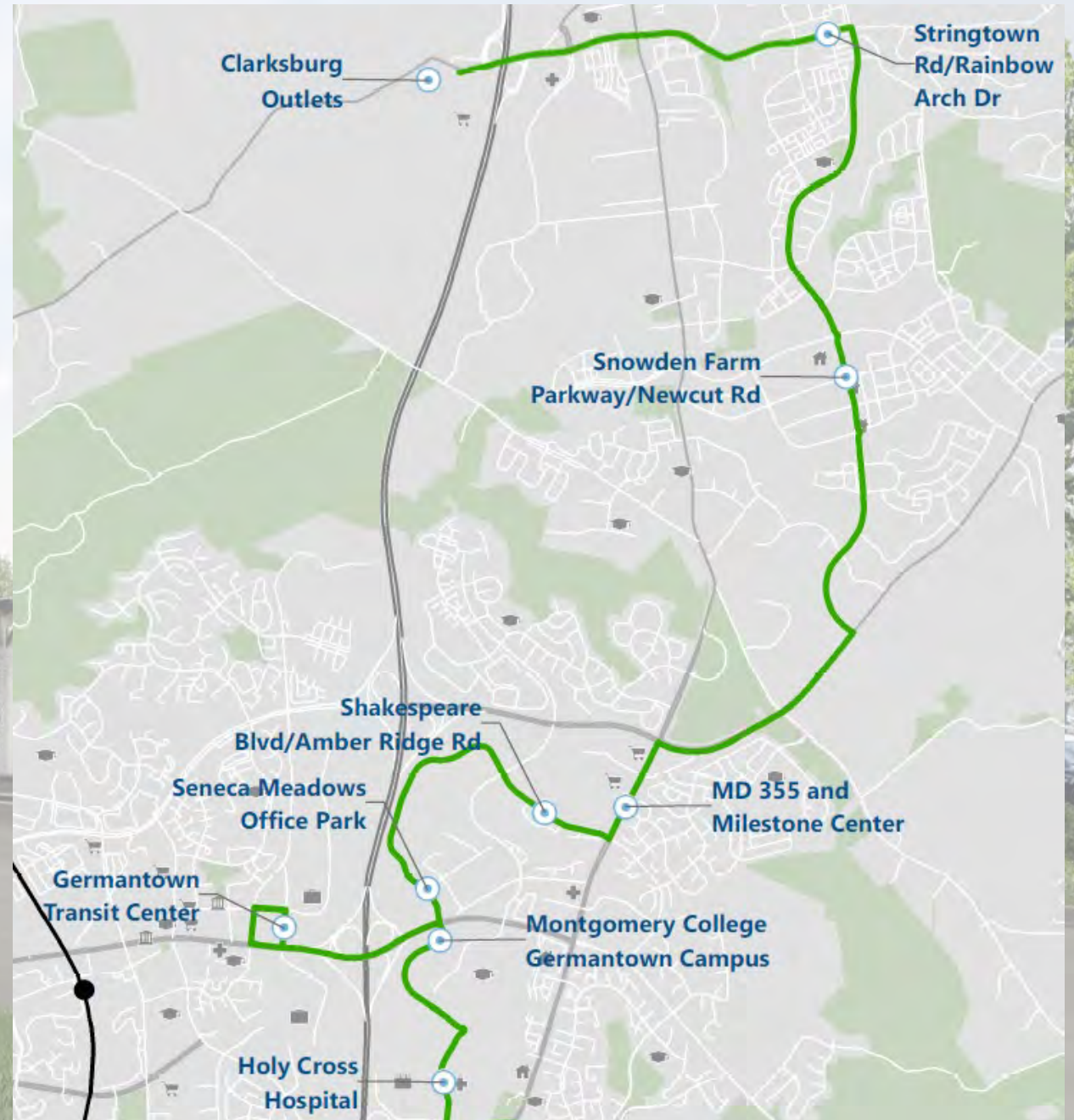
- Clarksburg Outlets
- Observation & Shawnee
- COMSAT (infill)
- Milestone Center Drive
- Milestone P&R
- Montgomery College – Germantown
- Holy Cross Hospital
- Germantown Transit Center





# Proposed Station Locations in Segment 7 along Snowden Farm Parkway

- Clarksburg Outlets
- Stringtown & Gateway (infill)
- Stringtown & Rainbow Arch
- Snowden Farm & Newcut
- Milestone Center
- Milestone P&R
- Seneca Meadows Office Park
- Montgomery College – Germantown
- Holy Cross Hospital
- Germantown Transit Center



