Volume 1

Montgomery County Department of Transportation

MidCounty Corridor Study

Division of Transportation Engineering

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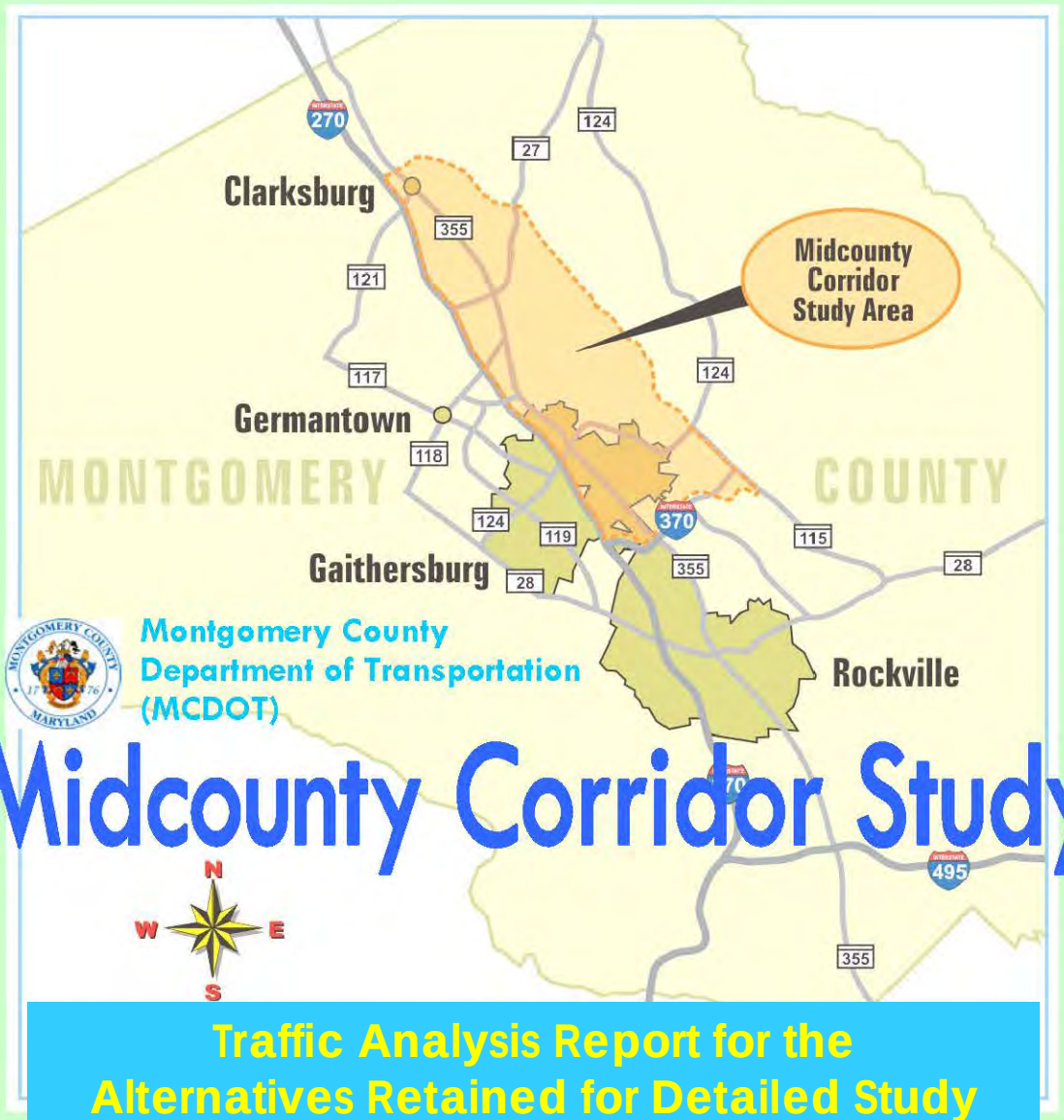

Traffic Analysis Report for the Alternatives Retained for Detailed Study

June 2012

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EXECUTIVE SUMMARY

The purpose of this report is to summarize the results of the traffic analysis of several proposed alternatives for the Midcounty Corridor Study. The goal of the broader study is to evaluate each of the Alternatives Retained for Detailed Study (ARDS) to determine which alternative best satisfies the Purpose and Need for the project. The project's purpose and need, and the environmental effects of the various ARDS, are discussed in separate documents. The goal of this traffic study is to determine which alternative would provide the greatest benefits to drivers by providing adequate intersection capacity, minimizing travel time through the corridor, and accommodating the projected future travel demand within the study area.

Existing traffic conditions were evaluated for use as a benchmark for understanding the effects of future year traffic growth on operations within the study area. For this study, the Existing conditions are based on Year 2011 traffic volumes. The design year for the ARDS is 2030; therefore, the traffic analyses for the future year conditions are based on projected Year 2030 volumes. The future year traffic volume forecasts were developed using the Metropolitan Washington Council of Governments (COG) regional travel demand model.

Intersection capacity was analyzed using the Critical Lane Volume (CLV) method. Synchro was used to estimate travel times during the AM and PM peak hours along four primary north-south corridors within the study area. The future travel demand was evaluated by establishing several screenlines across the study area and comparing the volume of peak hour and daily traffic that is projected to cross these screenlines under each of the ARDS.

This study evaluated the ARDS based on three key measures of effectiveness: Critical Lane Volumes (CLVs), Travel Times, and Screenline Volumes (i.e., number of vehicles served in the study area). Year 2030 projected traffic volumes were used for the analysis. The following are the conclusions of this study:

- Under Alternative 9 (Master Plan Alignment), more major intersections (i.e., intersections of primary or secondary arterial roadways) would operate below the county's CLV congestion standard of 1,425 vehicles during more peak hours than any of the other alternatives.
- Alternative 9 would provide the fastest north-south travel route through the study area during the AM and PM peak hours, compared to the other alternatives, and would also reduce travel times along the MD 124-MD 355-MD 27 corridor more than 3 other alternatives during the AM peak hours and more than all the other alternatives during the PM peak hour.
- Alternative 9 would allow greater mobility across the study area while providing a roadway on new alignment to accommodate traffic growth without burdening existing facilities.

Based on these findings, **Alternative 9 (Master Plan Alignment)** would provide the greatest transportation benefits, and is therefore recommended as the Preferred Alternative.

TABLE OF CONTENTS

Index of Tables

Index of Figures

Index of Figures (Continued)

I. Introduction

The purpose of this report is to summarize the results of the traffic analysis of several proposed alternatives for the Midcounty Corridor Study. The goal of the broader study is to evaluate each of the Alternatives Retained for Detailed Study (ARDS) to determine which alternative best satisfies the Purpose and Need for the project. The project's purpose and need, and the environmental effects of the various ARDS, are discussed in separate documents. The goal of this traffic study is to determine which alternative would provide the greatest benefits to drivers by providing adequate intersection capacity, minimizing travel time through the corridor, and accommodating the projected future travel demand within the study area.

The Midcounty Corridor Study area includes the following significant existing roadways: Frederick Road (MD 355), Montgomery Village Avenue, Goshen Road, Watkins Mill Road, Snouffer School Road, Brink Road, Wightman Road, Ridge Road (MD 27), and the existing portion of Midcounty Highway. Each of these roads help facilitate north-south travel through the study area. The study area also includes short segments of Middlebrook Road and Germantown Road, which provide east-west connectivity. ***Figure 1-1*** is a map of the study area.

II. Alternatives Retained For Detailed Study

This report summarizes the results of the Existing (Year 2011) and Future (Year 2030) traffic operations analyses that were performed to evaluate the six Alternatives Retained for Detailed Study (ARDS). Each of the ARDS is described briefly below. The extension of Midcounty Highway from Montgomery Village Avenue to Ridge Road is designated as M-83 in the master plan.

