MONTGOMERY COUNTY DEPARTMENT OF TRANSPORTATION

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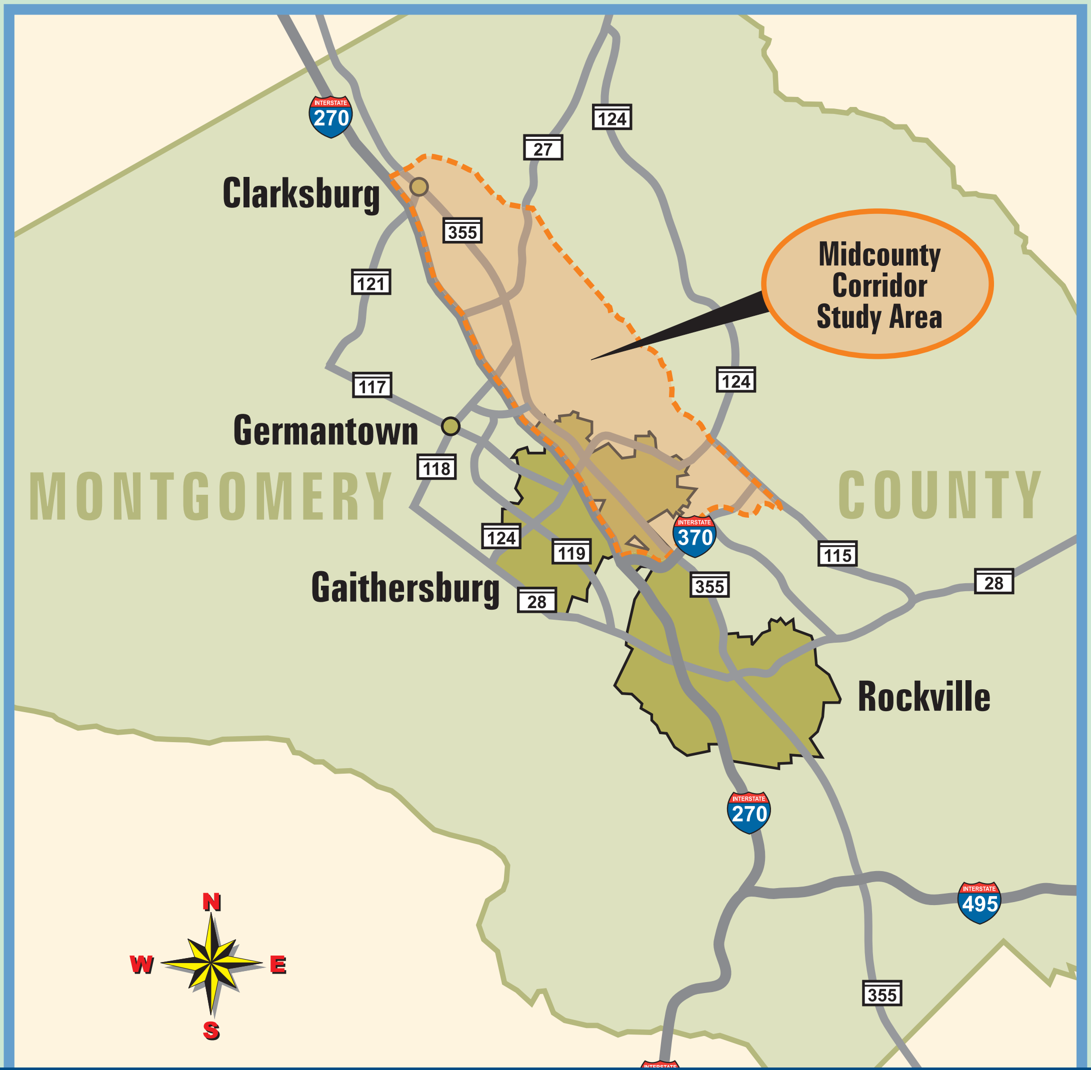
Midcounty Corridor Study



Supplemental Report
February 10, 2017

Department of Transportation
Division of Transportation Engineering
100 Edison Park Drive, 4th Floor
Gaithersburg, MD 20878
PHONE: 240-777-7220 FAX: 240-777-7277

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1. INTRODUCTION

The Midcounty Highway, also referred to as M-83 has been in Montgomery County's Master Plan of Highways for many decades. The corridor is intended to provide an additional high-capacity connection between Clarksburg, Germantown East, and Gaithersburg, ultimately linking to the area near the Shady Grove METRO station. The Master Plans for the communities along this corridor have been approved anticipating that this corridor would ultimately be available as a transportation link providing capacity for this area of the county. Over the intervening years, growth within this corridor has continued apace based on the associated master plans.

Planning for implementation of this corridor took place off and on over the last twenty-five years, and was advanced more significantly in the earlier part of this decade. More recently, the County, in partnership with the Maryland Department of Transportation, began advancing study of Bus Rapid Transit (BRT) implementation on the parallel Maryland 355 (MD 355) corridor. The concept of BRT for this portion of the county was initially introduced as part of the Maryland Transit Administration's (MTA's) Corridor Cities Transitway (CCT) project, and emphasized further with the adoption of the Countywide Transit Corridors Functional Master Plan (CTCFMP) in 2013.

Citing concerns with the potential open space and environmental impacts of the Midcounty Highway Corridor and to consider the implications of BRT on the need for the capacity provided by the corridor, MCDOT was asked to prepare a supplement to the Midcounty Corridor Study (MCS) that addresses the relationship between the Midcounty Highway and BRT on Maryland 355.

This report presents the results of the supplemental analysis of the transportation system performance in the Midcounty region based on a variety of scenarios that include different elements of the alternatives in the original MCS, coupled with BRT implementation on Maryland 355. As described in this report, implementation of versions of the Midcounty Highway (in the preferred alignment defined by the previous round of planning) and the MD 355 BRT, separately and in combination with each other, provide substantial improvement to the transportation network performance in the study area. Across the metrics considered (Vehicle Miles Traveled, person-throughput, mode-choice, travel time, and intersection operations), the projects perform differently as illustrated through the scenarios analyzed. As a basic finding, this analysis shows that both projects are beneficial and neither project substantially replaces the benefit of the other. Rather, the benefits of the projects are cumulative.

The supporting analysis and associated findings are presented in the summary section that follows. More detail about the background of the Midcounty Corridor, the MD 355 BRT, the methodology, performance measures, analysis scenarios, and outcomes is presented in the detailed sections that follow.

2. SUMMARY OF FINDINGS

A. Study Objectives

The purpose of this supplement to the Midcounty Corridor Study is to assess the effect of Bus Rapid Transit (BRT) along MD 355 on the projected traffic operations in the study area for the different scenarios considered in the Midcounty Corridor Study. One new scenario that considers a reversible two-lane configuration is also being considered and evaluated as part of this supplement. The objective of the study is to quantify the operational measures of effectiveness associated with the various scenarios being studied.

B. Analysis Scenarios

Four scenarios for the Midcounty Corridor Study that assume various improvements throughout the study area by Year 2040 are presented in this report. The specific improvements associated with each scenario are as follows:

- Scenario 1 includes BRT Alternative 3B along MD 355 and local intersection improvements from MCS Alternatives 2 and 5
- Scenario 2 includes BRT Alternative 3B along MD 355 and building reversible two-lane roadway along the master plan alignment for M-83
- Scenario 3 consists of building a four-lane roadway along the master plan alignment for M-83

C. Scenario Comparison

i. Vehicle-Miles Traveled (VMT)

Table 2-1 shows the annual VMTs along the study corridors for the four (4) scenarios analyzed. The study corridors include MD 355, Midcounty Highway Extended (M-83), Montgomery Village Avenue, Goshen Road and Wightman/Snouffer School Roads. The VMTs are shown in units of million vehicle-miles traveled.

Table 2-1: Annual Vehicle-Miles Traveled

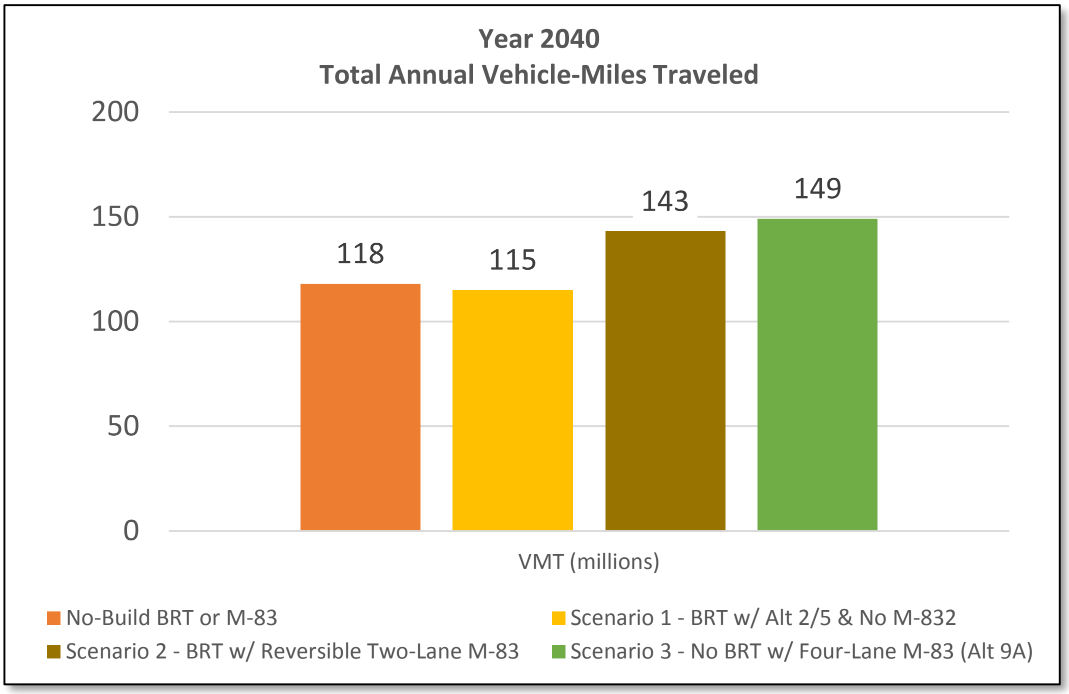
	Annual Vehicle-Miles Traveled (VMT)			
	2040 Projections			
	No-Build	Scenario 1	Scenario 2	Scenario 3
Total VMT (millions)	118	115	143	149

This comparison shows that Scenario 1 would have a slightly lower VMT compared to the No-Build Conditions in 2040, due to the implementation of BRT on MD 355, coupled with minimal expansion of roadway capacity.

Scenarios 2 and 3 each would have higher overall VMTs than No-Build or Scenario 1 because they each include some form of M-83 (for Scenario 2, it is the 2-Lane Reversible Roadway, and for Scenario 3, it is the 4-Lane Roadway) which increases the overall capacity of the roadway network in the study area in both scenarios. The additional roadway facility adds lane-miles to the study area and provides an alternate route for additional traffic to use when traveling north-south across the study area.

Figure 2-1 present the Year 2040 total annual VMT analyses results for the scenarios studied. According to the figure, the Scenario 1 VMT is 4% lower than the No-Build condition. The Scenario 2 VMT is 20% higher than the No-Build Condition. The Scenario 3 VMT is 24% higher than the No-Build Condition. The additional increase of VMT between Scenario 2 and Scenario 3 is likely due to traffic using M-83 in the non-peak direction. This finding is significant since it suggests there is substantial demand for off-peak travel in the corridor.

Figure 2-1: Comparison of Annual VMT



ii. Person Throughput

Three transportation modes were analyzed for Person Throughput. The modes were Automobile, Non-BRT Transit and BRT.