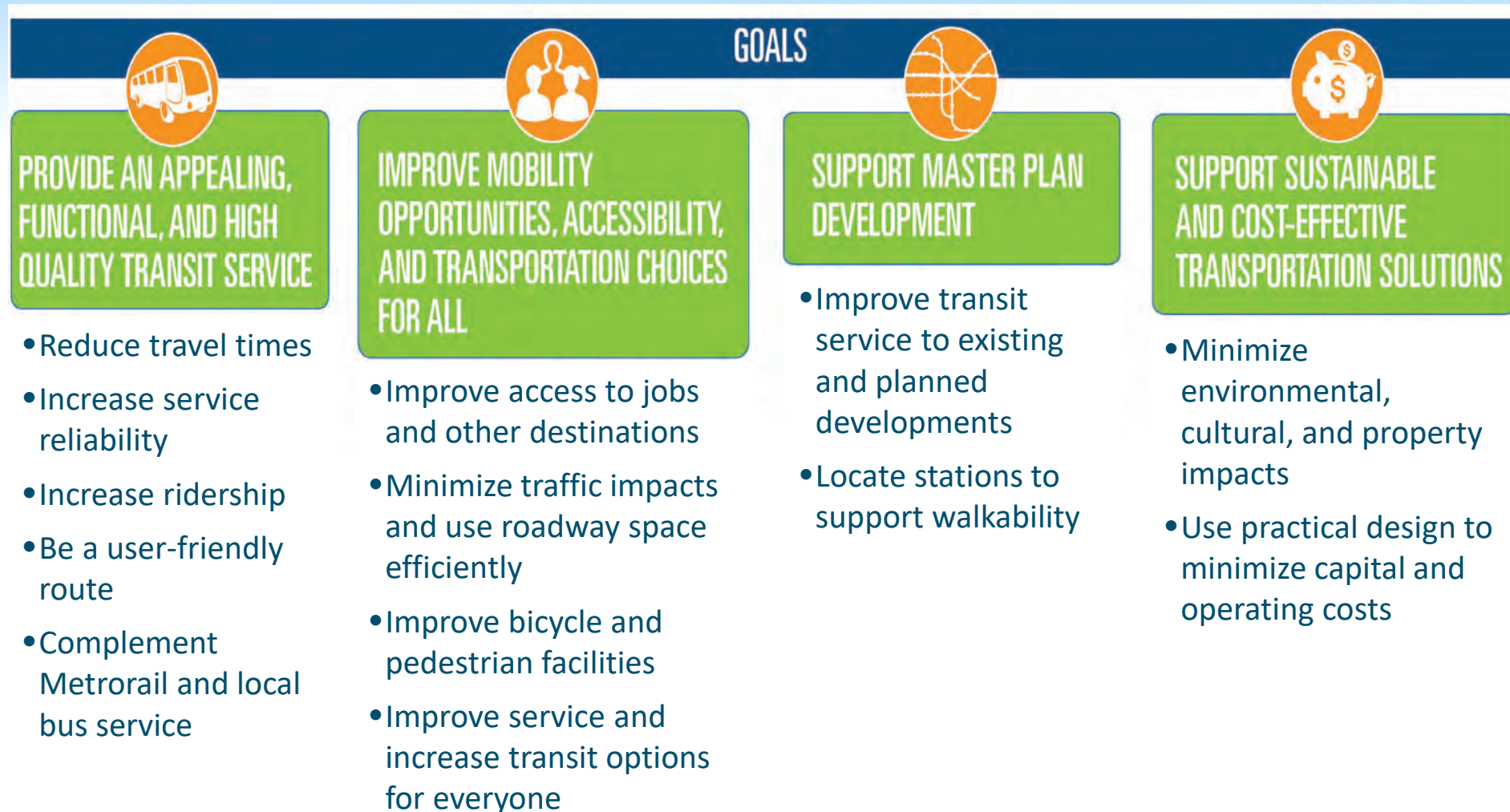


# Proposed Station Locations between Middlebrook Rd. and Bethesda Metro

- Gunners Branch Road
- Professional Drive (infill)
- Watkins Mill Road
- Lakeforest Transit Center\*
- Lakeforest Boulevard
- Chestnut Street/Walker Avenue (infill)
- Cedar Avenue/Fulks Corner Avenue
- Education Boulevard
- S Westland Drive
- Shady Grove Metro Station
- Indianola Drive (infill)
- Montgomery College - Rockville
- Dawson Avenue (infill)
- Rockville Metro Station
- Mount Vernon Place
- Edmonston Drive
- Templeton Place (infill)
- Halpine Road
- Bou Avenue
- White Flint Metro Station
- Security Lane
- Grosvenor Metro Station
- Pooks Hill (infill)
- Cedar Lane (infill)
- Medical Center
- Cordell Avenue
- Bethesda Metro Station (Future Second Entrance)



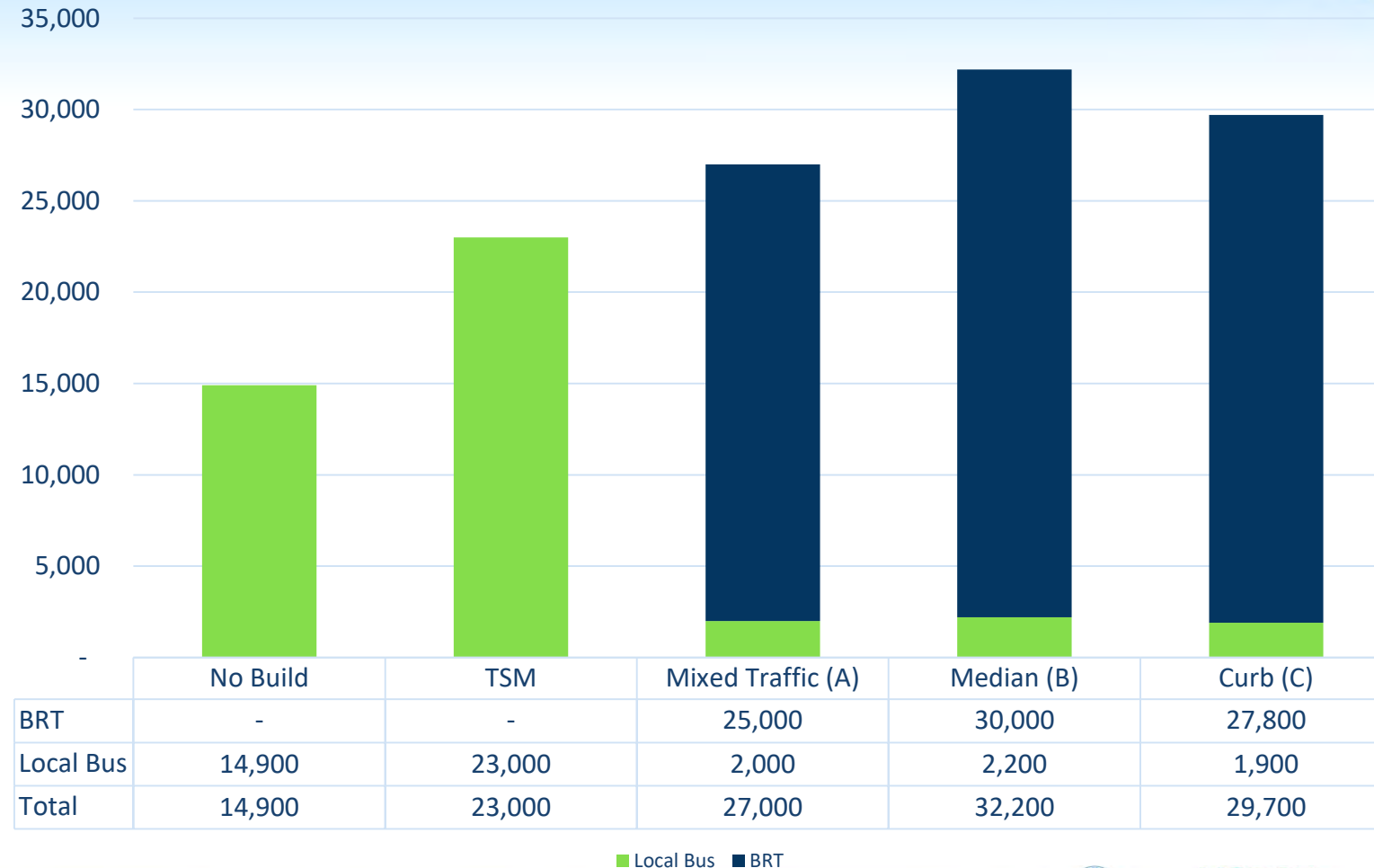
# How Will The Alternatives Be Evaluated?