- Alternative 1 – No-Build
- Alternative 2 – TSM/TDM (Spot Capacity Improvements within Right-of-Way)
- Alternative 4 Modified – Brink-Wightman-Goshen-Snouffer School-Muncaster Mill Roads Route
- Alternative 5 – MD 27-MD 355-MD 124 with Service Roads to consolidate driveways
- Alternative 8 – Master Plan Alignment for M-83 truncated at Watkins Mill Road
- Alternative 9 – Master Plan Alignment for M-83

Except for Alternatives 1 and 2, each of the ARDS consists of a specific route along existing and/or proposed roadways that would be improved or constructed on new alignment. For Alternative 2, capacity improvements would be implemented on an intersection-by-intersection basis throughout the entire study area, depending on the need for additional capacity to achieve a maximum critical lane volume of 1,425 vehicles per hour during the AM and PM peak hours. The Alternative 2 improvements were developed such that no additional right-of-way would be required for implementation. ***Figures 2-1 through 2-5*** are maps showing the build alignments for each of the ARDS, except Alternatives 1 and 2. The Alternative 1 map shows the master-planned and constrained long-range planned transportation improvements that are expected to be completed by Year 2030. These improvements are assumed to be in place under all of the ARDS.

Alternatives 8 and 9 include three different alignment options at the northern end of the corridor that were retained for detailed study. Option A would follow the master-planned alignment for M-83. Option B would deviate from the master-planned alignment to reduce parkland impacts, and would terminate Midcounty Highway at Brink Road, and would include upgrades along Brink Road and Ridge Road between this terminus and Snowden Farm Parkway. Option D would also deviate from the master-planned alignment to reduce parkland impacts, but would continue north of Brink Road, turning west to intersect Ridge Road at Snowden Farm Parkway.

Figure 1-1: Map of the Study Area

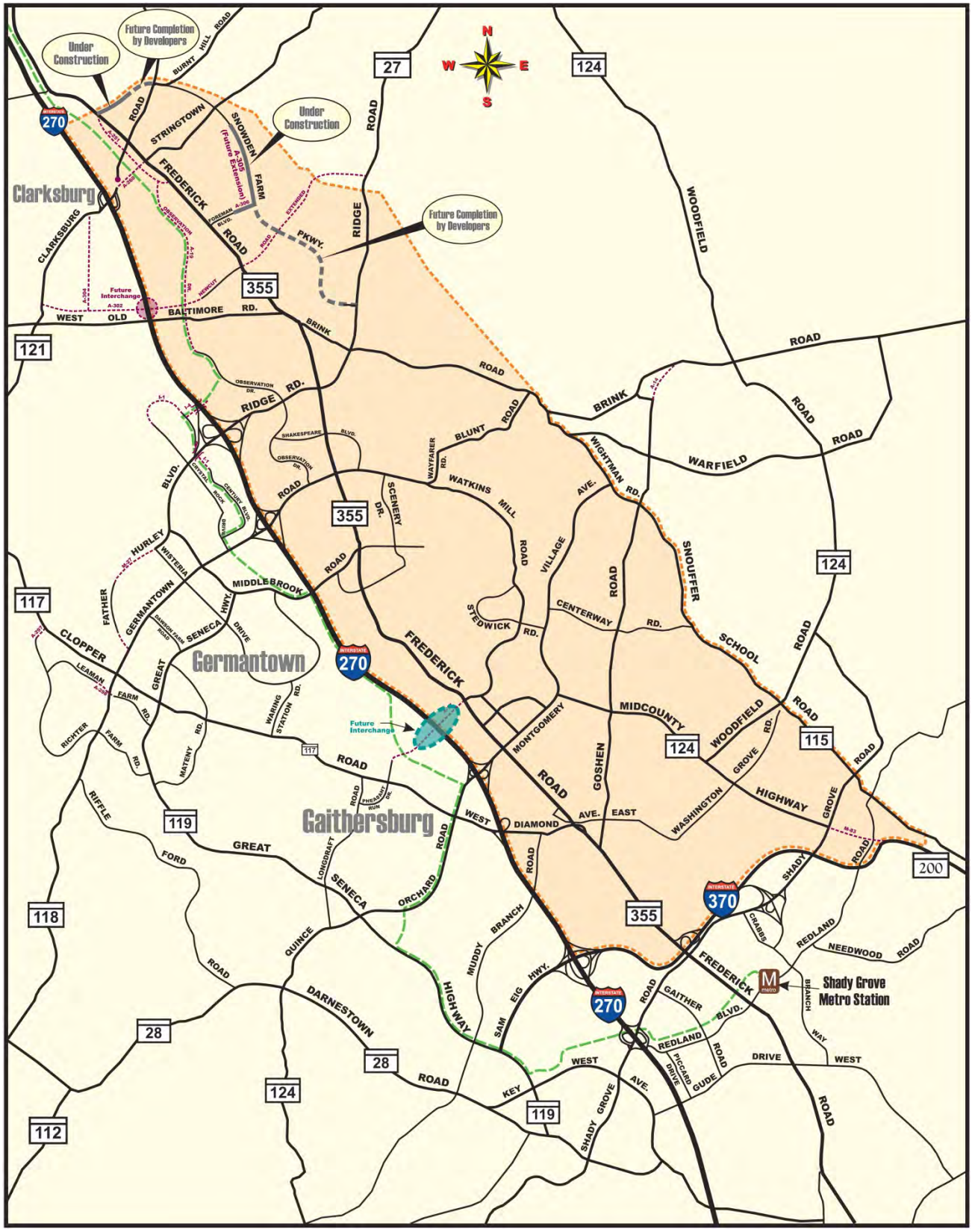


Figure 2-1: Map of Background Improvements for Year 2030 (Alternative 1 – No Build)