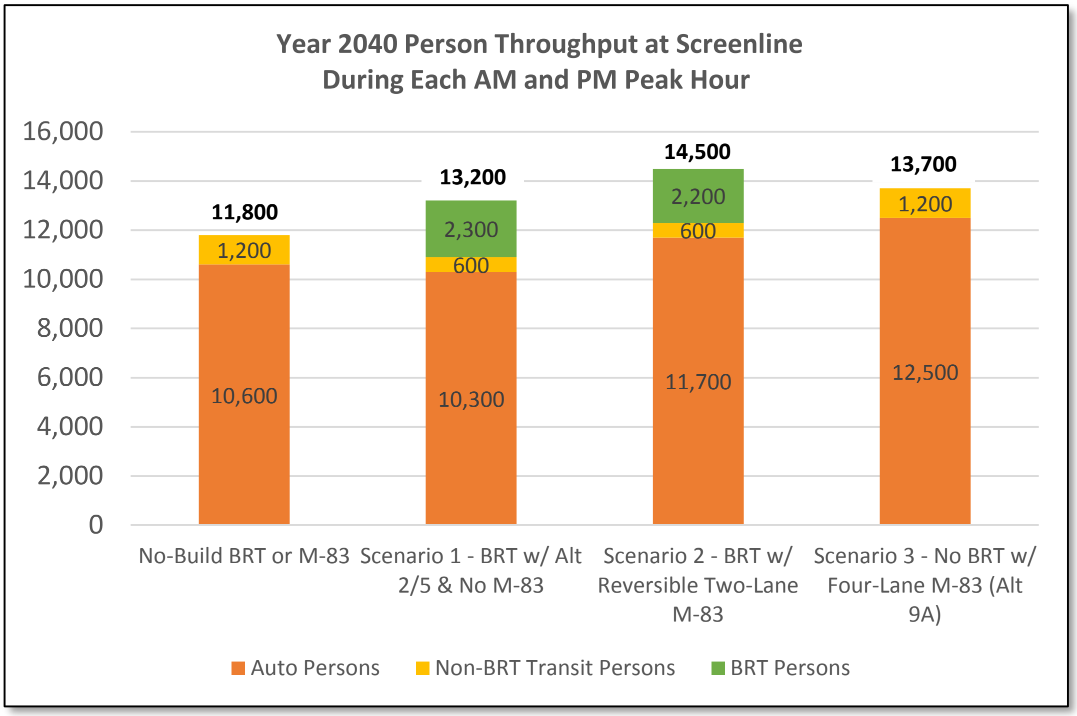
According to **Figure 2-2**, the highest person throughput at the designated screenline during the AM and PM peak hours would occur with Scenario 2, with a total throughput of 14,500 persons per hour. This is because Scenario 2 includes the BRT, in addition to other transit, and the additional auto accessibility provided by M-83 in the peak direction of travel, compared to the other scenarios that lack either BRT or M-83. Scenario 3 would have the second-highest throughput with 13,700 persons per hour.

The percentage of peak hour person-trips using transit would increase to 21.9 percent under Scenario 2, compared to 10 percent under No-Build, due to the implementation of BRT on MD 355. However, the total annual VMT for Scenario 2 would only decrease by 3 million compared to No-Build. This indicates latent demand would limit the VMT reduction potential of implementing BRT.

When comparing Scenarios 1 and 2, an interesting finding is that transit ridership in the corridor is not substantially influenced by the presence of M-83, with ridership in the narrow range of 2,800 to 2,900 passengers per hour in either scenario – a variance of about 4 percent.

Similarly, BRT has a limited influence on the throughput enabled by M-83 as these values range between 11,700 and 12,500 for Scenarios 2 and 3. The variance is approximately 6 percent, some of which may be attributed to non-peak direction travel on M-83 which is not possible in Scenario 2.

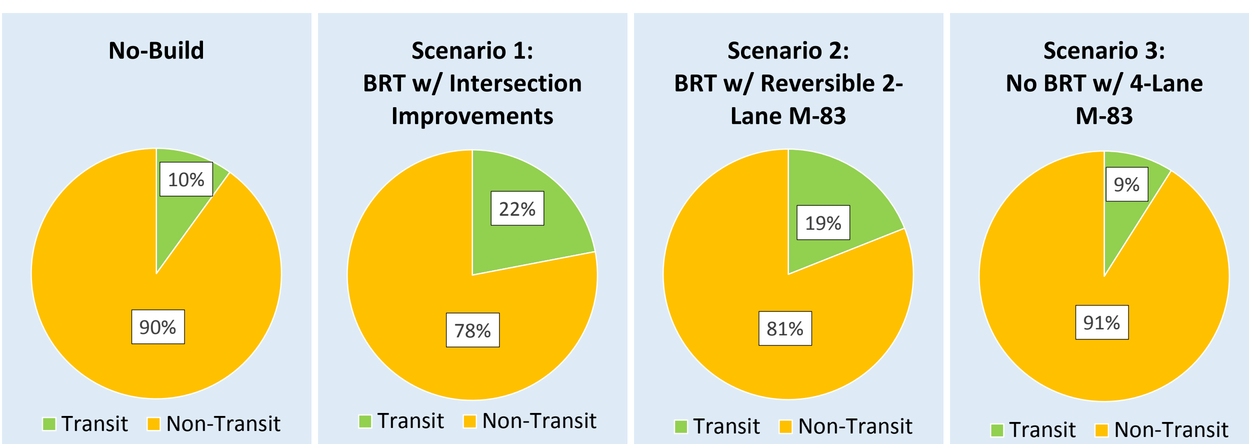
Figure 2-2: Comparison of Person Throughput



iii. Transit Mode Share

During the past several decades, Montgomery County has been working to employ smart growth principles including reducing the reliance on automobiles for travel and providing transit alternatives throughout the County. The effectiveness of transportation investment in achieving these objectives can be assessed by the peak hour mode choice on a corridor, or within a defined geography. For this supplement, the percent of person-throughput on transit during each AM and PM peak hour on the study corridors is reported as a performance measure for each of the analysis scenarios. This percentage includes the trips made on the BRT and existing transit services. **Figure 2-3** shows the transit mode share for each scenario.

Figure 2-3: 2040 Transit Mode Share during Each AM and PM Peak Hour



iv. Travel Time

The southbound AM and northbound PM peak hour travel times for the key north-south corridors within the study area for each scenario are presented in **Figure 2-4** on the following page. **Figure 2-4** shows the travel time along four routes identified by color:

- The Purple Route is MD 355
- The Red Route is M-83
- The Blue Route is Brink, Wightman, and Goshen Roads
- The Yellow Route is Brink, Wightman, and Snouffer School Roads

<u>Southbound – AM Peak Hour</u>

According to **Figure 2-4**, the BRT along MD 355 is expected to have the same travel time under Scenarios 1 and 2 (17 minutes). BRT will not be constructed under the No-Build condition or Scenario 3. The travel times for BRT vehicles are slower than those for general traffic due to BRT vehicle dwell times at the BRT stops within these limits, and delays due to single-lane segments where BRT vehicles cannot run concurrently in both directions.

For comparison, current transit travel times are about 24 minutes on this corridor, based on the schedule for Ride-On Route 55. This analysis indicates that implementation of BRT on MD 355 dramatically improves transit travel times, improving the competitiveness for transit for choice riders on this corridor and dramatically improving service for existing transit riders. This finding is reinforced by the person throughput presented in **Figure 2-2**, which shows that 50 percent of non-BRT transit passengers switch to BRT when it is available.

The No-Build AM peak hour travel time along the southbound Blue Route is significantly longer than the travel time along the Yellow Route due to long delays on the southbound approach of Goshen Road at the MD 124 intersection. These delays are not present in the reverse direction during the PM peak hour.

Along MD 355, Scenario 1 would have the lowest vehicular travel time (12 minutes) compared to the other scenarios, including No-Build. This is due to the proposed additional intersection improvements along MD 355 under Scenario 1, and not under any of the other scenarios. Travel time along M-83 (10 minutes) will be the same under Scenarios 2 and 3, and is the shortest travel time of any scenario by any mode.

Along Goshen Road, Scenario 2 is projected to have the lowest travel time (14 minutes) compared to the other scenarios. This could be due to the availability of the BRT on MD 355 and the availability of the Two-Lane Reversible M-83 under Scenario 2. Travel time (15 minutes) along Wightman Road/Snouffer School is the same for all scenarios.

<u>Northbound – PM Peak Hour</u>

Along MD 355, Scenario 1 would have the lowest vehicular travel time (14 minutes) compared to the other scenarios. This could be due to the proposed additional intersection improvements along MD 355 under Scenario 1, and not under any of the other scenarios. Also, Scenario 1 is projected to have the lowest travel time along the BRT segment. BRT vehicles are projected to travel 1 minute faster under Scenario 1 compared to Scenario 2.

Traveling along M-83 is projected to be slightly faster under Scenario 2 (10-minute travel time), compared to Scenario 3 (11-minute travel time). M-83 will not be constructed under the No-Build condition and Scenario 1. M-83 is the fastest route among any of these available under all scenarios. Along Goshen Road, Scenario 2 is projected to have the lowest travel time (13 minutes) compared to the other scenarios. This could be due to the availability of the BRT on MD 355 and M-83 under Scenario 2. The No-Build Condition and Scenario 1 have the fastest travel time (14 minutes) along Wightman Road/Snouffer School Roads.

Travel times on the BRT are slightly longer during the PM peak hour than during the AM peak hour. This is likely due to increased delays at study area intersections because of a less-pronounced directional split of the traffic volumes during the PM peak hour. However, transit travel times are still significantly improved over existing conditions by about 10 minutes, compared to about 27 minutes based on the schedule of Ride-On Route 55.

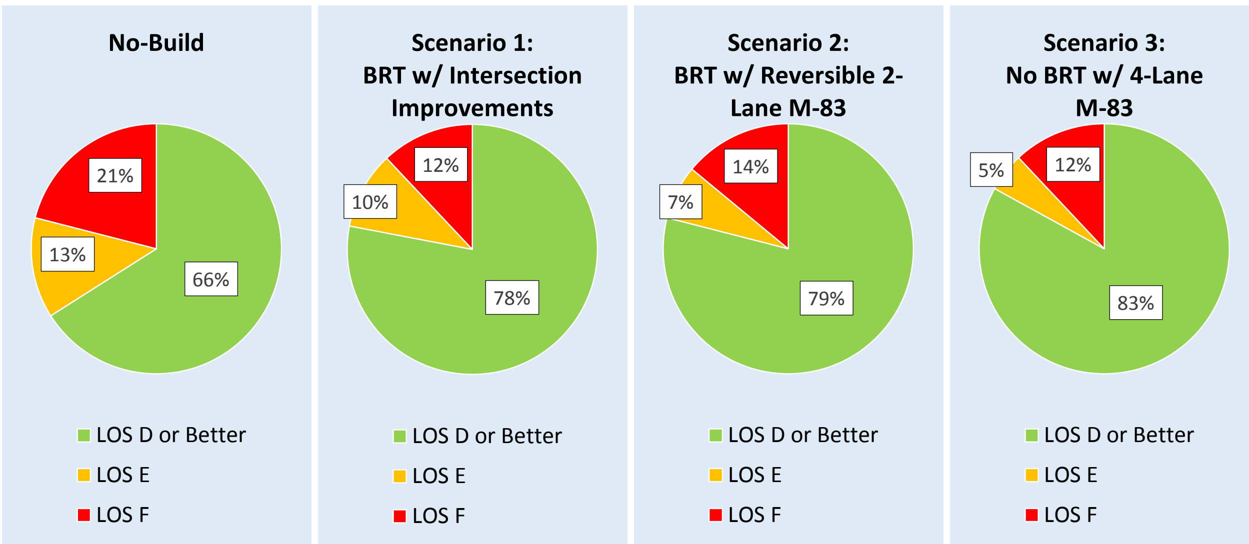
Figure 2-4: 2040 Travel Time Analysis Summary

In Minutes	Purple Route MD 355		Red Route M-83	Blue Route Goshen	Yellow Route Wightman Snouffer School
	Cars	BRT			
AM Peak Hour					
No-Build BRT or M-83	17	n/a	n/a	22	15
Case 1: BRT w/ Alt 2/5 Improvements	12	17	n/a	19	15
Case 2: BRT w/ Reversible 2-Lane M-83	16	17	10	14	15
Case 3: No BRT w/ 4-Lane M-83 (Alt 9A)	17	n/a	10	15	15
PM Peak Hour					
No-Build BRT or M-83	20	n/a	n/a	15	14
Case 1: BRT w/ Alt 2/5 Improvements	14	18	n/a	14	14
Case 2: BRT w/ Reversible 2-Lane M-83	20	19	10	13	16
Case 3: No BRT w/ 4-Lane M-83 (Alt 9A)	22	n/a	11	15	15

v. Intersection Operations

Figure 2-5 shows the percentage of intersections projected to be operating at Level of Service (LOS) E or F during either the AM or PM peak hours in 2040 (see **Section 4.C.iv** for the definition of LOS). Thirty-four percent of the intersections in the No-Build Condition are expected to be LOS E or LOS F during the AM or PM peak hours. Twenty-two percent of the intersections analyzed for Scenario 1 are expected to operate at LOS E or LOS F, while 21 percent of the intersections analyzed for Scenario 2 are expected to operate at LOS E or LOS F. Scenario 3 is expected to have the lowest number of intersections operating at LOS E or F, at 17 percent.