# Objective – Increase Transit Ridership

- All three build alternatives perform better than the TSM
- The Median alternative is double the No Build
- Minimal impact on Metrorail ridership

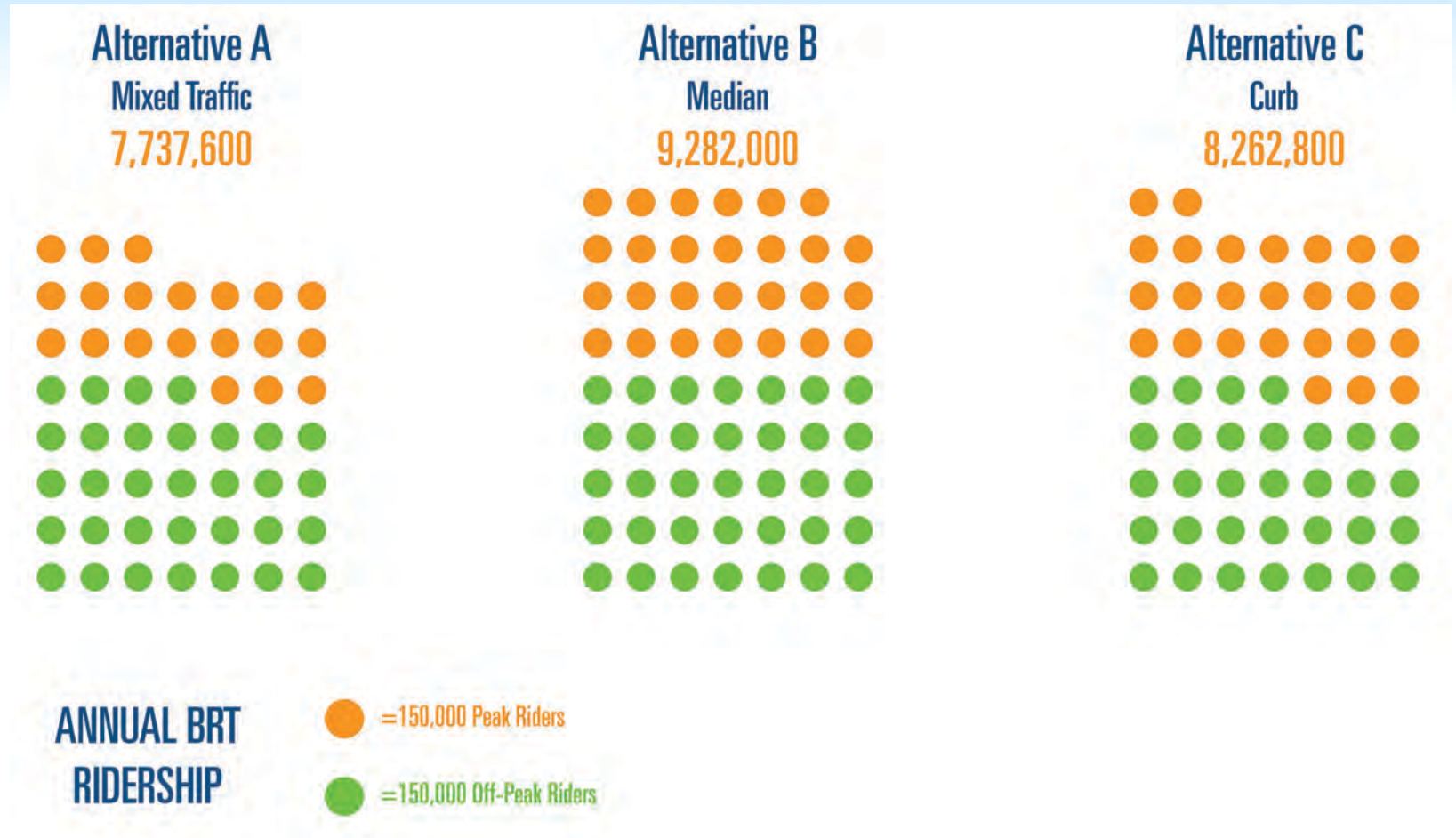
Weekday Bus Ridership (2040)