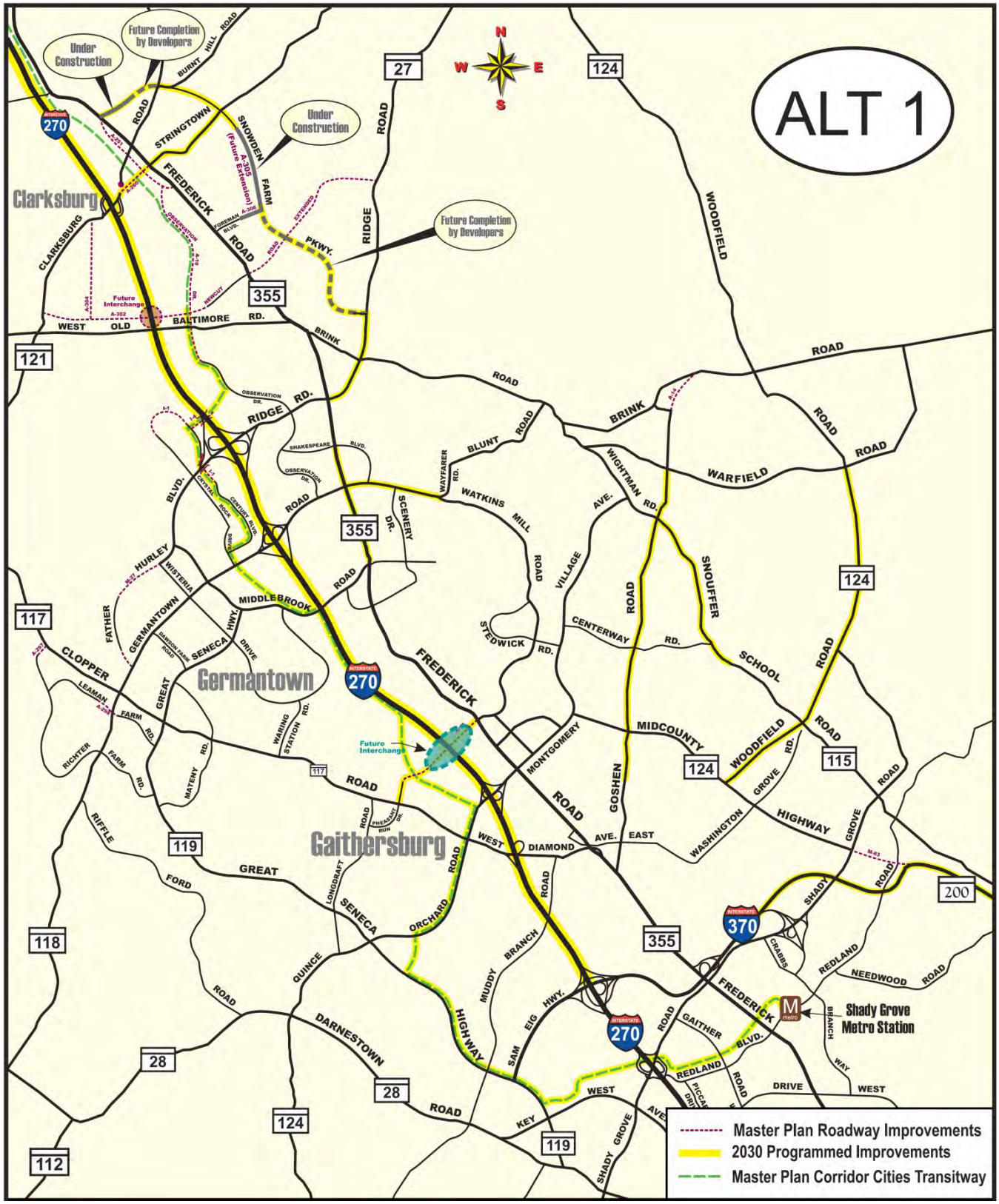


Figure 2-2: Map of the Alternative 4 Modified Alignment

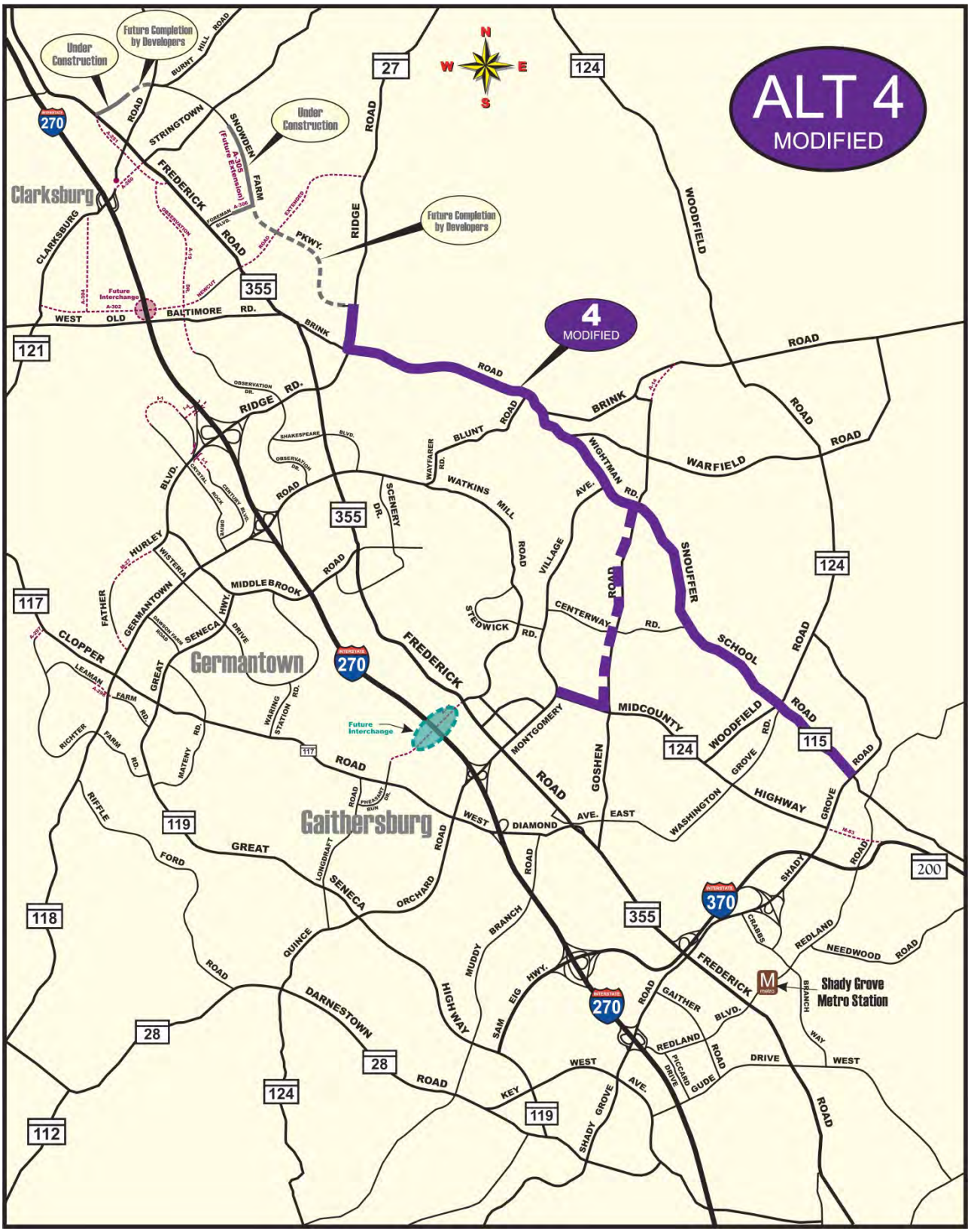


Figure 2-3: Map of the Alternative 5 Alignment