Figure 2-5: 2040 Intersection Operations Summary



D. Evaluation Metric Outcomes

The performance measurement criteria for each scenario are summarized in **Table 2-2**.

Table 2-2: General Summary of Performance Measures

	2040 No-Build	Change versus No-Build		
		2040 Scenario 1: BRT w/ Intersection Improvements	2040 Scenario 2: BRT w/ Reversible 2-Lane M-83	2040 Scenario 3: No BRT w/ 4-Lane M-83
Annual VMT (millions)	118	-3	+25	+31
Peak Hour Person-Throughput	11,800	+1,400	+2,700	+1,900
Transit Mode Share (% transit)	10%	22%	19%	9%
MD 355 Auto Travel Time AM / PM (minutes)	17 / 20	-5 / -6	-1 / 0	0 / +2
M-83 Auto Travel Time AM / PM (minutes)	n/a	n/a	-7* / -10*	-7* / -9*
BRT Travel Time AM / PM (minutes)	n/a	-3* / -5*	-3* / -4*	n/a
Percent LOS E / F Intersections	34%	22%	21%	17%

* Compared to MD 355 Auto Travel Time under No-Build, since M-83 and BRT do not exist to allow a direct comparison under No-Build

E. Key Findings

Vehicle-Miles Traveled (VMT): Scenario 1 would result in a negligible reduction in VMT compared to No-Build, as the increase in VMT associated with additional capacity from the intersection improvements is offset by a decrease in VMT associated with the implementation of BRT. Scenario 2 shows there would be a marked increase in VMT versus No-Build, due to the additional capacity provided by the reversible two-lane M-83. Scenario 3 shows the highest increase in VMT compared to No-Build, likely due to the additional capacity associated with the four-lane M-83 with no BRT route to offset a portion of the vehicle traffic.

Person-Throughput: Each of the three scenarios examined shows an increase in peak hour person-throughput along the combined key north-south routes through the study area, compared to No-Build. Scenario 1 shows an increase that can be attributed solely to the presence of BRT along MD 355 (since this metric is based on regional travel demand modeling that does not include the effects of intersection improvements). Scenario 2 shows there would be a significant increase associated with the combined effect of BRT on MD 355 and the reversible two-lane M-83, compared to No-Build. Scenario 3 provides the highest throughput in automobiles and no change in transit throughput compared to the No-Build scenario.

Travel Time: Since M-83 does not exist under the No-Build alternative, the No-Build travel times along MD 355 are used as the benchmark to which the MD 355 and M-83 travel times for Scenarios 1, 2 and 3 are compared. All scenarios analyzed show there would be a decrease in travel times during both the AM and PM peak hours compared to the No-Build alternative. These travel time improvements are the result of the increased capacity that would be provided under each of the three scenarios. In all scenarios, M-83 provides the shortest travel time of all options evaluated.

Bus-Rapid Transit Travel Time: Since BRT does not exist under the No-Build alternative, the No-Build automobile travel times along MD 355 are used as the benchmark to which the BRT travel times for Scenarios 1 and 2 are compared. Both Scenarios 1 and 2 showed BRT travel times along MD 355 that would be 3 to 5 minutes shorter than the automobile travel times along the same portion of MD 355. Transit travel times are dramatically improved in Scenarios 1 and 2, by 7 to 10 minutes compared to the AM and PM peak hour schedule times of existing Ride-On service along the corridor.

Transit Mode Share: The transit mode share percentage for the No-Build Scenario would be about 10 percent during each AM and PM peak hour in 2040. Under Scenario 1 which adds BRT on MD 355 plus local intersection improvements, the transit mode share would increase to about 22 percent compared to No-Build. The transit mode share would increase to about 19 percent under Scenario 2, compared to No-Build, as this scenario includes BRT on MD 355 plus the reversible 2-lane roadway along the Master Plan alignment for M-83. Scenario 3, which consists of a 4-lane roadway along the Master Plan alignment for M-83 and no BRT on MD 355, would have a transit mode share that is one percent lower than No-Build.

Intersection Operations: The number of individual intersections throughout the study area that are projected to operate at LOS F only during the AM peak hour, only during the PM peak hour, or during both the AM and PM peak hours, is projected to decrease significantly for each of the three Build scenarios, compared to No-Build. The largest reduction in the number of LOS F intersections would occur under Scenario 1, because this alternative primarily consists of capacity improvements on MD 355, and most of the LOS F intersections would be located along MD 355.Thirty-four percent of the intersections in the No-Build Condition are expected to be LOS E or LOS F during the AM or PM peak hours. Twenty-two percent of the intersections analyzed for Scenario 1 are expected to operate at LOS E or LOS F, while 21 percent of the intersections analyzed for Scenario 2 are expected to operate at LOS E or LOS F. Scenario 3 is expected to have the lowest number of intersections operating at LOS E or F, at 17 percent.

3. PROJECT BACKGROUND

A. Overview of Upcounty Growth Plans and Infrastructure Needs

i. Clarksburg Plan and Development Progression

The 1994 *Clarksburg Master Plan* established a long-range vision of Clarksburg as the northern-most population center along the I-270 Corridor in Montgomery County. The plan implementation will span decades, so development has been staged over time. The plan detailed a vision of Clarksburg as a transit- and pedestrian-oriented community surrounded by open space. The concept for Clarksburg featured a Town Center, including the Clarksburg Historic District; a regional transit-way (The Corridor Cities Transitway); two new neighborhoods, one east of I-270 and one west of I-270; the continuation of the residential character along MD 355, a greenway network, and employment along the I-270 Corridor. The concept placed a strong emphasis on farmland and open space preservation and promotes transit-oriented neighborhoods.

As of December 2011, 5,197 dwelling units and 1.3 million square feet of commercial space had been constructed within the Clarksburg planning area, an additional 9,891 dwelling units and 3.9 million square feet of commercial space was planned and 480 additional projects were pending approval; per the Clarksburg Overview Presentation dated December 2011: http://www.montgomeryplanning.org/community/plan_areas/I270_corridor/clarksburg/documents/ClarksburgOverview12_12_11.pdf

The Clarksburg Master Plan also proposed a number of improvements to existing roadways and new highways, transit routes, and bikeways to support future development. Widening of I-270, MD 355 (Frederick Road), an I-270 interchange with Newcut Road, the extension of Observation Drive, and the construction of Midcounty Highway Extended (M-83) are included in the transportation improvements, and are highlighted in the section below.

ii. Planned Major Transportation Improvements

Several transportation system improvements are planned to support the master plan vision of Clarksburg and travel demand growth in the upcounty and neighboring Frederick County. Many of these projects are progressing through planning and design; however, none of the projects have been completed as of this date. As a result, pressure on the current infrastructure to satisfy the growing demand is acute. **Figure 4-1** is a map showing the locations of the roadway projects below that are included in the 2016 Constrained Long-Range Plan (CLRP).

a. Corridor Cities Transitway (CCT)

The proposed 14-mile Corridor Cities Transitway (CCT) would run from the Shady Grove Metro Station to the COMSAT site in Clarksburg. As indicated in the June, 2010 *Great Seneca Science Corridor Master Plan*, the CCT will provide a transit option among the Corridor Cities, improve mobility within the corridor, reduce congestion on I-270, and extend transit service west and north of the Shady Grove Metro Station. In addition to the existing stations at Metropolitan Grove MARC Station and Shady Grove Metro Station, fourteen new stations are planned.

b. MD 355 Bus Rapid Transit (BRT)

The *Countywide Transit Corridors Functional Master Plan* (M-NCPPC, December 18, 2013) recommended BRT facilities along 11 corridors, traversing 102 miles throughout the county. The proposed BRT service would move more people to and from jobs, homes, shopping, and entertainment areas in urbanizing parts of the county, while making more efficient use of our public ROW and existing pavement. MD 355 is one of the corridors recommended for improvements in the *Countywide Transit Corridors Functional Master Plan*.

The *MD 355 Bus Rapid Transit Study* is underway to evaluate roadway improvements to implement Montgomery County's BRT system between Bethesda and Clarksburg. The overall corridor is approximately 21-miles-long and alignments under study include MD 355 and Observation Drive north of Middlebrook Road. A total of 29 to 31 station locations are being evaluated depending on the alignment. This project is currently funded by the County through alternatives development.

c. Interstate 270 Widening

The *Clarksburg Master Plan, Transportation and Mobility Plan* (June 1994) proposed the widening of I-270 to no more than eight travel lanes within a 350-foot right-of-way between MD 121 (Clarksburg Road) and Ridge Road and no more than six travel lanes from MD 121 north to the Frederick County line. The 35-mile, I-270 corridor carries from 79,400 vehicles a day on the north end of I-270 to 261,200 vehicles a day near the Capital Beltway. By the year 2035, these volumes are projected to increase to 107,000 to 290,000 vehicles a day.

In January 2008, the Montgomery County Planning Department published *Guiding the Future of the MD 355/I-270 Corridor*, which identified strategies to improve the 27-mile corridor connecting Bethesda and Clarksburg. These strategies included, but were not limited to, providing additional multimodal connections along the corridor to encourage use of transit, walking and bicycling to reduce automobile dependency, constructing the Corridor Cities Transitway and the Purple Line, expand MARC train service, and improving transit service (e.g., shorter headways on major arterials, bus lanes, and queue jumping for express service).

d. MD 355 Widening

The Master Plan of Highways proposes that MD 355 provide 4 to 6 lanes between MD 27 and MD 121, with the wider section to the south of Brink Road. The plan also proposes constructing a new alignment of MD 355 around the Clarksburg Historic District. Widening of MD 355 has not entered the facility planning process and is not contained in the 2016 CLRP.

e. Newcut Road (Little Seneca Parkway) Interchange at I-270

The *Clarksburg Master Plan, Transportation and Mobility Plan* (June 1994) identified Newcut Road as a proposed arterial east-west link between the proposed Midcounty Highway and I-270. A new interchange at I-270 and Newcut Road was proposed to serve the southern portion of the Clarksburg Planning Area, in the vicinity of Comsat and approximately one-mile south of the existing I-270/MD 121 interchange.

The *I-270/US 15 Multi-Modal Corridor Study* (2009) further considered the proposed new interchange at I-270 and Newcut Road. Additional study or design of this interchange is not funded as of November 2016.

f. Watkins Mill Road Interchange at I-270

This project constructs a new interchange at Watkins Mill Road Extended. This consists of a full interchange connecting I-270 to and from Watkins Mill Road Extended. This also includes two-lane Collector-Distributor roads on I-270 in the northbound and southbound directions.

g. Observation Drive

The *Clarksburg Master Plan, Transportation and Mobility Plan* (June 1994) identified Observation Drive as a proposed four-lane arterial roadway extending from Germantown to MD 355, north of the Clarksburg Historic District. As proposed, this roadway would be wide enough to accommodate a separate bus lane or light rail. The roadway would provide additional access to major employment areas within the Study Area.