# Objective – Increase Transit Ridership

**Over 50% of the daily riders occur during the off-peak**

**Approximately 9,000 new daily riders**

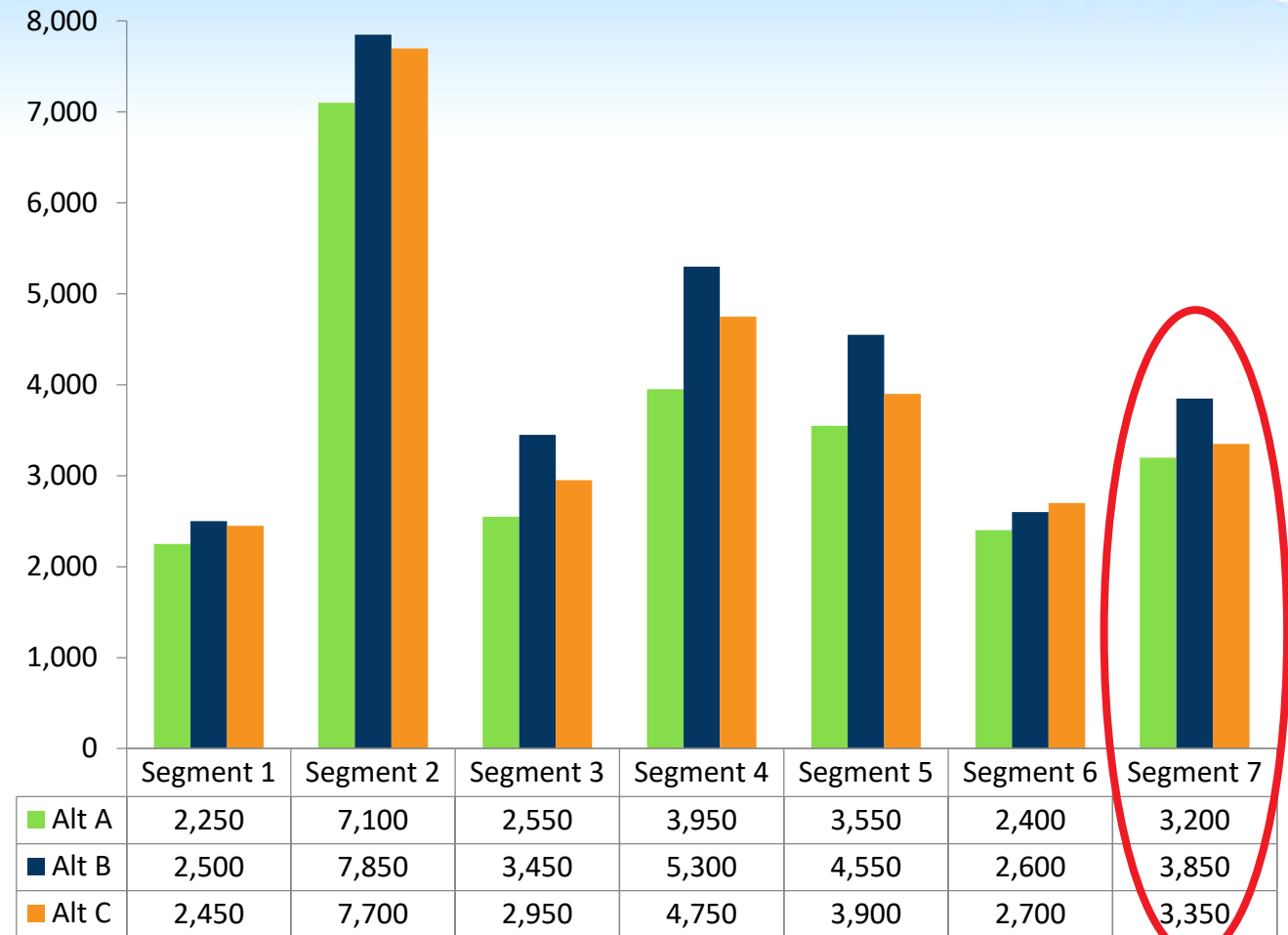




# Objective – Increase Transit Ridership

- Highest ridership segments
  - White Flint (2)
  - Shady Grove (4)
  - Gaithersburg (5)
- Highest ridership stations
  - Metrorail (except Medical Center & Grosvenor)
  - Lakeforest Transit Center
  - Montgomery College – Rockville
  - Watkins Mill Road
- No clear ridership differences for Segment 7 alignments

Weekday BRT Ridership by Segment (2040)



# Objective – Increase Transit Ridership

- Park and Rides would support 900-1,800 daily BRT riders
  - 50% of boardings at Lakeforest Transit Center
  - 20% of boardings at Clarksburg
  - 20% of boardings at Milestone
- MCDOT needs to begin identifying suitable sites moving forward



# Objective – Make bus trips faster and more competitive



**Alternatives B and C provide a travel time savings over the No Build, TSM, and Alternative A**

**Alternative C provides added benefit to local bus**

**Off-peak travel times are consistent across all Build alternatives**

Travel Time (minutes)						
Origin	Destination	No Build	TSM	Alternative A	Alternative B	Alternative C
		Bus	Extra	BRT	BRT	BRT
AM Southbound						
Chestnut St	East-West Hwy	72.8	66.3	63.1	53.0	51.8
AM Northbound						
East-West Hwy	Chestnut St	70.5	56.3	48.9	49.9	53.7
PM Southbound						
Chestnut St	East-West Hwy	66.3	55.1	56.5	49.5	47.9
PM Northbound						
East-West Hwy	Chestnut St	83.9	69.5	64.7	59.6	62.8



# MD 355 Reliability

- Along the MD 355 corridor, Metrobus and Ride On bus both suffer from service reliability
  - Metrobus on-time performance is 77.6% (goal of 79 percent)
  - Ride On on-time performance is 71-74% (goal of 90 percent)
- Reliability can be impacted by many factors
  - Traffic fluctuations
  - Bottlenecks
  - Traffic incidents (crashes, breakdowns, debris)
  - Work zones
  - Weather
  - Special events

# Objective – Improve transit quality

**Generally Alternative B (median) shows better reliability in “normal” conditions**

Percent of buses arriving between 7 and 13 minutes after the preceding bus ( $\pm 3$  minutes headway variability)