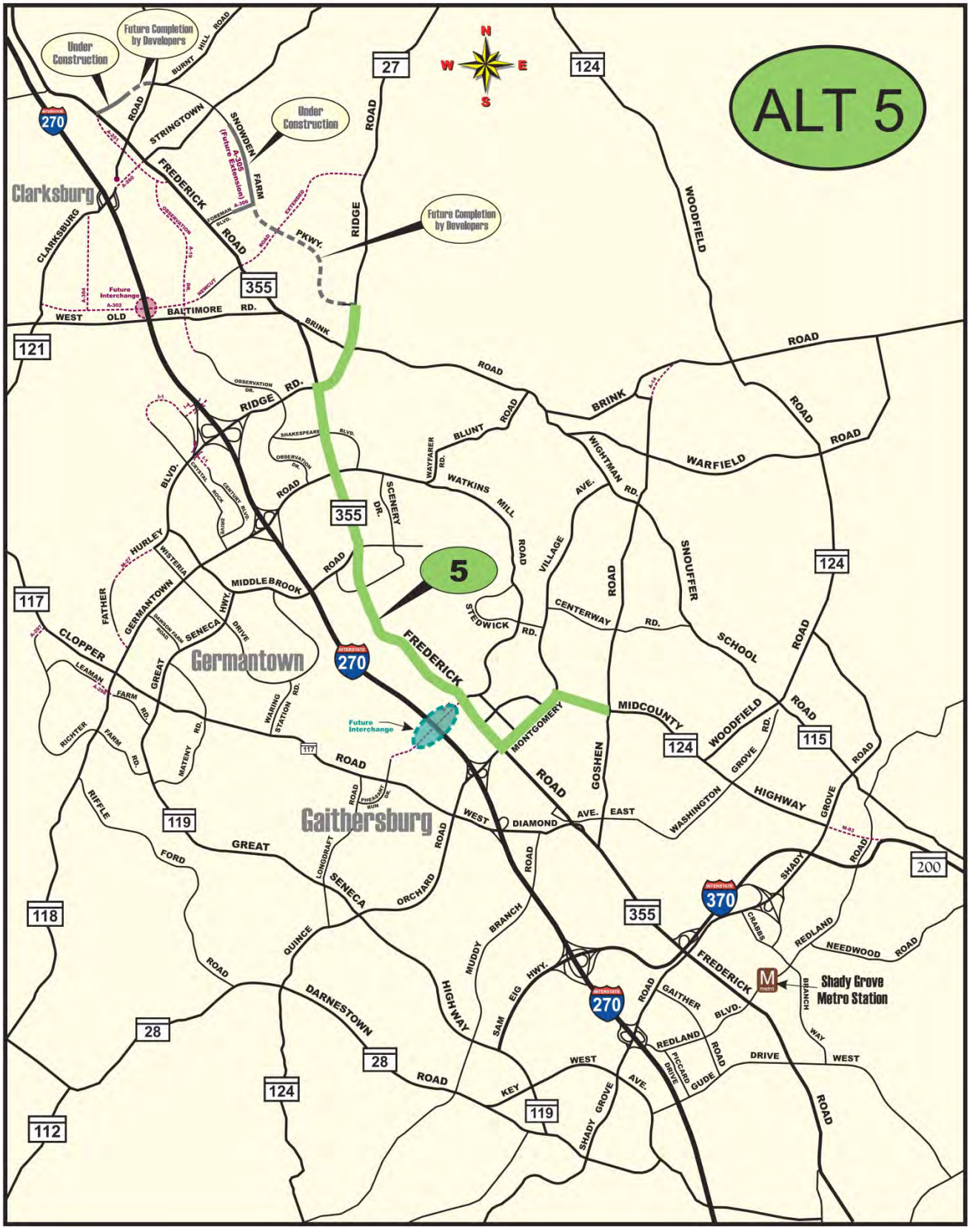


Figure 2-4: Map of the Alternative 8 Alignment

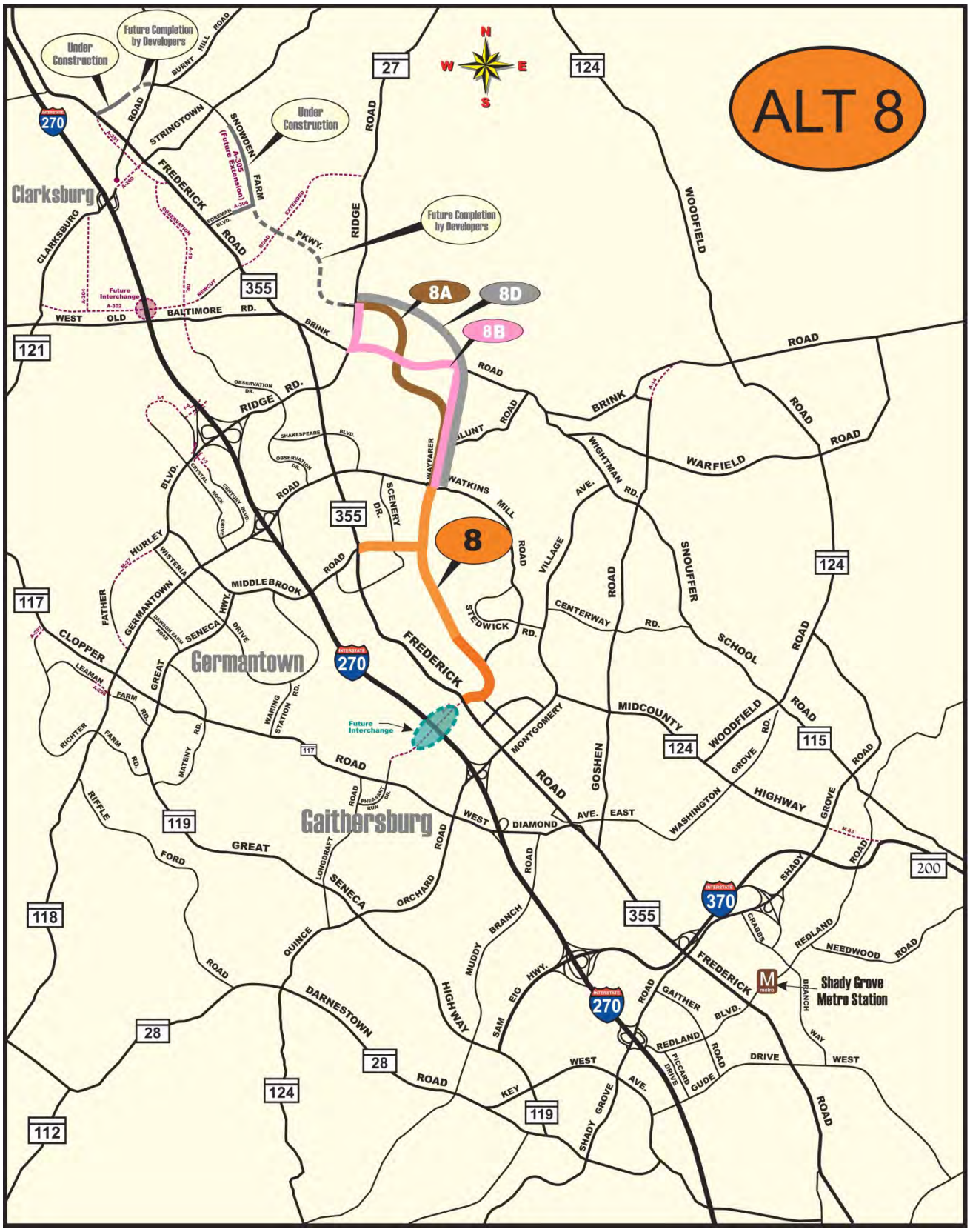
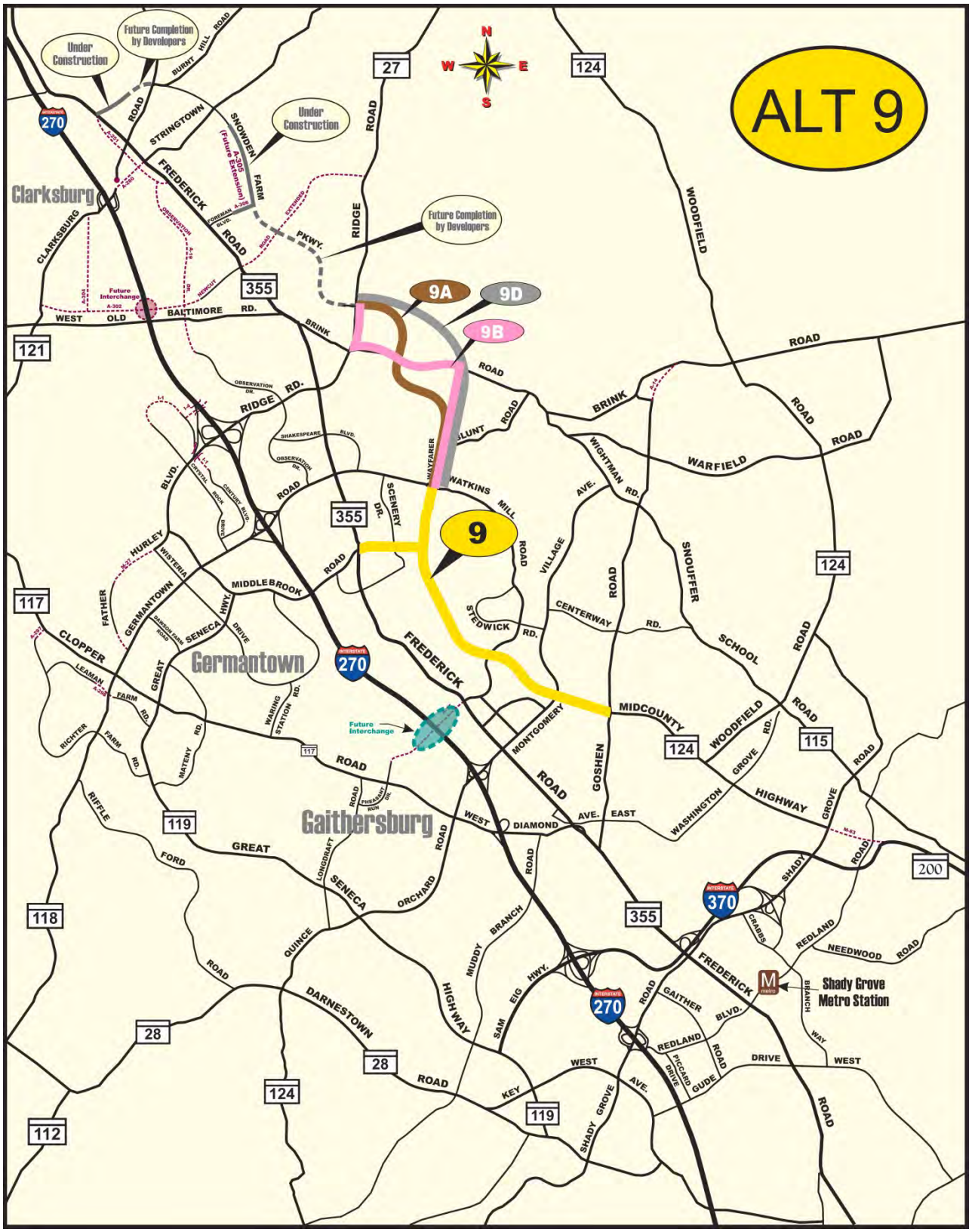