Portions of Observation Drive have been constructed in both Germantown and Clarksburg. As of November 2007, Facility Planning of Observation Drive from Water Discovery Lane (existing road) in Germantown to approximately 0.25-mile south of Stringtown Road in Clarksburg was underway. No current funding or approved construction plans are in place.

h. Goshen Road South

This project provides for the design of roadway improvements along Goshen Road from south of Girard Street to 1,000 feet North of Warfield Road, a distance of approximately 3.5 miles. The improvements will widen Goshen Road from the existing 2-lane open section road to a 4-lane divided, closed section roadway. A sidewalk and a hiker/biker path are also proposed. Construction completion is scheduled for FY '22, and included in the CIP in the "Beyond 6 Years" period.

i. Midcounty Highway (M-83)

The *Clarksburg Master Plan, Transportation and Mobility Plan* (June 1994) built upon earlier plans and proposed the extension of Midcounty Highway as a six-lane road from Germantown to MD 27 (Ridge Road) and a further extension of this roadway as a four-lane facility from MD 27 to Stringtown Road. Midcounty Highway would provide connections between Clarksburg, Germantown, and Gaithersburg for access to existing and planned development. The current status of studies evaluating M-83 are described in greater detail in **Section 3.C.**

B. MCS Study Purpose, Objectives, and Relationships to Other Studies

The purpose of this supplement to the Midcounty Corridor Study is to assess the effects of the planned Bus Rapid Transit route along MD 355 on the projected traffic operations in the Midcounty Corridor Study area with and without several of the proposed alternatives from the Midcounty Corridor Study. One new alternative is also being considered and evaluated as part of this update. The objective of the study is to quantify operational measures of effectiveness associated with these alternatives, which are described in **Section 4.**

C. Brief Review of M-83

i. Element of Master Plans

The purpose of the Midcounty Corridor Study (MCS) is to develop transportation improvements in Montgomery County east of I-270 between Clarksburg and Gaithersburg that will:

- Reduce projected congestion on roadway facilities;
- Provide a north-south corridor which improves the safety and efficiency of short and moderate length trips in the study area;
- Improve vehicular, pedestrian and bicycle access to residential, commercial and employment destinations in Clarksburg and in the eastern areas of Gaithersburg and Germantown; and
- Be implementable in an environmentally sensitive manner using measures to avoid, minimize, and mitigate impacts.

The need for this project is based on the following seven considerations:

- *Reduce congestion*: 74 intersections (including 7 proposed new intersections) were evaluated within the project study area. Sixteen (16) of these intersections would be highly congested by the design year 2040, including six (6) intersections along MD 355.
- *Improve safety*: Nearly all the arterials comprising the build alternatives currently experience crash rates higher than the statewide average for similar facilities.
- *Enhance connections between economic centers*: MD 355 currently has more than 90 driveways, entrances, and signalized/unsignalized intersections along MD 355 between MD 27 and MD 124 (Montgomery Village Avenue). Traffic from I-270 uses MD 355 to avoid peak period congestion on I-270. Travel time along MD 355 is projected to increase by 70% during the AM peak hour and 43%

during the PM peak hour in 2040, compared to existing conditions, and the mixing of regional and local traffic is expected to lead to increased crashes.

- *Accommodate planned land use*: The MD 355/I-270 Technology Corridor accounts for 60% of the County's jobs, 73% of its industrial acreage, 81% of its office space, and 56% of its retail sales. In addition, it has the capacity to accommodate 72% of the County's anticipated future residential development and 83% of its future job growth.
- *Provide bicycle and pedestrian connections:* The region lacks adequate north-south, on-street and off-street bicycle facilities necessary to provide safe, efficient connections between existing and future bicycle facilities in the region.
- *Emergency response:* A new or improved north-south regional highway would improve emergency response and incident management.
- *Improve access*: Reducing commuting times and improving mobility and traffic safety would enhance quality of life.

ii. Alternatives Studied and Recommendations

a. MCS Project Development Timeline

Since the 1960s, Midcounty Highway (M-83), a proposed 8.7-mile controlled access, four to six-lane major highway from Ridge Road (MD 27) in Clarksburg to Redland Road in Derwood, has been an element of the transportation master plan for Montgomery County. The County has completed a three-mile section of Midcounty Highway between Shady Grove Road and Montgomery Village Avenue.

In the 1980s, the Maryland State Highway Administration (SHA) conducted the *Maryland Route 355 Corridor Study*. This study concluded that improvements to MD 355 and a completed Midcounty Highway (M-83) would both be required in the next 10-15 years to provide access for existing and planned development east of I-270 in Germantown.

Accordingly, in 1986 MCDOT initiated the *Germantown-Montgomery Village Connector Study (Montgomery County CIP #863116)* that included preliminary engineering for the northern extension of Midcounty Highway from Montgomery Village Avenue to MD 27 along the Master Plan alignment. Due to fiscal constraints, the *Germantown-Montgomery Village Connector Study* was put on hold in 1992; however, planned development and SHA improvements to MD 355 proceeded. As communities developed along the proposed Midcounty Highway north of Montgomery Village Avenue, portions of the Midcounty Highway Master Plan alignment were constructed and additional rights-of-way were dedicated. By 2000, the portion of MD 355 between Montgomery Village Avenue and Middlebrook Road was reconstructed as a six-lane highway, and the portion from Middlebrook Road to Ridge Road was reconstructed as a four-lane highway.

Begun in 2004, the *Midcounty Highway (M-83) Facility Planning Study* reinitiated the evaluation of the master plan alignment from Montgomery Village Avenue to MD 27. Due to the potential magnitude of environmental impacts associated with the project, and the likelihood that the project would need federal permits, the *Midcounty Highway (M-83) Facility Planning Study* expanded to include the development of various alternatives to the Master Plan, in compliance with the National Environmental Policy Act (NEPA). The County invested additional resources for the evaluation of alternatives, and changed the project name to Midcounty Corridor Study (MCS) to reflect the expanded analysis. The U.S. Army Corps of Engineers (USACE) joined the effort as the lead federal agency for purposes of managing the NEPA process. USACE, the U.S. Environmental Protection Agency (EPA), and the Maryland Department of the Environment (MDE) agreed to be "concurring parties." Concurrence from these parties was received in two project milestones: Purpose and Need (P&N), and Alternatives Retained for Detailed Study (ARDS). Concurrence would also be needed for the third and final milestone, the Preferred Alternative and Conceptual Mitigation (PACM), should the project advance beyond the study stage.

b. Alternatives Considered

Beginning with a suite of eleven preliminary alternatives, the MCS focus was narrowed to five build alternatives and the No-Build Alternative. The alternatives and their primary characteristics are briefly described below.

Alternative 1 – No-Build Alternative

The No-Build Alternative is a baseline for comparing the build alternatives.

Alternative 2 – Transportation Systems Management/Travel Demand Management

Alternative 2 consists of intersection improvements which could be implemented within the existing right-of-way, with the goal of trying to improve all intersections that were projected to be highly congested in the design year under the No-Build scenario.

Alternative 4 Modified - Brink-Wightman-Snouffer School-Muncaster Mill

Alternative 4 Modified would widen the Brink-Wightman-Snouffer School-Muncaster Mill corridor to a four to six-lane divided highway without access controls. A sidewalk, 10-foot wide shared use path, and two 5.5-foot on-street bicycle lanes would be provided. The alternative would include more than 125 access points (13 signalized intersections, 25 unsignalized intersections, and 90 driveways).

Alternative 5 –MD 355 with Service Roads

Alternative 5 would improve MD 355 to a six-lane highway, with service roads at select locations. The service roads would reduce the number of driveways from 62 to 17, between MD 27 and MD 124, thereby reducing the potential for accidents.

Alternative 8 – Master Plan Alignment Truncated at Watkins Mill Road

Alternative 8 would provide a new four-lane divided highway with access controls, following the M-83 Master Plan alignment from Snowden Farm Parkway to Watkins Mill Road, where the new highway would tie into Watkins Mill Road (a distance of 4.3 miles). This alternative would leave a gap in Midcounty Highway between Watkins Mill Road and Montgomery Village Avenue to avoid impacts to the Whetstone Run stream valley.

Three Northern Terminus Options were proposed at the north end of the alignment. Option A would follow the Master Plan alignment. Option B would incorporate existing Brink Road and Ridge Road, and has been shown to be undesirable in terms of operations and safety. Option D would traverse the Agricultural Reserve, but would also avoid sensitive resources in North Germantown Greenway Stream Valley Park.

Alternative 9 – Master Plan Alignment

Alternative 9 would provide a new four-lane divided highway with access controls, following the M-83 Master Plan alignment for a distance of 5.7 miles. With its connection to the existing Midcounty Highway to the south and Snowden Farm Parkway to the north, Alternative 9 would complete a 12.2-mile, access-controlled, four-lane divided highway between Gaithersburg and Clarksburg. This alternative includes the same three Northern Terminus Options described for Alternative 8.

D. Brief Review of BRT Studies

i. Countywide Transit Corridors Functional Master Plan

The Countywide Transit Corridors Functional Master Plan provides enhanced opportunities for travel by transit to support Montgomery County's economic development and mobility goals in an environmentally sustainable way, and in a way that preserves our existing communities.

As a Functional Master Plan, it makes no changes to current planned land use or zoning, but recommends changes and additions to the transportation network that are needed to serve the County's most densely developed areas, areas planned for redevelopment, and areas planned for new dense development.

The plan includes 11 corridors, located mostly in the southern third of the county. However, two corridors – the Corridor Cities Transitway (CCT) and MD 355 North – extend toward the upcounty area parallel to I-270.

ii. MD 355 Alternatives Analysis

An independent study of the MD 355 BRT corridor is being performed jointly by the Maryland State Highway Administration (SHA), the Maryland Transit Administration (MTA), and MCDOT along MD 355 between Redgrave Place in Clarksburg and the Bethesda Metro Station. This ongoing study is an evaluation of approximately 21 miles of proposed BRT improvements, with potential alignments along MD 355 and Observation Drive, that was initiated in January 2015. The baseline design year condition for the SHA/MTA BRT study assumes that Midcounty Highway (M-83) would be constructed as defined in the Master Plan.

This supplement to the Midcounty Corridor Study focuses only on the segment of the planned BRT route between MD 27 and Shady Grove Road.

a. Range of Alternatives North of MD 124

At the time of the Midcounty Corridor Study's evaluation of BRT effects, the SHA/MTA BRT study was evaluating two BRT alternatives along MD 355:

- Alternative 3A: BRT from Rockville Metro Station to Redgrave Place in Clarksburg, with the BRT alignment following MD 355 up to Middlebrook Road, then following a parallel alignment along Observation Drive.
  - BRT would operate in dedicated transit lanes while on MD 355
  - BRT would operate in lanes shared with general traffic on Middlebrook Road and Observation Drive
  - Observation Drive extended to Clarksburg as a multi-lane divided arterial roadway
- Alternative 3B: BRT from Rockville Metro Station to Redgrave Place in Clarksburg, with the entire alignment remaining on MD 355.
  - BRT would operate in dedicated lanes along MD 355 south of Brink Road
  - BRT would operate in lanes shared with general traffic along MD 355 north of Brink Road
  - MD 355 north of Ridge Road is master-planned to be widened to a 6-lane divided roadway to Brink Road, and to a 4-lane divided roadway to Observation Drive extended, including a bypass of the Clarksburg historic district (although this widening is not included in the 2016 CLRP).

b. Alternative Selected for Midcounty Corridor Study Analysis

Based on preliminary information provided by the SHA/MTA BRT Study team, the Midcounty Corridor Study analysis of BRT effects includes BRT Alternative 3B.

4. METHODOLOGY

A. Assembly of Analysis Scenarios

This supplement includes four scenarios for the Midcounty Corridor Study (MCS) that assume various improvements throughout the study area by Year 2040. The specific improvements associated with each scenario are presented in **Table 4-1**.