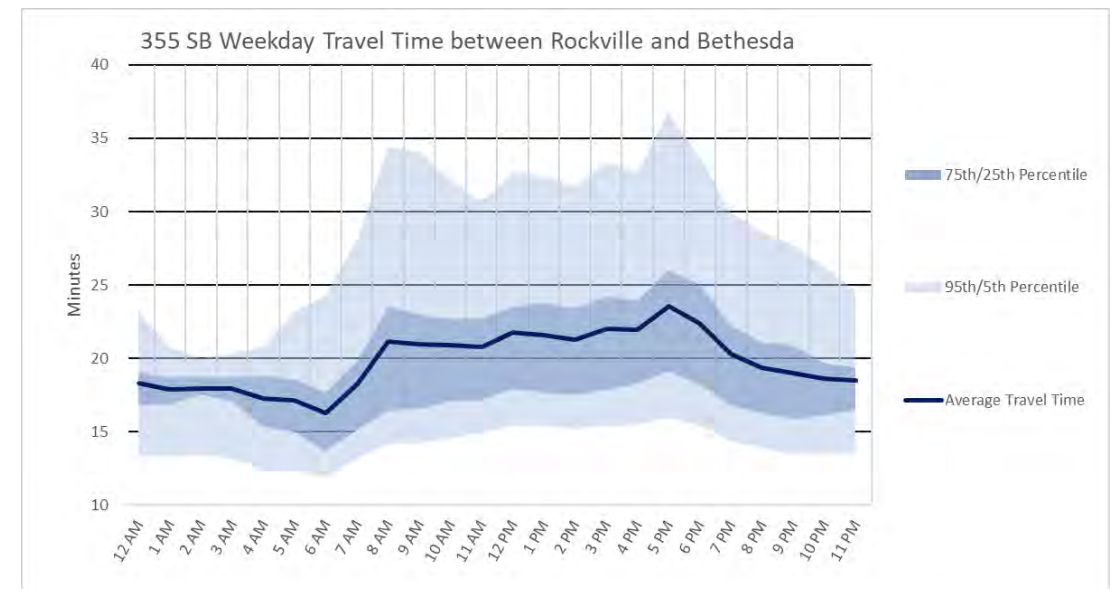
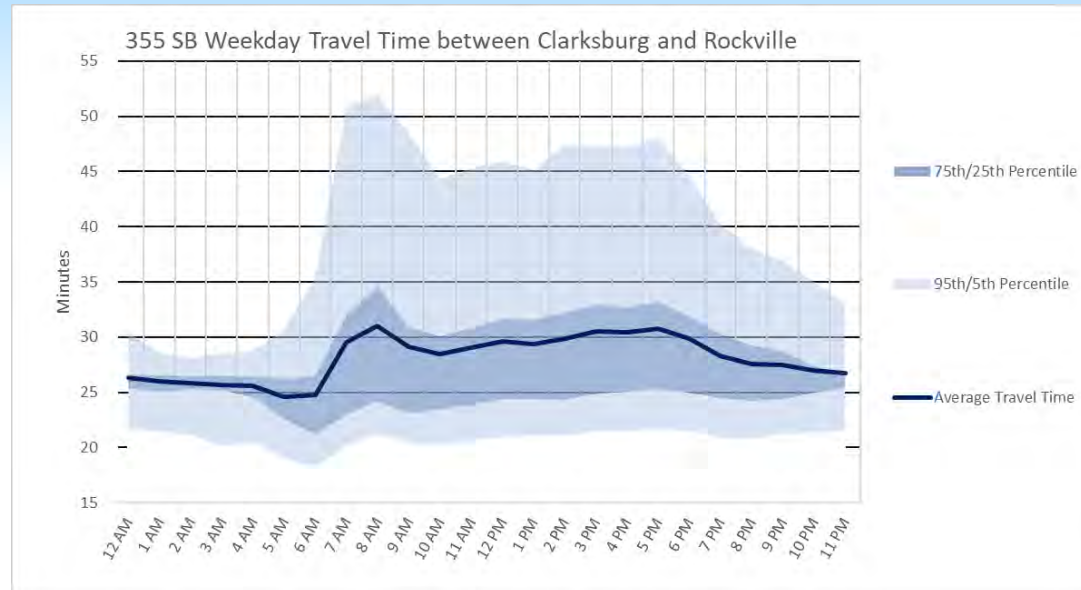
PM Peak Northbound			
Route Pattern	Alternative		
	Alternative A	Alternative B	Alternative C
Grosvenor to Lakeforest	92%	87%	93%
Montgomery College to Germantown	82%	94%	88%
Montgomery College to Clarksburg	64%	96%	83%