Figure 2-5: Map of the Alternative 9 Alignment



III. Travel Demand Modeling

Previous traffic analyses for the Midcounty Corridor Study were conducted using traffic volume projections based on the version 2.1D and version 2.2 of the Metropolitan Washington Council of Governments (COG) regional travel demand model, with Round 6.4a and Round 7.1a Cooperative Land Use Forecasts. For the current work, these traffic volume projections were updated based on version 2.2 of the COG model using Round 8.0 Cooperative Land Use Forecasts. The model output using the older land use forecasts had been previously refined and calibrated using NCHRP Report 255, Chapter 4 procedures. Therefore, the updated traffic volume projections were prepared by comparing the model output to the new model output, then adjusting the previously-refined volume projections from the old model based on the difference between the old and new model runs. This process was used for each of the ARDS.

IV. Critical Lane Volume Analysis

Future traffic operations on the key roadways within the Midcounty Corridor Study area were evaluated for Existing (Year 2011) and Future (Year 2030) conditions for each of the six Alternatives Retained for Detailed Study (ARDS) using the Critical Lane Volume (CLV) method. The ARDS include a No-Build alternative (Alternative 1) and five Build alternatives (Alternatives 2, 4-Modified, 5, 8, and 9).

Each of the ARDS includes up to 72 intersections that were evaluated. The proposed future lane configurations at the signalized intersections along the Build alignment for each of the ARDS were based on the need to achieve a maximum CLV of 1,425 vehicles per hour during both the AM and PM peak hours in Year 2030. A CLV of 1,425 is the intersection congestion standard established by the Montgomery County Planning Department's Local Area Transportation Review (LATR) Guidelines for the policy areas in which the Midcounty Corridor is located. These policy areas are Gaithersburg, Montgomery Village/Airpark, Germantown East, and Clarksburg. A sensitivity analysis was performed at each intersection, testing different combinations of lanes on each approach until the CLV became equal to or less than the 1,425 CLV threshold. At some intersections, an additional major improvement (such as adding a lane) would be required for the CLV to change from just above the acceptable limit (say, 1,445) to below the limit. In these instances, the additional major improvement was not recommended, because the impacts of widening the road to add a lane were too significant to justify the minor CLV reduction needed to reach the acceptable limit.

The lane use factors used to calculate the critical lane volumes were provided by Montgomery County Planning Department (M-NCPPC), and are different from the default values used by the Maryland State Highway Administration (SHA). The M-NCPPC factors slightly reduce the friction effects of having multiple through or multiple left-turn lanes on an intersection approach, compared to the default SHA factors (i.e., a high-volume left-turn movement would be more likely to require multiple left-turn lanes to function efficiently using the default SHA factors than using the lower M-NCPPC factors). The default CLV thresholds for determining Levels of Service (LOS) were not adjusted (i.e., the CLV range for LOS E remains 1,450 to 1,599, and so forth).

Appendix A includes a table that summarizes the AM and PM peak hour critical lane volumes for all of the intersections evaluated within the study area for Existing (Year 2011) Conditions and for each of the six ARDS in Year 2030. This table can be used to determine how traffic operations at specific intersections would change depending on the alternative selected. The actual CLV worksheets showing the detailed analysis results for the Existing Conditions and each of the ARDS, including the projected intersection turning movement volumes that were used, are provided in ***Appendices B through H***.

There are 17 major intersections located along the alignments for the Build alternatives. These are locations where an arterial roadway (e.g., Frederick Road) intersects another arterial roadway (e.g., Montgomery Village Avenue) or a major collector roadway (e.g., Watkins Mill Road). ***Figures 4-1 through 4-17*** are charts for each of these major intersections, showing how the AM and PM peak hour CLVs for each intersection would change depending on the alternative selected. The maximum-acceptable policy area CLV of 1,425 is also shown on each figure.

Figure 4-1: Critical Lane Volumes for Frederick Road at Montgomery Village Avenue