Table 4-1: Midcounty Corridor Study (MCS) Scenarios for Year 2040

List of Improvements by Year 2040	No-Build	Scenario 1	Scenario 2	Scenario 3
BRT Alt 3B along MD 355		✓	✓	
MCS Alt 2/5 – Local Intersection Improvements		✓		
Two-Lane, Reversible M-83 Master Plan Alignment			✓	
MCS Alt 9A – Four-Lane M-83 Master Plan Alignment				✓

The 2011 MCS evaluated alternatives for improving mobility along the Midcounty Corridor between Gaithersburg and Clarksburg. The earlier study did not include any BRT alternatives. The MCS study area includes the following key roadways:

- Existing Midcounty Highway, from Shady Grove Road to Montgomery Village Avenue
- MD 355 (Frederick Road), from Shady Grove Road to MD 27 (Ridge Road)
- Montgomery Village Avenue, from MD 355 to Wightman Road
- Goshen Road, from existing Midcounty Highway to East Village Avenue
- Muncaster Mill/Snouffer School/Wightman Roads, from Shady Grove Road to Brink Road
- Brink Road, from Wightman Road to MD 27 (Ridge Road)
- Watkins Mill Road, from MD 355 (Frederick Rd) to Apple Ridge Road

i. Existing Conditions

Existing conditions were evaluated as part of the Midcounty Corridor Study report completed in 2011. Please refer to that document for the results of the existing conditions analysis.

ii. Year 2040 No-Build Condition

The No-Build Condition assumes that Midcounty Highway would not be constructed along any alignment, none of the localized intersection improvements associated with Midcounty Corridor Study Alternatives 2 or 5 would be implemented, and none of the BRT alternatives from the SHA/MTA study would be built. However, all other proposed features of the transportation system from the 2016 Constrained Long-Range Plan (CLRP) are assumed to have been implemented. A list of these projects can be found in documents online at http://old.mwcog.org/clrp/resources/KeyDocs_2014.asp. **Figure 4-1** shows the Midcounty Corridor Study area boundary and the 2040 road network associated with the No-Build Condition.

iii. Scenario 1 – Year 2040 BRT with Alt 2/5 (Intersection Improvements) without M-83

Scenario 1 includes all of the planned roadway improvements from the No-Build Condition, plus BRT Alternative 3B and the improvements from Alternatives 2 and 5. Scenario 1 does not include building Midcounty Highway (M-83). **Figure 4-2** shows the study area boundary along with the roadway network and improvement locations associated with Scenario 1.

Midcounty Corridor Study (MCS) Alternative 2 was proposed to improve the existing transportation system using localized intersection improvements confined to the existing right-of-way. Based on Year 2030 forecasts from the MCS, there would be 16 intersections located throughout the study area that would exhibit a high degree of congestion. Intersection improvements that could be constructed within the existing rights-of-way (such as additional turning lanes) were evaluated at these 16 intersections.

MCS Alternative 5 consists of improvements along 6.6-miles of existing roads, including MD 27, MD 355, and MD 124 (Montgomery Village Avenue and existing Midcounty Highway). The proposed corridor improvements associated with MCS Alternative 5 include:

- Ridge Road would be widened to a six-lane divided highway with a sidewalk and shared use path from Snowden Farm Parkway to Brink Road. (From Brink Road to MD 355, Ridge Road is already six lanes.)
- From Ridge Road to Middlebrook Road, MD 355 would be widened from a four-lane divided highway that contains auxiliary turning lanes at various locations to a six-lane divided highway with auxiliary turning lanes, service roads at select locations, and a sidewalk and shared use path.
- From Middlebrook Road to Montgomery Village Avenue, MD 355 is already a six-lane divided highway. Service roads would be added at select locations, which would require substantial property takings to accommodate them.
- Montgomery Village Avenue between MD 355 and Midcounty Highway is already a six-lane divided highway, but would be modified by replacing the existing eastern sidewalk with a shared use path.
- Existing Midcounty Highway from Montgomery Village Avenue to Goshen Road would be widened from the existing four-lane divided highway to a six-lane divided highway with a sidewalk and shared use path.

iv. Scenario 2 – Year 2040 BRT with M-83 Reversible Two-Lane Option

Scenario 2 includes all of the planned roadway improvements from the No-Build alternative, plus BRT Alternative 3B and a reversible two-lane M-83 option. This option for M-83 consists of building a two-lane undivided roadway along the master plan alignment, with the both lanes carrying traffic one-way southbound during the AM peak period and one-way northbound during the PM peak period. At all other times, the roadway would carry one lane of northbound traffic and one lane of southbound traffic. There are a few locations where the two-way traffic must be maintained at all times to provide access to/from “landlocked” communities (at Blunt Road, Grassy Knoll Terrace, and Gatlin Drive). The parkway will consist of a three lane undivided section along these relatively short segments. **Figure 4-3** shows the study area boundary along with the roadway network associated with Scenario 2.

v. Scenario 3 – Year 2040 No BRT with M-83 Alternative 9A

Scenario 3 includes all of the planned roadway improvements from the No-Build alternative, plus Alternative 9A. Scenario 3 represents the preferred alternative resulting from the MCS and the required public involvement and agency approvals. This alternative consists of a roadway built on new alignment (designated as M-83 in the county master plan), extending from the current northern terminus of Midcounty Highway to MD 27. The Preferred Alternative conforms in its entirety to the Master Plan Alignment for M-83. It does not include any BRT alternatives along MD 355. **Figure 4-4** shows the study area boundary along with the roadway network associated with Scenario 3.