**Traffic simulation does not model effects of traffic incidents or other non-recurring congestion on the alternatives**

# MD 355 Reliability

**Morning southbound commute  
can require 8 to 21 minutes  
additional “planning” time to  
arrive on time**

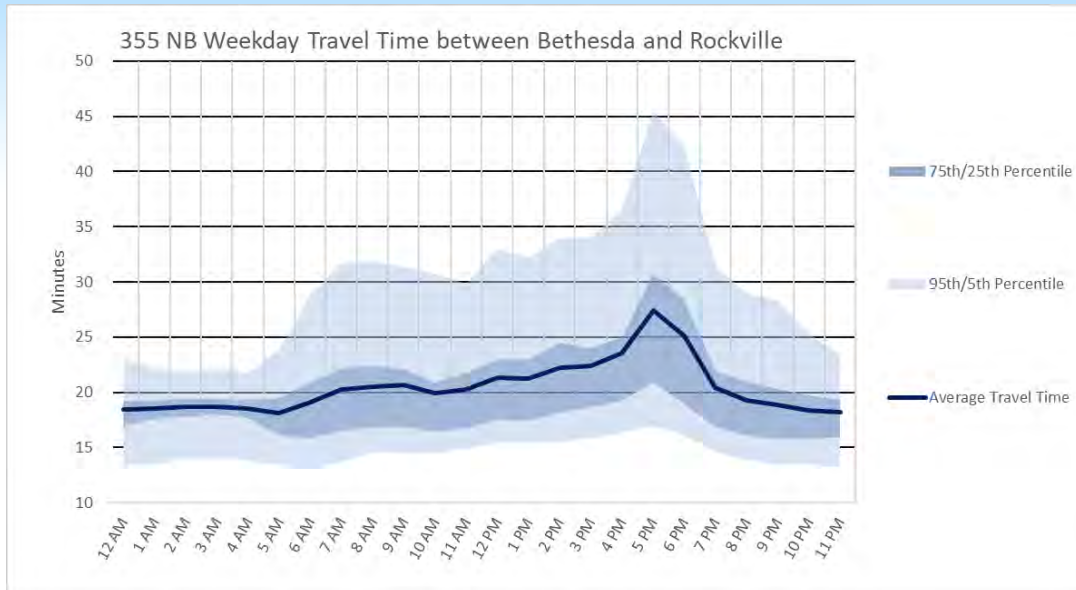


Source: Inrix data for 2018

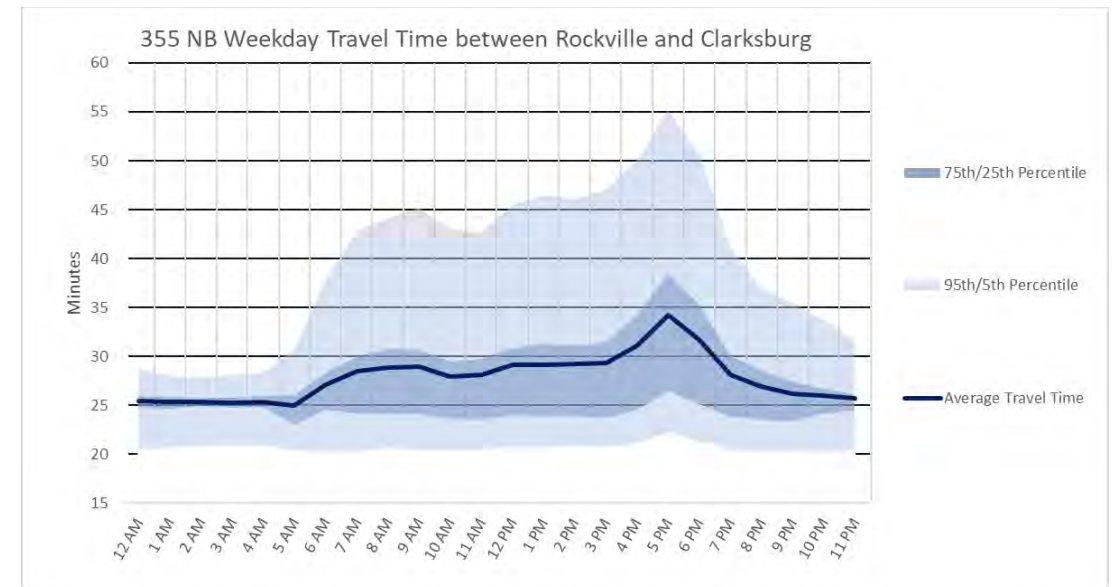


# MD 355 Reliability

**Evening commute can require from 11 to 21 minutes additional “planning” time to arrive on time**



**Alternative B should perform more consistently in line with the average travel time due to its physical separation from traffic**



Source: Inrix data for 2018

# Objective – Make bus trips faster and more competitive

**The No Build Auto drive time is only 12% to 30% faster than Alternative B and C depending on the direction and time of day**

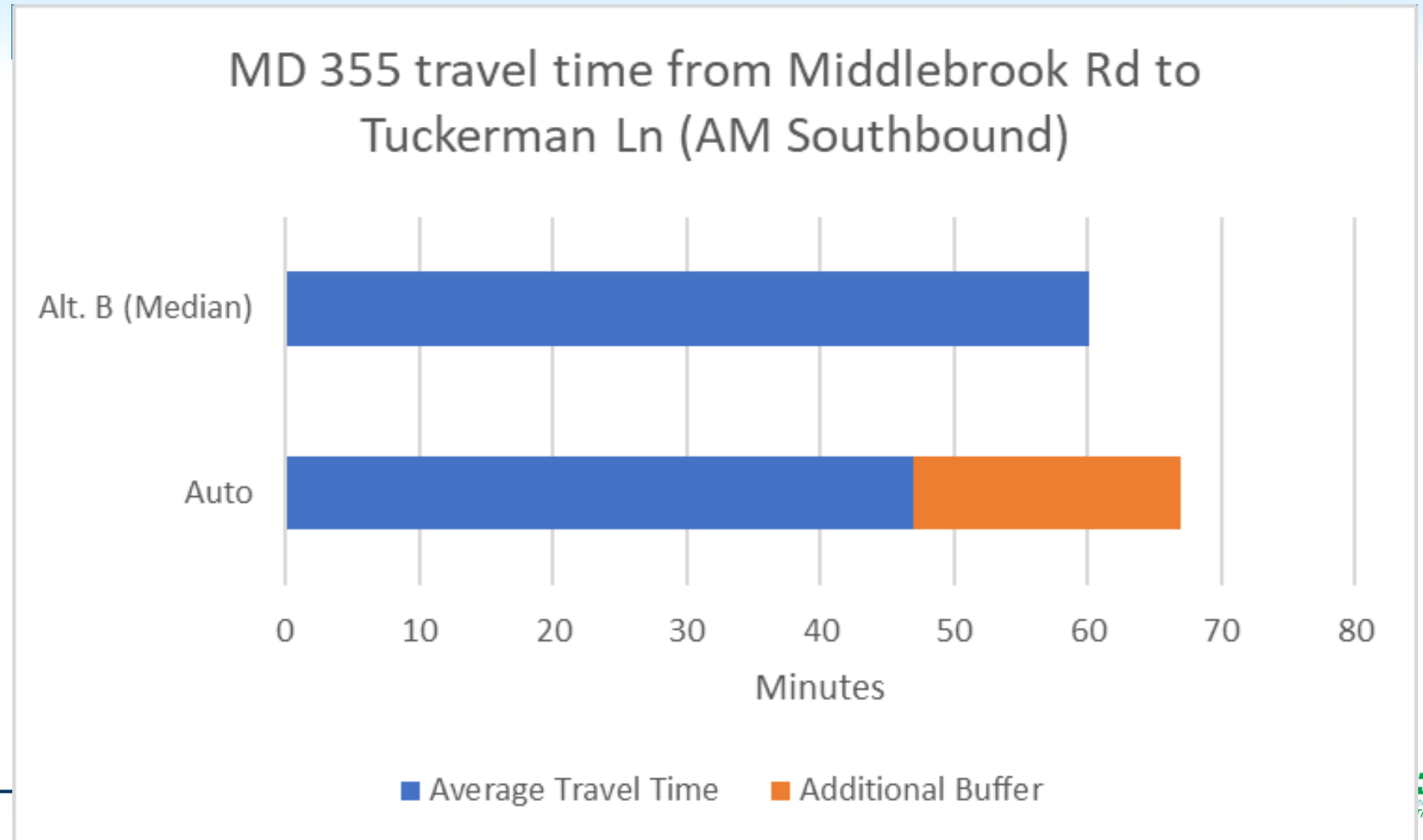
**These figures do not account for non-recurring congestion which would result in slower Auto travel time compared to Alternative B**