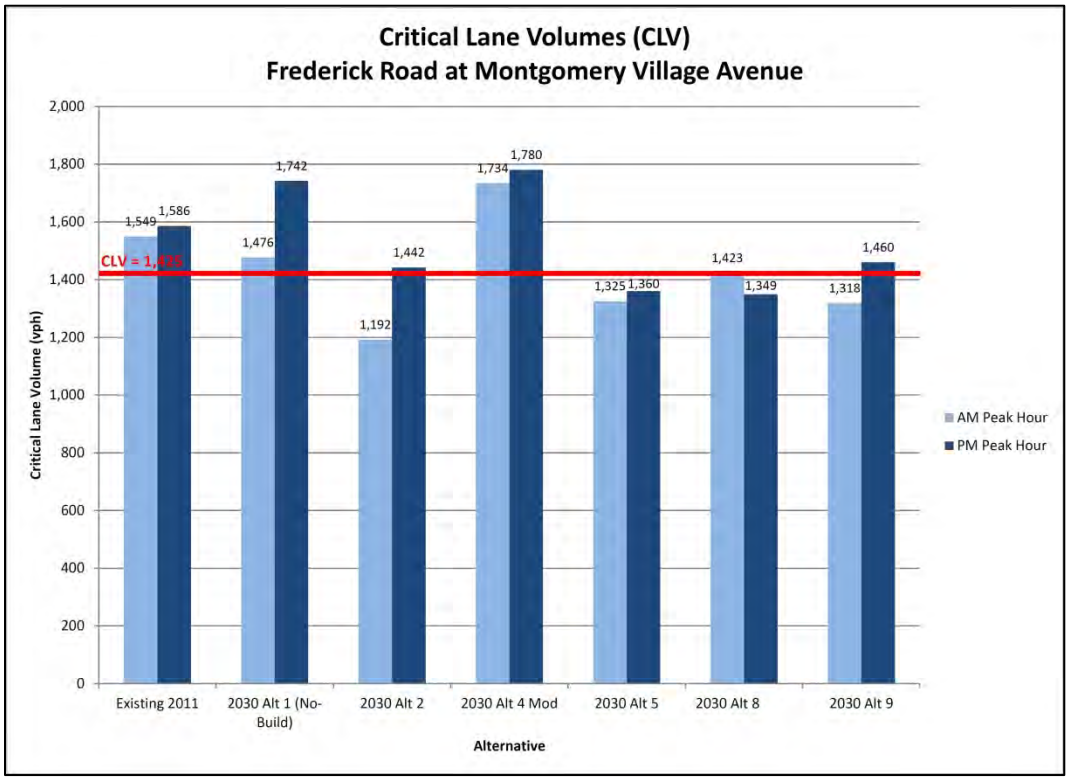


Figure 4-2: Critical Lane Volumes for Frederick Road at Watkins Mill Road

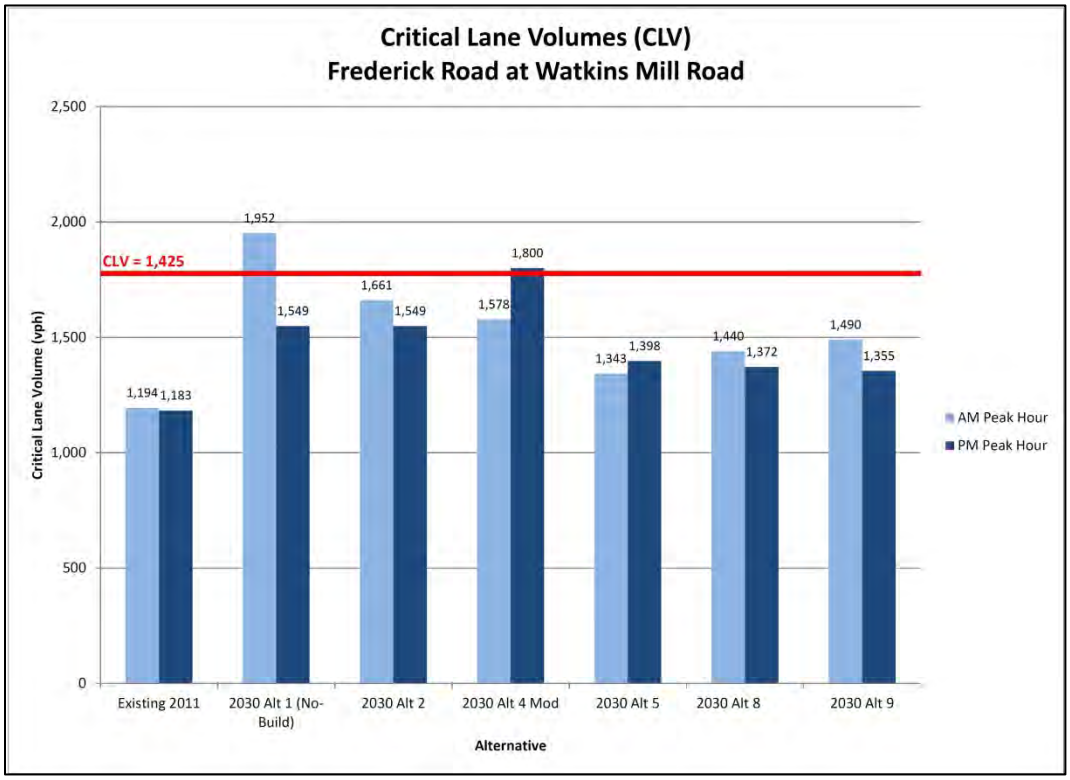


Figure 4-3: Critical Lane Volumes for Frederick Road at Middlebrook Road

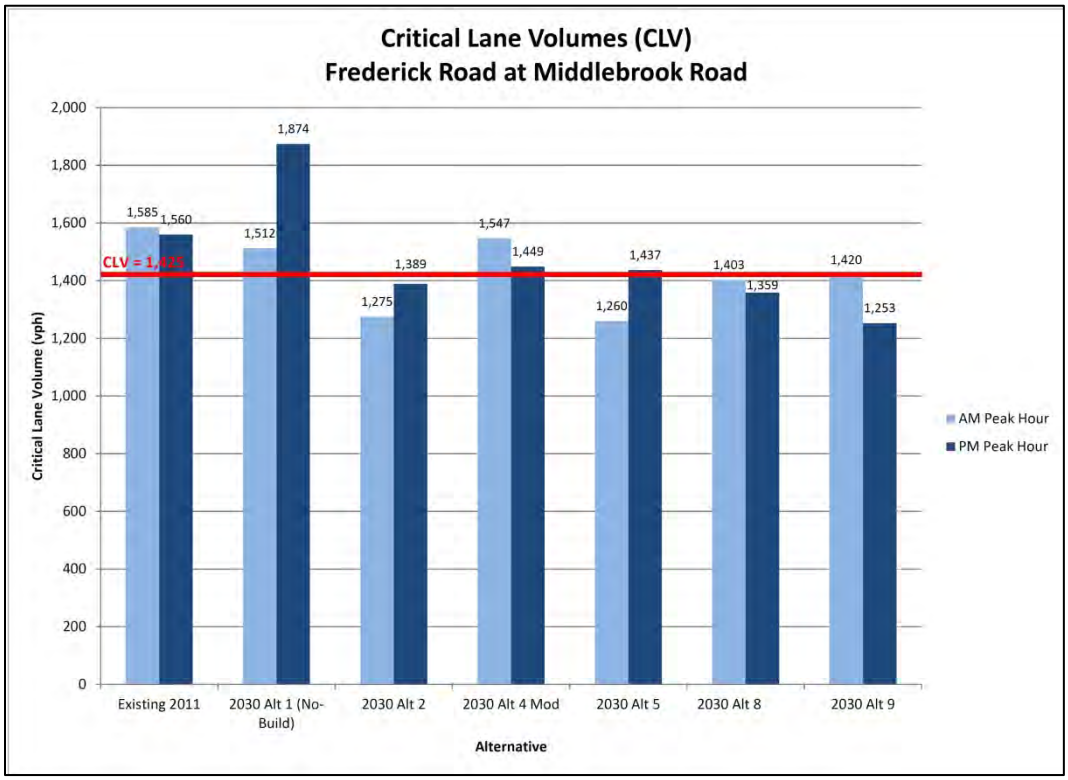


Figure 4-4: Critical Lane Volumes for Frederick Road at Germantown Road