Figure 4-1: Study Area with 2040 No-Build Transportation Network

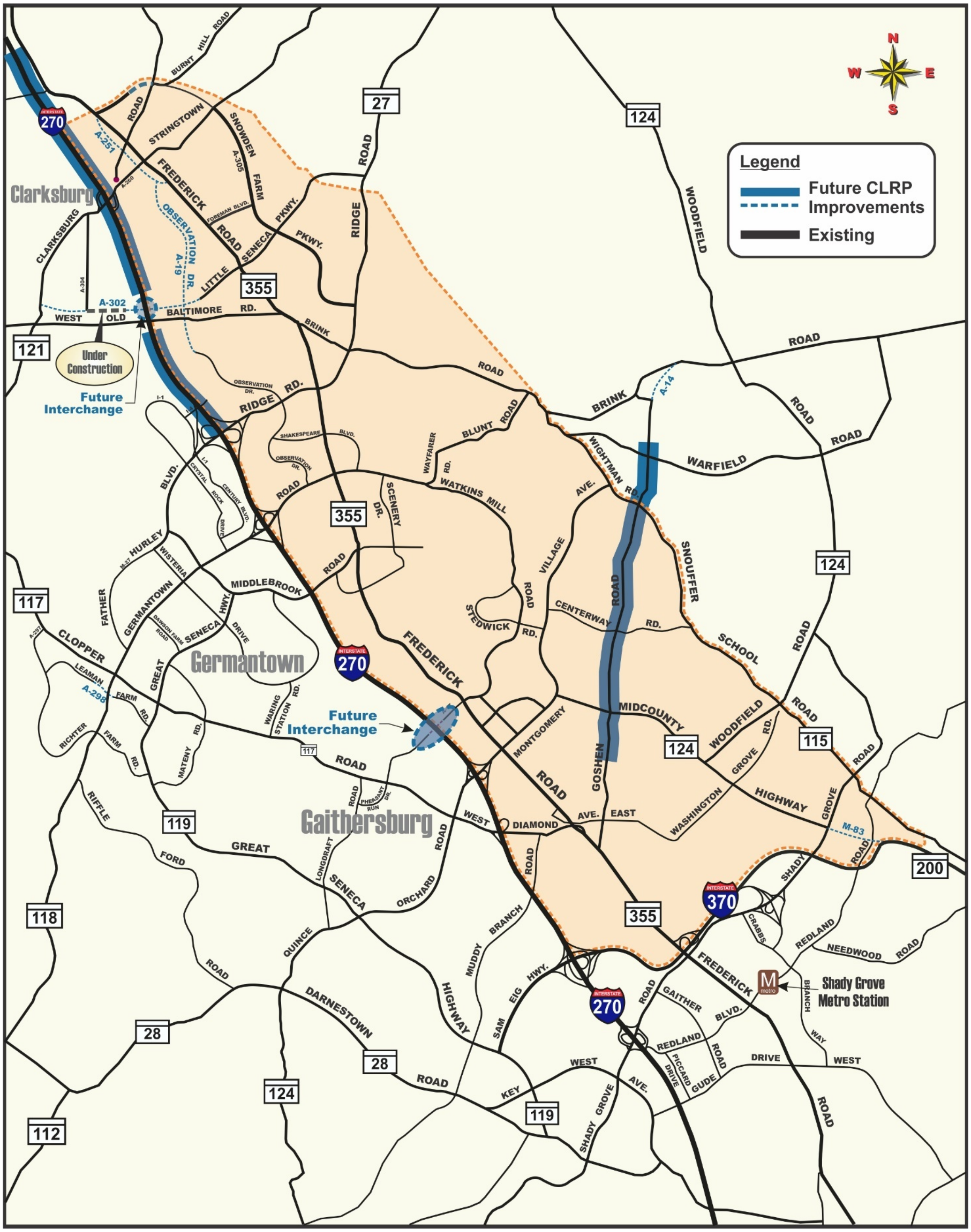


Figure 4-2: Study Area with 2040 Scenario 1 Improvements

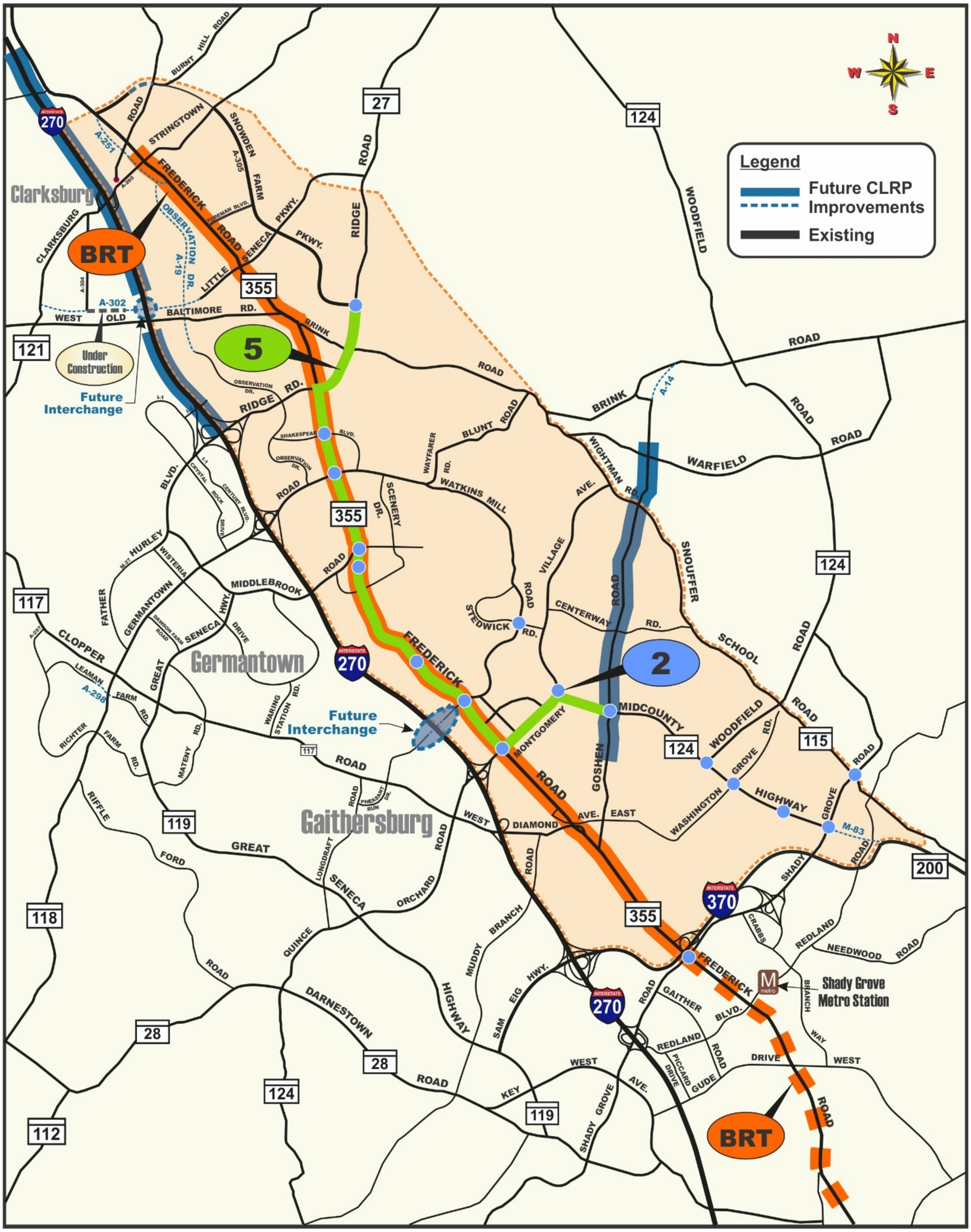


Figure 4-3: Study Area with Scenario 2 Improvements

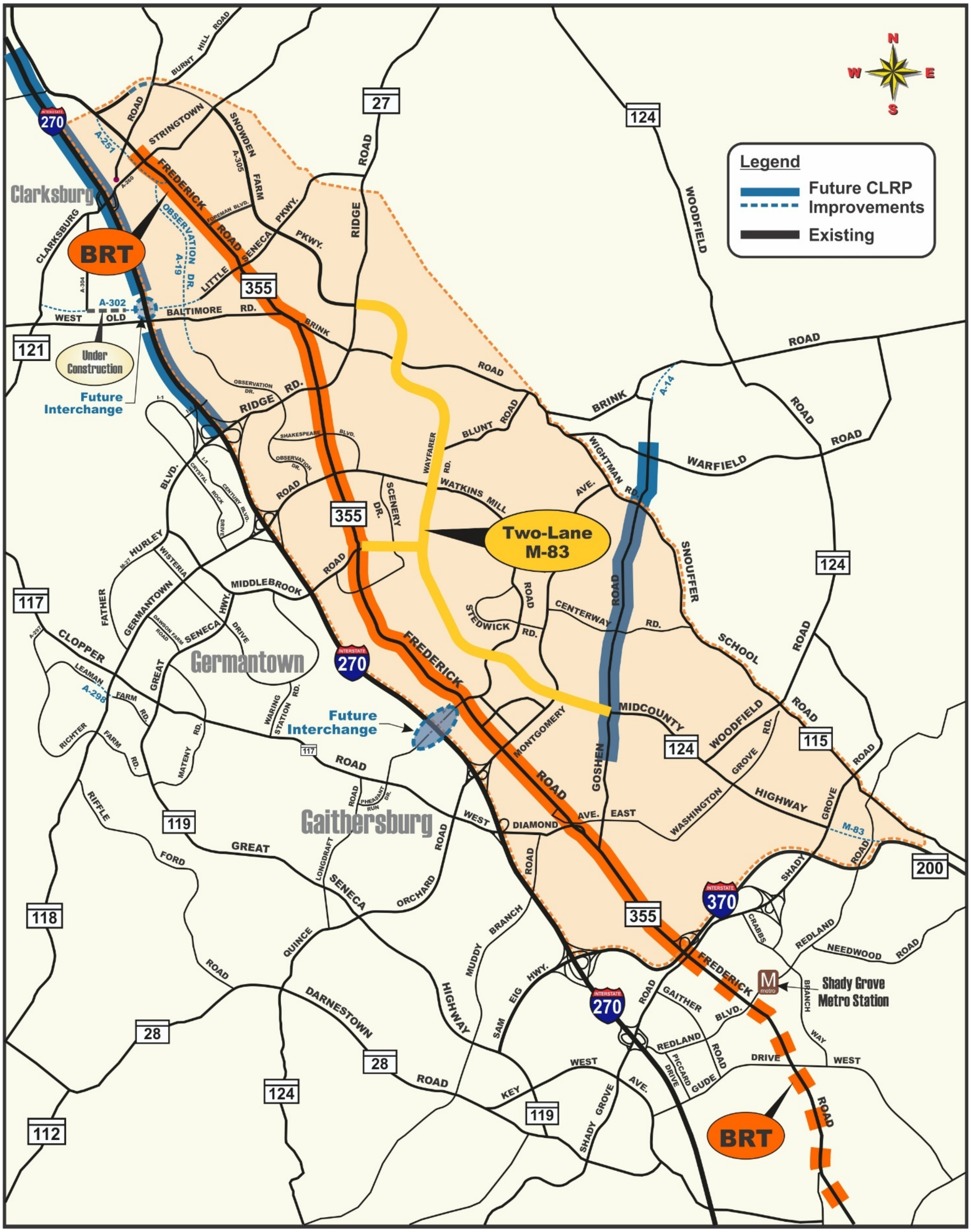
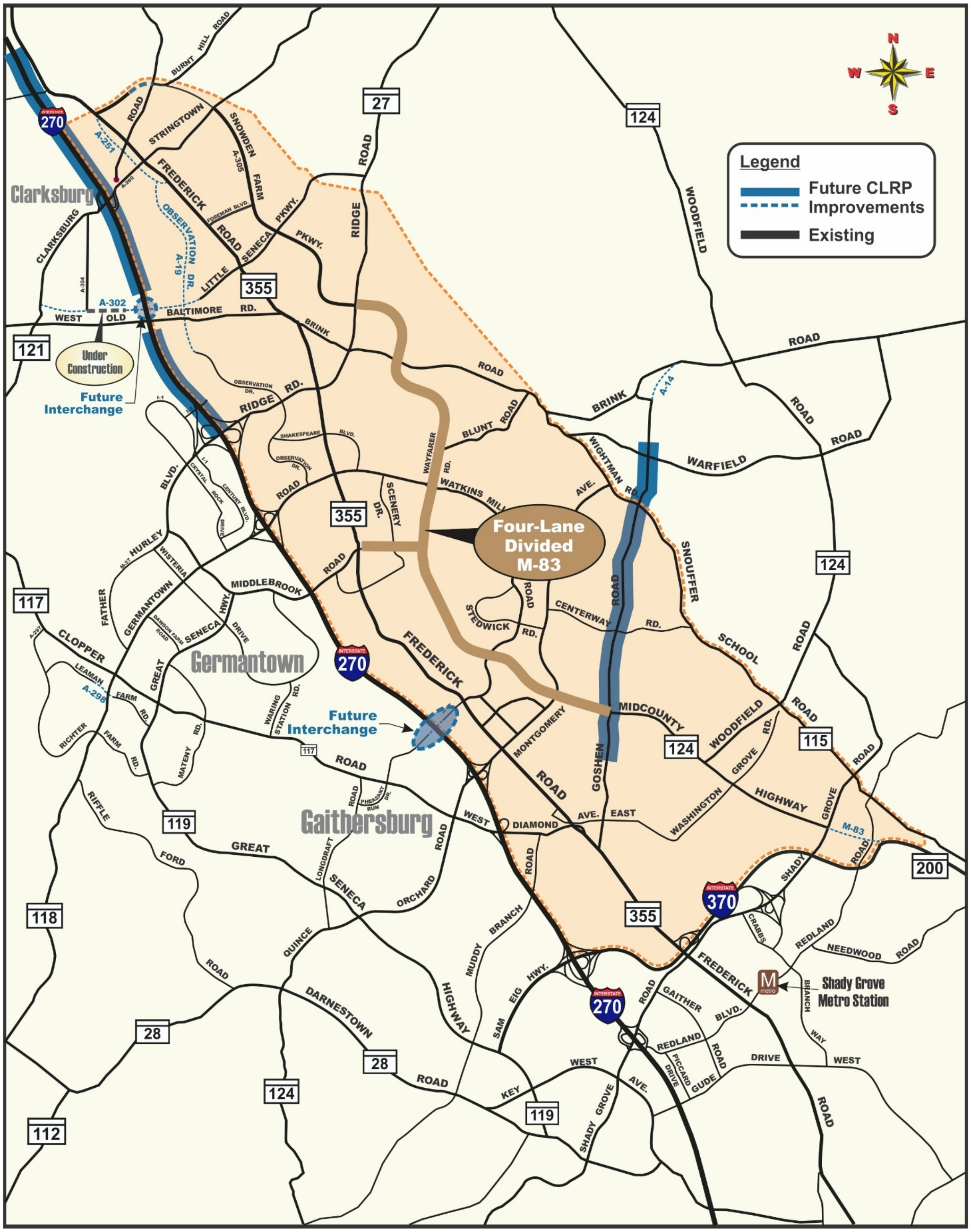


Figure 4-4: Study Area with Scenario 3 Improvements



B. Determination of Analysis Year and Associated Network and Land Use Conditions

The travel demand modeling for the study was performed using the Metropolitan Washington Council of Governments (MWCOG) model (Version v2.3 build 57 with Round 8.3 Cooperative Land Use Forecasts). The operational analyses were performed using Synchro (version 9) for the study area (excluding MD 355) and VISSIM (version 8) for the portion of MD 355 within the study area (i.e., from Shady Grove Road to Ridge Road). Year 2040 was selected as the design year for all analyses to be consistent with the work being done by others for the SHA/MTA MD 355 BRT Study.

The transportation network input data for the regional travel demand model was obtained from the SHA/MTA MD 355 BRT study consultant team and, therefore, included the planned BRT routes for that study's BRT Alternative 3B. However, since M-83 is a master-planned roadway, their model input networks also included this roadway (Midcounty Highway Extended) and defined it as a 6-lane major highway. For the 2040 No-Build Condition and Scenarios 1 and 2, the model input networks were modified to remove this roadway and the models were run with this change to generate new AM peak hour, PM peak hour, and daily roadway link volumes for design year 2040. No new travel demand modeling was necessary for Scenario 3 since it had already been modeled (from prior study) as MCS Alternative 9A which did not include BRT on MD 355.

C. Determination of Evaluation Metrics

i. Vehicle-Miles Traveled

Vehicle-Miles Traveled, or VMT, is a useful measure of travel demand because it includes a distance component, whereas a simple measure of volume occurs at a single point along a roadway. VMT is often calculated based on an annual period, and is therefore typically a large number. For this reason, this measure is usually depicted in units of 100-Million Vehicle-Miles Traveled, or 100MVMT. The various parallel north-south roadways within the project study area have different lengths, and the different alternatives being evaluated shift the demand in varying degrees from one road to the next. Measurement of VMT accounts for these shifts.