Travel Time (minutes)						
Origin	Destination	No Build	TSM	Alternative A	Alternative B	Alternative C
		Auto	Extra	BRT	BRT	BRT
AM Southbound						
Middlebrook Rd	Tuckerman Ln	47.0	74.2	73.3	60.1	58.9
AM Northbound						
Tuckerman Ln	Middlebrook Rd	35.4	68.2	60.7	60.5	59.7
PM Southbound						
Middlebrook Rd	Tuckerman Ln	42.7	68.4	67.0	58.1	56.8
PM Northbound						
Tuckerman Ln	Middlebrook Rd	56.9	80.5	74.8	63.5	69.1

# Objective – Make bus trips faster and more competitive

**The No Build Auto drive time is only 12% to 30% faster than Alternative B and C depending on the direction and time of day**

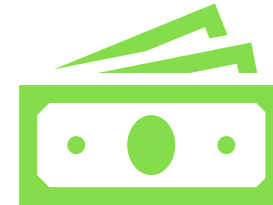
**These figures do not account for non-recurring congestion which would result in slower Auto travel time compared to Alternative B**





# Objective – Make bus trips faster and more competitive

- Additional benefits beyond travel time
  - Reduction in vehicle ownership costs
    - Insurance
    - Parking
    - Fuel
    - Maintenance
  - Increases in traffic safety
  - Increases in walking (health)
  - Productive use of traveling time
  - Environmental benefits



# Objective – Improve transit services for key demographics

Group	No Build	TSM	Builds
Minority	28,400	31,700	34,700
Low income	3,788	3,858	5,096
Low English proficiency	2,376	1,982	2,908
65 and older	5,819	7,648	8,920



**All Build Alternatives increase accessibility to high frequency transit for key demographic groups along the corridor**

# Objective - Provide improved accessibility to jobs and activity centers

Alternative	30 minutes	45 minutes	60 minutes
No-Build Alternative	130,900	395,500	832,300
TSM Alternative	131,100	397,100	835,600
Build Alternatives	140,300	414,400	860,600



**Improvements in travel speed result in greater access (travelshed) for transit users coming from the corridor as well as traveling to the corridor**



# Objective – Balance the mobility needs of all users

- Most alternatives show an **increase** in miles of LOS E/F
  - Increases associated with changes such as TSP, queue jumps, and phase changes
- Average person delay only increases a small amount (**half a minute or less**) compared to the No Build for each alternative
- AM Peak Intersection LOS remains relatively **unchanged** compared to the No Build **except** for Alternative B
- PM Peak intersection LOS **degrades** for Alternatives B and C
  - Total intersection delay ↑ between 4-6 minutes across 77 intersections
- All Alternatives experienced some localized **reductions** in delay
- **Further refinement may address impacts**

# Objective – Minimize environmental impacts

**TSM  
Alternative**



Reduction of 271,962 lbs of  
CO<sub>2</sub>-equivalent emissions

**Alternative A  
Mixed Traffic**



Reduction of 733,646 lbs of  
CO<sub>2</sub>-equivalent emissions

**Alternative B  
Median**



Reduction of 731,605 lbs of  
CO<sub>2</sub>-equivalent emissions

**Alternative C  
Curb**



Reduction of 729,173 lbs of  
CO<sub>2</sub>-equivalent emissions

# Objective – Minimize environmental impacts

Streams

Forests

Wetlands

Parks

Floodplains

Endangered  
Species



NO IMPACT

NO IMPACT

MINIMAL  
All less than one acre

MINIMAL  
All less than one acre

MINIMAL  
All less than one acre

MINIMAL  
TSM & Alt C - no impact  
Alts A & B - one potentially  
impacted area



# Objective – Minimize environmental impacts

## Architectural Properties within Limit of Disturbance (LOD)



30 sites require additional assessment

## Archaeological Sites



**Alternative A**  
10 sites require additional assessment

**Alternative B**  
1 site requires additional assessment

**Alternative C**  
3 sites require additional assessment

## Hazardous Materials



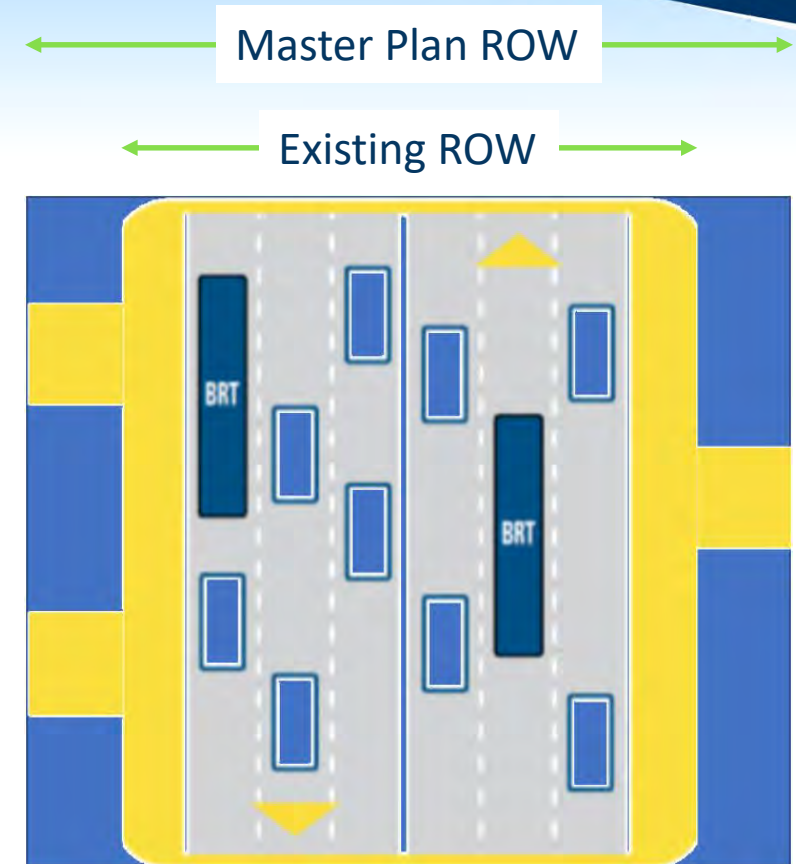
**Alternative A**  
173 sites require additional assessment