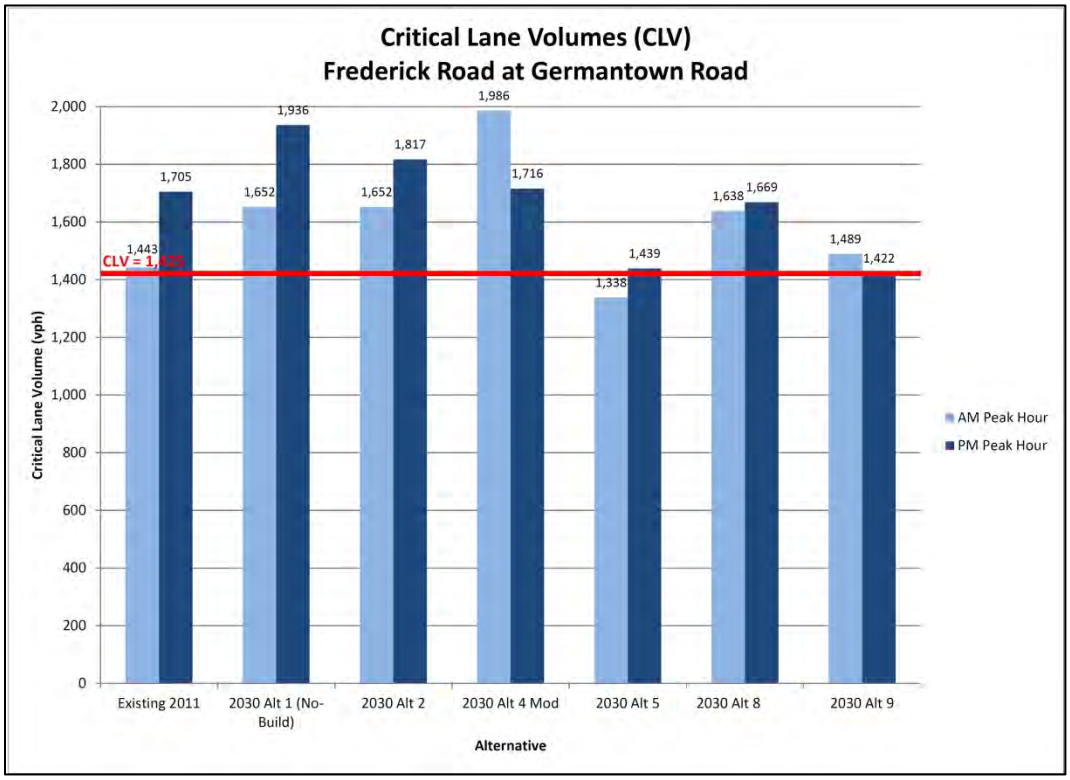


Figure 4-5: Critical Lane Volumes for Frederick Road at Ridge Road

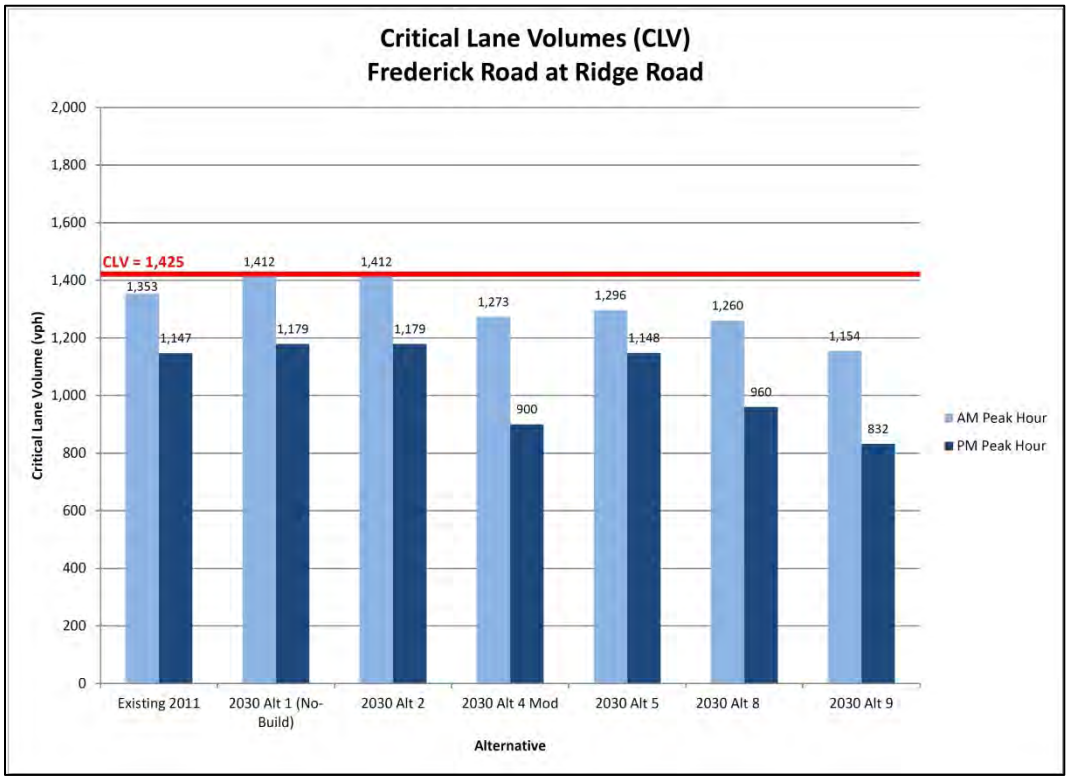


Figure 4-6: Critical Lane Volumes for Ridge Road at Brink Road

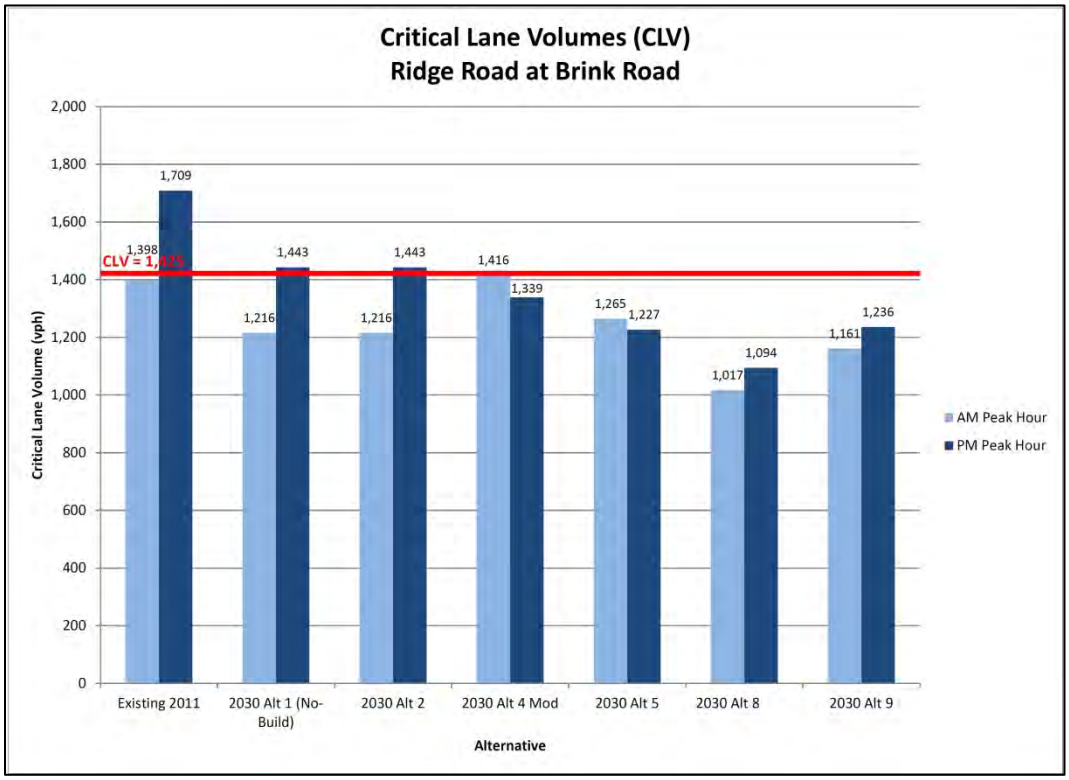


Figure 4-7: Critical Lane Volumes for Ridge Road at Midcounty Highway/Snowden Farm Parkway