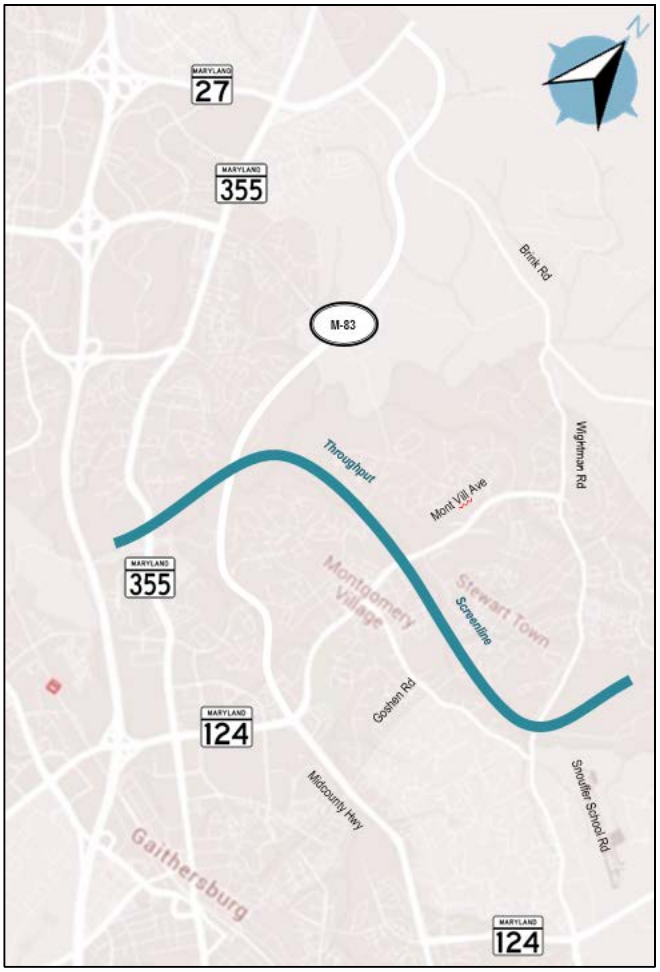
Disadvantages of using VMT as an evaluation metric include its inability to convey specific traffic operational conditions and its lack of localized applications. It also does not express travel demand in terms of people, but does so only in terms of vehicles. It is a broad measure of traffic demand that can be used to compare how effectively different alternatives move vehicles throughout an entire area, but must be considered in combination with other metrics in order to be a useful measure of transportation system performance.

For this study, VMT was calculated using post-processed daily traffic volume output from the MWCOG travel demand model, in conjunction with the distances along the key north-south roadways being evaluated for each scenario.

ii. Person Throughput

Person Throughput is a measure of the number of people moving across a defined cordon or screen line within a given period of time. **Figure 4-5** shows the location of the screen line selected for this study. It is measured in units of Persons per Hour. A key advantage of this measure is its focus on moving people in multiple modes of transportation. A primary goal of this transportation study is to evaluate various alternatives based on how well they move people, not just cars. Person-throughput includes an estimate of people being moved by transit as well as in high-occupancy vehicles (HOVs) by using vehicle occupancy data measured along the key corridors and transit ridership projected using the MWCOG travel demand model. Passenger car volumes are based on post-processed daily traffic volume output from the MWCOG travel demand model.

Figure 4-5: Measurement Location for Person-Throughput



iii. Travel Time

One of the most commonly-used and simplest to understand metrics being used for this study is Travel Time. Travel Time is measured in minutes between two predetermined points or screen lines. **Figure 4-6** shows the routes that were selected for measuring the travel times through the Midcounty Corridor Study area along with the lengths and designated endpoints for each route. The routes from the northern terminus to the various southern termini, which start at MD 27 and end at MD 124 are as follows:

- Two-Lane or Four-Lane M-83 – 5.1-mile distance
- MD 355 (Purple) – 5.2-mile distance
- Brink/Wightman/Goshen Roads (Blue) – 6.1-mile distance
- Brink/Wightman/Snouffer School Roads (Yellow) – 6.5-mile distance

Travel time is a beneficial measure of effectiveness because it can be perceived or measured by the actual roadway users without any knowledge of the overall volume of traffic on the roadway or the distance that has been traveled. Drivers and transit users alike often use travel time to make major long-term decisions such as where to live or where to work, but also spontaneous decisions such as whether to take a bus, use Metrorail, or drive, and if driving, which route to take. Therefore, it is the most tangible of all the metrics being evaluated for this study.

A disadvantage of the travel time metric is that it cannot account for variations in traffic conditions caused by incidents or inclement weather. Projected travel times that are measured in the field or estimated using simulation software assume typical conditions based on roadway capacity, traffic signal timing, and traffic volume. Also, this measure does not quantify how manty people are served by the facility.

Figure 4-6: Map of Routes Measured for Travel Times

iv. Intersection Congestion

Intersection Congestion is measured in terms of delay and often depicted in terms of Levels of Service (LOS). Delay is measured in units of seconds per vehicle. Delay is a useful metric because it quantifies what drivers typically experience as they travel. LOS helps qualify the delay by explaining classifying ranges of delay into letter grades A through F that are easily understood by the public. For example, a driver may experience approximately 60 seconds of delay waiting at a red traffic signal, but that driver may not understand whether 60 seconds is “good” or “bad”. Based on the Highway Capacity Manual (HCM), a delay of 60 seconds at a traffic signal equates to LOS E, which usually coincides with long queues that occasionally fail to completely clear during every signal cycle. Drivers typically begin to feel uncomfortable when experiencing this level of service. The only level worse than LOS E is LOS F, which is characterized by excessive queuing. **Table 4-2** below summarizes the delay ranges corresponding to each level of service, for signalized intersections and unsignalized intersections. The delays corresponding to poorer levels of service are lower for unsignalized intersections than for signalized intersections, because research has shown that drivers are conditioned to accept longer delays at traffic signals than at stop signs.

Table 4-2: Level of Service and Delay Thresholds (HCM)

	Control Delay (Seconds per Vehicle)	
Level of Service (LOS)	Signalized Intersection	Unsignalized Intersection
A	≤10	≤10
B	10 – 20	10 – 15
C	20 – 30	15 – 25
D	35 – 55	25 – 35
E	55 – 80	35 – 50
F	>80	>50

Delay has the same disadvantages as Travel Time when used as a measure of effectiveness to evaluate different transportation alternatives, in that it cannot account for variations in traffic conditions resulting from incidents or inclement weather. It is merely a representation of average or typical conditions. Delay per vehicle does not quantify how many people are served by the facility being evaluated, and does not reflect the cumulative effect experienced by traveling through multiple intersections.

D. Technical Analysis

The evaluation of the metrics described previously (i.e., Vehicle-Miles Traveled and Person Throughput) consists of a comparison among the various Year 2040 scenarios (including No-Build).

The analysis of the operational metrics described in the previous section (i.e., Travel Time and Intersection Congestion) was performed using Synchro/SimTraffic for the entire study area (excluding MD 355) and VISSIM for the portion of MD 355 within the study area (i.e., from Shady Grove Road to Ridge Road). The projected intersection turning movement volumes for Year 2040 were imported into the Synchro/SimTraffic and VISSIM (MD 355 only) networks. This report combines the microsimulation analysis results from SimTraffic and VISSIM to form a complete portrayal of the Year 2040 traffic operations throughout the study area.

For this study, 67 intersections were analyzed within the study area for Existing, No-Build, and Scenario 1 conditions. Ten (10) of these are unsignalized, and the remaining 57 are signalized. Twenty-three (23) of the 67 intersections in the study area are located along MD 355, and for Scenarios 1 and 2, these were analyzed using VISSIM instead of SimTraffic to account for the effects of the BRT's dedicated transitway. For Scenarios 2, and 3, each of which includes some form of the proposed Midcounty Highway Extended (M-83), 74 intersections were analyzed within the study area. The 74 intersections include the 67 aforementioned intersections plus seven (7) intersections along the proposed M-83 corridor.

5. RESULTS

A. No-Build Condition

i. Vehicle-Miles Traveled (VMT)

The results of the VMT analysis under the No-Build Condition showed that, along the 12.7 miles of key roadways in the study area analyzed for VMT under the No-Build condition, 118 million vehicle-miles will be traveled in Year 2040 in the study area.

ii. Person Throughput

Under the Year 2040 No-Build Conditions, along the analyzed throughput screenline in the study area (see **Figure 4-5**), the projected person throughput on the key north-south roadways and transit routes within the study area would be 11,800 persons per hour during the AM and PM peak hours. During the peak hours, the person throughput on transit would be 9.9% of all person-trips. Therefore, non-transit automobile trips would account for 90.1% of the total person-trips during the AM and PM peak hours.

iii. Travel Time

Travel times for general traffic traveling through the Midcounty Corridor Study area were evaluated along three (3) of the north-south routes shown in **Figure 5-1.**

The southbound travel times were evaluated during the AM peak hour, and northbound travel times were evaluated during the PM peak hour. Travel time analyses along the routes were conducted using SimTraffic. The results of analyses showed that it would take 17 minutes to travel south along MD 355 from MD 27 to MD 124 (the Purple Route) during the AM peak hour, and 20 minutes northbound along the Purple Route during the PM peak hour, under No-Build conditions in Year 2040. The southbound AM and northbound PM travel times for general traffic along Brink/Wightman/Goshen Roads (the Blue Route) are projected to be 22 minutes and 15 minutes, respectively. The travel time along Brink/Wightman/Snouffer School Roads (the Yellow Route) is projected to be 15 minutes southbound during the AM peak hour, and 14 minutes northbound during the PM peak hour.

Figure 5-1: 2040 Travel Time Analysis Summary

In Minutes	Purple Route MD 355		Red Route M-83	Blue Route Goshen	Yellow Route Wightman Snouffer School
	Cars	BRT			
AM Peak Hour					
No-Build BRT or M-83	17	n/a	n/a	22	15
Case 1: BRT w/ Alt 2/5 Improvements	12	17	n/a	19	15
Case 2: BRT w/ Reversible 2-Lane M-83	16	17	10	14	15
Case 3: No BRT w/ 4-Lane M-83 (Alt 9A)	17	n/a	10	15	15
PM Peak Hour					
No-Build BRT or M-83	20	n/a	n/a	15	14
Case 1: BRT w/ Alt 2/5 Improvements	14	18	n/a	14	14
Case 2: BRT w/ Reversible 2-Lane M-83	20	19	10	13	16
Case 3: No BRT w/ 4-Lane M-83 (Alt 9A)	22	n/a	11	15	15

iv. Intersection Delay

The analysis results summarized in **Table 5-1** show the average delay for the entire study area under the Year 2040 No-Build Conditions, using the overall delay at each intersection, and the number of intersections operating at LOS E or LOS F. Sixty-seven (67) intersections were analyzed for this scenario. The table also shows the average delay per intersection for the MD 355 corridor (23 intersections total) within the study area. The results are provided for the AM and PM peak hours.

Table 5-1: Year 2040 No-Build SimTraffic/VISSIM Delay

SimTraffic/VISSIM Analyses for Year 2040	No-Build Conditions	
	AM Peak	PM Peak
Average Study Area Delay (sec/veh)	38.0	32.6
Average MD 355 Delay (sec/veh)	28.4	38.9
% of Study Area Signalized Intersections with Delay > 80 sec/veh (LOS F)	12%	10%
% of Study Area Signalized Intersections with Delay > 55 & ≤ 80 sec/veh (LOS E)	9%	6%

The No-Build Conditions results indicate the study area intersections are projected to operate with an average delay of 38 sec/veh and 32.6 sec/veh during the AM and PM peak hours, respectively. The average delays along MD 355 would be 28.4 sec/veh, and 38.9 sec/veh in the AM and PM peak hour, respectively.

B. Scenario 1 – BRT with Alt 2/5 & No M-83

i. Vehicle-Miles Traveled (VMT)

The results of the VMT analysis for Scenario 1 showed that, along the 12.7 miles of key roadways in the study area analyzed for VMT under Scenario 1, a total of 115 million vehicle-miles will be traveled in Year 2040 in the study area.

ii. Person Throughput

Under Year 2040 Scenario 1 conditions, along the analyzed throughput screenline in the study area (see **Figure 4-5**), the projected person throughput on the key north-south roadways and transit routes within the study area would be 13,200 persons per hour during each of the AM and PM peak hours. Under Scenario 1, the 2040 projected person throughput on non-BRT transit would be 4.6% of all person-trips during the AM and PM peak hours. Passenger car trips would comprise 78.0% of all person-trips during the AM and PM peak hours. The BRT person throughput during the AM and PM peak hours was projected to be 2,300 persons per hour, or 17.4% of the total person-trips.

iii. Travel Time

Travel times for general traffic traveling through the Midcounty Corridor Study area were evaluated along three (3) north-south routes, plus the BRT along MD 355. The routes are shown in **Figure 5-1**. The BRT travel time segment analyzed for this study also has a length of 5.2 miles along MD 355 with the same southern terminus in this study as the MD 355 travel time route, but with a northern terminus in this study at the intersection of MD 355 at Brink Road, so that the travel distance is consistent with the other routes. The southbound travel times were evaluated during the AM peak hour, and northbound travel times were evaluated during the PM peak hour.