**Alternative B**  
170 sites requires additional assessment

**Alternative C**  
174 sites require additional assessment

# Objective – Minimize impacts to private and public property

- The conceptual design fits within the Master Plan right of way
  - Much of this right of way is not currently available
- As properties come before the Planning Board for development/redevelopment the Master Plan ROW is acquired
  - Relying on this process to acquire all the ROW could take decades



# Objective – Minimize impacts to private and public property

- Conceptual design has sought to **reduce** the right of way needs as much as possible at this early stage of design
  - Reducing buffers, where necessary
  - Reducing lane widths
  - Including retaining walls
- **Work will continue to reduce right of way needs as design advances**
- All alternatives require some degree of right of way beyond what currently exists in certain locations
- Most of the right of way needs are partial and along the roadway frontage of properties along MD 355\*
  - Alternative B - 61 acres
  - Alternative B *Modified* - 54 acres
  - Alternative C - 39 acres
  - Alternative A - 13 acres
  - TSM - less than 1 acre



# Objective – Minimize the cost of transportation services

- BRT alternatives have a range of costs based on the infrastructure investment and the location along the corridor
- Costs are comparably low to other major regional transportation projects
  - **MD 355 BRT – \$7M to \$36M per mile**
  - Purple Line - \$163M per mile
  - Silver Line - \$248M per mile
  - I495/I270 Managed Lanes - \$200M per mile

# Objective – Minimize the cost of transportation services

- Annualized Cost per Rider supports the Build alternatives
- Alternatives B and C produce higher benefits (travel time savings and ridership)
- Right of way costs are a major contributor
  - Master plan right of way not available in most areas
  - Design efforts will continue to reduce right of way needs
  - Efforts will continue to work with development proposals to dedicate the appropriate right of way which can reduce project costs

# Objective – Minimize the cost of transportation services

Estimated Capital Costs					
Segment	TSM	Alternative A	Alternative B	Alternative B <i>Mod.</i>	Alternative C
1 – Bethesda	\$0.7M	\$18M	\$19M	\$19M	\$37M
2 – White Flint	\$0.9M	\$50M	\$346M	\$346M	\$190M
3 – Rockville	\$0.2M	\$11M	\$92M	\$92M	\$65M
4 – Shady Grove	\$0.3M	\$26M	\$170M	\$141M	\$123M
5 – Gaithersburg	\$0.5M	\$9M	\$86M	\$80M	\$10M
6 – Germantown	\$1M	\$9M	\$121M	\$91M	\$59M
7 - Clarksburg	\$2M	\$19M	\$15M	\$15M	\$13M
Vehicles	\$10M	\$43M	\$37M	\$37M	\$37M
<b>Total</b>	<b>\$15.6M</b>	<b>\$185M</b>	<b>\$886M</b>	<b>\$821M</b>	<b>\$534M</b>



# Objective – Minimize the cost of transportation services

Annualized Costs					
	TSM	Alternative A	Alternative B	Alternative B <i>Modified</i>	Alternative C
Annual Net Operating Costs	\$6,995,000	\$22,758,900	\$17,525,900	\$17,525,900	\$18,160,700
Annualized Capital Costs	\$5,939,645	\$10,950,321	\$34,826,671	\$23,635,569	\$22,714,430
Total Annual Capital and Operating Costs	\$12,934,645	\$33,709,221	\$52,352,571	\$41,161,469	\$40,875,130
Annual BRT Riders	3,816,800*	7,737,600	9,282,000	9,282,000	8,626,800
<b>Total Annualized Cost per Rider</b>	<b>\$3.39</b>	<b>\$4.36</b>	<b>\$5.64</b>	<b>\$4.43</b>	<b>\$4.74</b>

\* Annual BRT Riders are Ride On extRa riders in the TSM alternative

# Summary of Findings

All Build alternatives (A, B, C):

- improve accessibility
  - Key demographic groups
  - Jobs
  - Activity Centers
- Do not display a significant negative impact on traffic
- Display minimal environmental and cultural impacts

# Summary of Findings

All Build alternatives (A, B, C):

- Display high ridership
  - The Median (B) alternative displays the highest ridership (2x the No Build)
  - 50% of the ridership is in the off peak
- Snowden Farm Parkway is the alignment that best supports existing conditions
  - Current center of activity in Clarksburg
  - Only alignment that can be implemented in the near term
  - Selecting Snowden Farm Parkway does not preclude the other alignments



# Summary of Findings

- The Median (B) and Curb (C) alternatives provide travel time savings over local bus, the TSM, and the Mixed Traffic (A) alternative
  - The Median alternative also provides an advantage during more congested corridor conditions (travel time and reliability)
- The conceptual design fits within the master plan right of way, which in most cases is not currently available
  - Future design efforts will continue to reduce right of way needs
- Build alternatives have a range of costs based on the infrastructure investment and the location along the corridor
- Annualization of capital and operating costs provides a better comparison for the alternatives and supports selecting a build alternative

# Discussion/Questions