Travel time analyses along the routes were conducted using SimTraffic. VISSIM was also used to determine the AM and PM peak hour travel times for BRT vehicles using the dedicated transitway lanes along MD 355.

Figure 5-1 summarizes the results of the travel time analyses for the general traffic and BRT vehicles along the routes.

The results of the simulations show that BRT vehicles traveling southbound on MD 355 during the AM peak hour would have an average travel time of 17 minutes. The average travel time for BRT vehicles traveling northbound on MD 355 during the PM peak hour would be 18 minutes. The southbound AM and northbound PM travel times for general traffic along MD 355 within these same limits are 12 minutes and 14 minutes, respectively. The travel times for BRT vehicles are likely longer than those for general traffic due to BRT vehicle dwell times at the five (5) BRT stops within these limits, and delays due to the four (4) single-lane segments where BRT vehicles cannot run concurrently in both directions.

The southbound AM and northbound PM travel times for general traffic along Brink/Wightman/Goshen Roads are projected to be 19 minutes and 14 minutes, respectively. Traveling southbound along the 6.5-mile Brink/Wightman/Snouffer School Roads route would take 15 minutes during the AM peak hour, and 14 minutes traveling northbound during the PM peak hour.

iv. Intersection Delay

Table 5-2 shows the average delay for the entire study area, using the overall delay at each intersection. Sixty-seven (67) intersections were analyzed for this scenario. The results are provided for the AM and PM peak hours. This table also shows the average delay per intersection for the MD 355 corridor (23 intersections total) within the study area.

The results shown in the table indicate that the intersections in the study area would operate at an average delay of 34.6 sec/veh under Scenario 1 during the AM peak hour. During the PM peak hour, the intersections would operate at an average delay of 26.9 sec/veh. According to the analysis, 11 of the 57 signalized intersections, or 19% of the total, are expected to either fail or perform unsatisfactorily during the AM peak hour, and during the PM peak hour, 6 signalized intersections (11% of the total) are expected to either fail or perform unsatisfactorily.

Table 5-2: Year 2040 Scenario 1 SimTraffic/VISSIM Delay

SimTraffic/VISSIM Analyses for Year 2040	Scenario 1	
	AM Peak	PM Peak
Average Study Area Delay (sec/veh)	34.6	26.9
Average MD 355 Delay (sec/veh)	31.8	33.9
% of Study Area Signalized Intersections with Delay > 80 sec/veh (LOS F)	7%	4%
% of Study Area Signalized Intersections with Delay > 55 & ≤ 80 sec/veh (LOS E)	9%	4%

The average delays along MD 355 for Scenario 1 would be 31.8 sec/veh, and 33.9 sec/veh during the AM and PM peak hours, respectively. Four (4) of the 22 signalized intersections along MD 355 (18% of the total) are expected to perform unsatisfactorily during the AM peak hour; and three (3) signalized intersection are expected to fail or perform unsatisfactorily during the PM peak hour.

C. Scenario 2 – BRT with Reversible Two-Lane M-83

Scenario 2 consists of a 2-lane roadway along the master plan alignment, plus the proposed BRT Alternative 3B along MD 355. During the AM peak period, the parkway would carry one-way traffic southbound in both lanes. During the PM peak period, the direction of traffic would be reversed, with the parkway carrying one-way traffic northbound in both lanes. Traffic would be two-way (one lane per direction) during the off-peak hours.

i. Vehicle-Miles Traveled (VMT)

The results of the VMT analysis for Scenario 2 showed that a total VMT of 143 million vehicle-miles is expected to be traveled annually within this study area, based on the 17.8 miles of key corridors analyzed in Year 2040.

ii. Person Throughput

Under Year 2040 Scenario 2 conditions, along the analyzed throughput screenline in the study area (see **Figure 4-5**), the projected person throughput on the key north-south roadways and transit routes within the study area would be 14,500 persons per hour during each of the AM and PM peak hours. Under Scenario 2, the 2040 projected person throughput on non-BRT transit would be 3.8% of all person-trips during the AM and PM peak hours. Passenger car trips would comprise 81.2% of all person-trips during the AM and PM peak hours. The BRT person throughput during the AM and PM peak hours was projected to be 2,200 persons per hour, or 15% of the total person-trips.

iii. Travel Time

Travel times for general traffic traveling through the Midcounty Corridor Study area were evaluated along four (4) north-south routes, plus the BRT along MD 355. The routes are shown in **Figure 5-1.** The BRT travel time segment measured along MD 355 also has a length of 5.2 miles with the same southern terminus as the MD 355 travel time route, but with a northern terminus at the intersection of MD 355 at Brink Road so that the travel distance is consistent with the other routes. The southbound travel times were evaluated during the AM peak hour, and northbound travel times were evaluated during the PM peak hour.

Travel time analyses along the routes were conducted using SimTraffic. VISSIM was used to determine the AM and PM peak hour travel times for BRT vehicles using the dedicated transitway lanes along MD 355. **Figure 5-1** summarizes the results of the travel time analyses for the general traffic along the routes.

Traffic along M-83 would have an average travel time of 10 minutes during both the AM and PM peak hours. BRT vehicles traveling southbound on MD 355 during the AM peak hour would have an average travel time of 17 minutes. The average travel time for BRT vehicles traveling northbound on MD 355 during the PM peak hour would be 19 minutes. The southbound AM and northbound PM peak hour travel times for general traffic along MD 355 within these same limits are 16 minutes and 20 minutes, respectively.

The southbound AM and northbound PM travel times for general traffic, along the Goshen Road route, are projected to be 14 minutes and 13 minutes, respectively. Traveling along the 6.5-mile Brink/Wightman/Snouffer School Roads route would take 15 minutes during the AM peak hour southbound, and 16 minutes northbound during the PM peak hour.

iv. Intersection Delay

The analysis results summarized in **Table 5-3** show the average study area delay, using the overall delay at each intersection, the average delay along the MD 355 corridor, and the number of intersections operating at LOS E or LOS F. Seventy-four (74) intersections were analyzed for this scenario within the study area, with 23 of those located along MD 355. The results are provided for the AM and PM peak hours. The table also shows the average delay for intersections along the Reversible Two-Lane M-83 within the study area.

The results shown in the table indicate that the intersections in the study area would operate at an average delay of 37.1 sec/veh under Scenario 2 during the AM peak hour. During the PM peak hour, the intersections would operate at an average delay of 32.6 sec/veh. According to the table, 14 of the 61 signalized intersections (23% of the total) are expected to either fail or perform unsatisfactorily during the AM peak hour; and during the PM peak hour, 13 signalized intersections (21% of the total) are expected to either fail or perform unsatisfactorily.

Table 5-3: Year 2040 Scenario 2 SimTraffic/VISSIM Delay

SimTraffic/VISSIM Analyses for Year 2040	Scenario 2	
	AM Peak	PM Peak
Average Study Area Delay (sec/veh)	37.1	32.6
Average MD 355 Delay (sec/veh)	47.1	51.8
Average Midcounty Highway Extended (M-83) Delay (sec/veh)	23.6	18.7
% of Study Area Signalized Intersections with Delay > 80 sec/veh (LOS F)	11%	11%
% of Study Area Signalized Intersections with Delay > 55 & ≤ 80 sec/veh (LOS E)	8%	7%

During both the AM and PM peak hours, the average delays along MD 355 are projected to be higher than the average for the overall study area. The average delays along MD 355 would be 47.1 sec/veh and 51.8 sec/veh in the AM and PM peak hours, respectively. Nine (9) of the 22 signalized intersections along MD 355 (41% of the total) are expected to either fail or perform unsatisfactorily during the AM peak hour; and 10 signalized intersections are expected to fail or perform unsatisfactorily during the PM peak hour. The average delay for intersections along M-83 is projected to be 23.6 sec/veh during the AM peak hour, but lower (18.7 sec/veh) during the PM peak hour.

D. Scenario 3 – No BRT with Four-Lane Divided M-83 (Alternative 9A)

i. Vehicle-Miles Traveled (VMT)

The results of the VMT analysis for Scenario 3 showed that a total VMT of 149 million vehicle-miles is expected to be traveled annually within this study area, based on the 17.8 miles of key corridors analyzed in Year 2040.

ii. Person Throughput

Under Year 2040 Scenario 3 conditions, along the analyzed throughput screenline in the study area (see **Figure 2-5**), the projected person throughput on the key north-south roadways and transit routes within the study area would be 13,700 persons per hour during each of the AM and PM peak hours. Under Scenario 3, the 2040 projected person throughput on transit would be 8.6% of all person-trips during the AM and PM peak hours. Passenger car trips would comprise 91.4% of all person-trips during the AM and PM peak hours.

iii. Travel Time

Travel times for general traffic traveling through the Midcounty Corridor Study area were evaluated along the four (4) north-south routes shown in **Figure 5-1**. The southbound travel times were evaluated during the AM peak hour, and northbound travel times were evaluated during the PM peak hour.

Travel time analyses along these routes were conducted using SimTraffic. **Figure 5-1** summarizes the results of the travel time analyses for the general traffic along the routes. Traffic along M-83 would have an average travel time of 10 minutes during the AM peak hour, and an average travel time of 11 minutes during the

PM peak hour. The southbound AM and northbound PM travel times for general traffic along MD 355 would be 17 minutes and 22 minutes, respectively.

Southbound AM and northbound PM traffic along the Goshen Road route is projected to have an average travel time of 15 minutes for both peak hours. Traveling along the 6.5-mile Brink/Wightman/Snouffer School Roads route would also take 15 minutes during both the southbound AM and northbound PM peak hours.

iv. Intersection Delay

The analysis results summarized in **Table 5-4** show the study area average delay, using the overall delay at each intersection, the delay along the MD 355 corridor, and the number of intersections operating at LOS E or LOS F. Seventy-four (74) intersections were analyzed for this scenario within the study area, with 23 of these located along MD 355. The results are provided for the AM and PM peak hours. The table also shows the average Four-Lane Divided M-83 delay.

Table 5-4: Year 2040 Scenario 3 SimTraffic/VISSIM Delay

SimTraffic/VISSIM Analyses for Year 2040	Scenario 3 (Alt 9A)	
	AM Peak	PM Peak
Average Study Area Delay (sec/veh)	30.3	27.0
Average MD 355 Delay (sec/veh)	36.0	37.4
Average Midcounty Highway Extended (M-83) Delay (sec/veh)	19.2	19.7
% of Study Area Signalized Intersections with Delay > 80 sec/veh (LOS F)	8%	7%
% of Study Area Signalized Intersections with Delay > 55 & ≤ 80 sec/veh (LOS E)	5%	7%

The results shown in **Table 5-4** indicate intersections for the overall study area under Scenario 3 would have an average delay of 30.3 sec/veh and 27 sec/veh during the AM and PM peak hours, respectively. Under Scenario 3, the average delays along MD 355 are expected to be 36 sec/veh, and 37.4 sec/veh during the AM and PM peak hours, respectively. Intersections along the proposed Midcounty Highway Extended (M-83) are expected to operate at an average delay of 19.2 sec/veh during the AM peak hour and 19.7 sec/veh during the PM peak hour.

E. Summary

A detailed cross-cutting analysis of the scenarios is provided in the Summary of Findings at the beginning of this report. As a basic conclusion, implementation of versions of the Midcounty Highway (in the preferred alignment defined in the previous round of planning) and the MD 355 BRT, separately and in combination with each other, provide substantial improvement to the transportation network performance in the study area. Across the metrics considered (Vehicle Miles Traveled, Person-throughput, mode-choice, travel time, and intersection operations), the projects perform differently as illustrated through the scenarios analyzed. As a basic finding, this analysis shows that both projects are beneficial and neither project substantially replaces the benefit of the other. Rather, the benefits of the projects are cumulative.