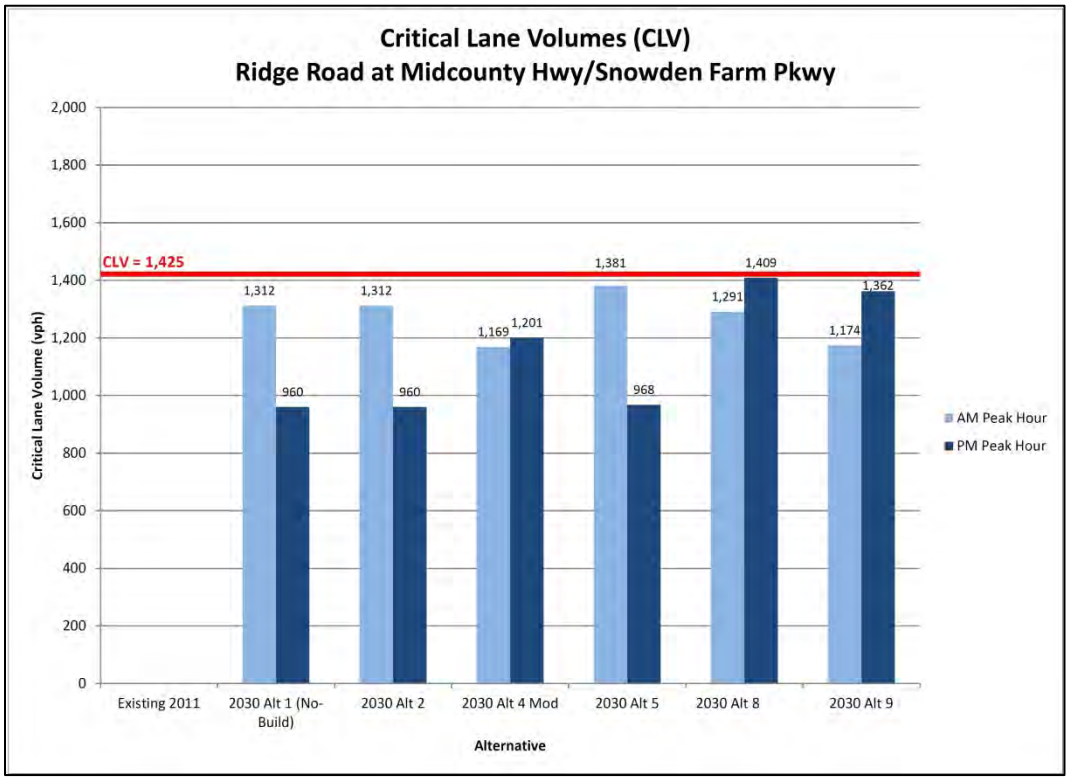


Figure 4-8: Critical Lane Volumes for Muncaster Mill Road at Shady Grove Road

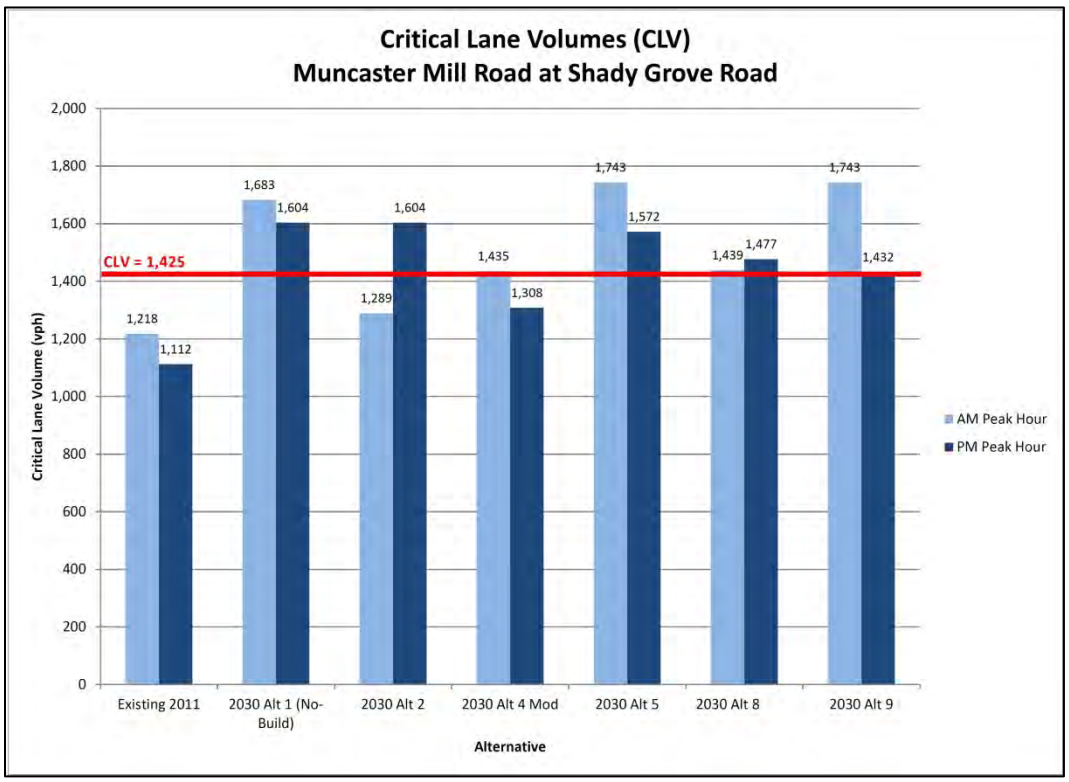


Figure 4-9: Critical Lane Volumes for Snouffer School Road at Woodfield Road

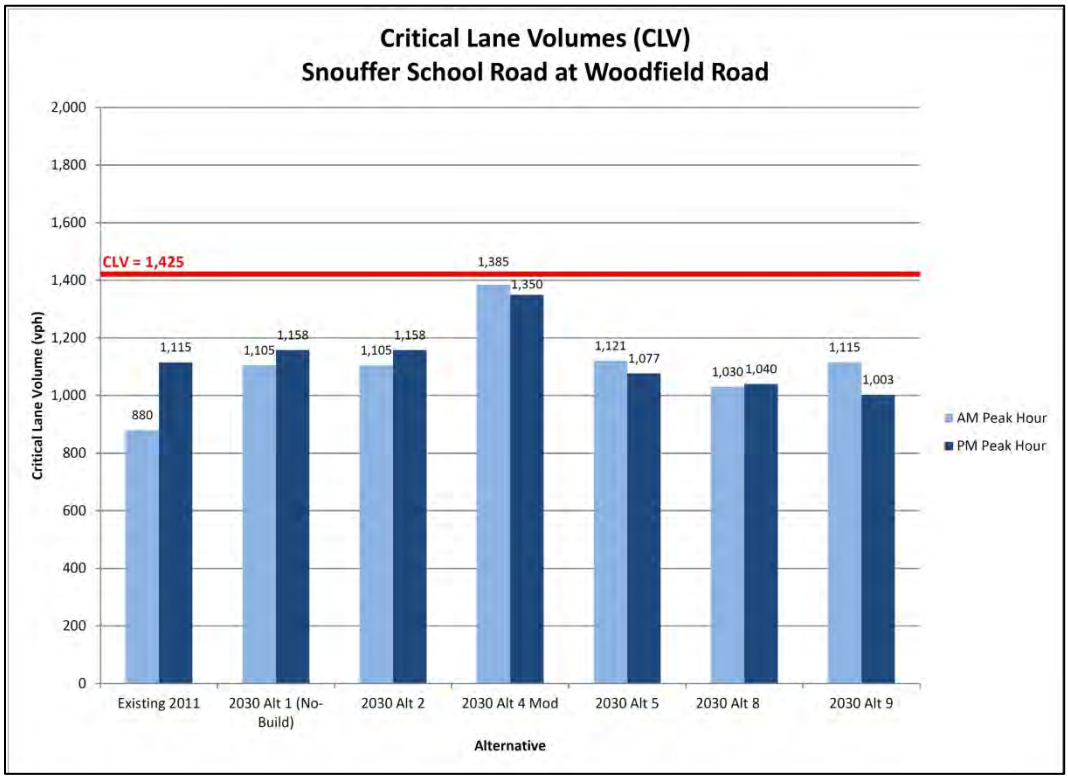


Figure 4-10: Critical Lane Volumes for Wightman Road at Goshen Road

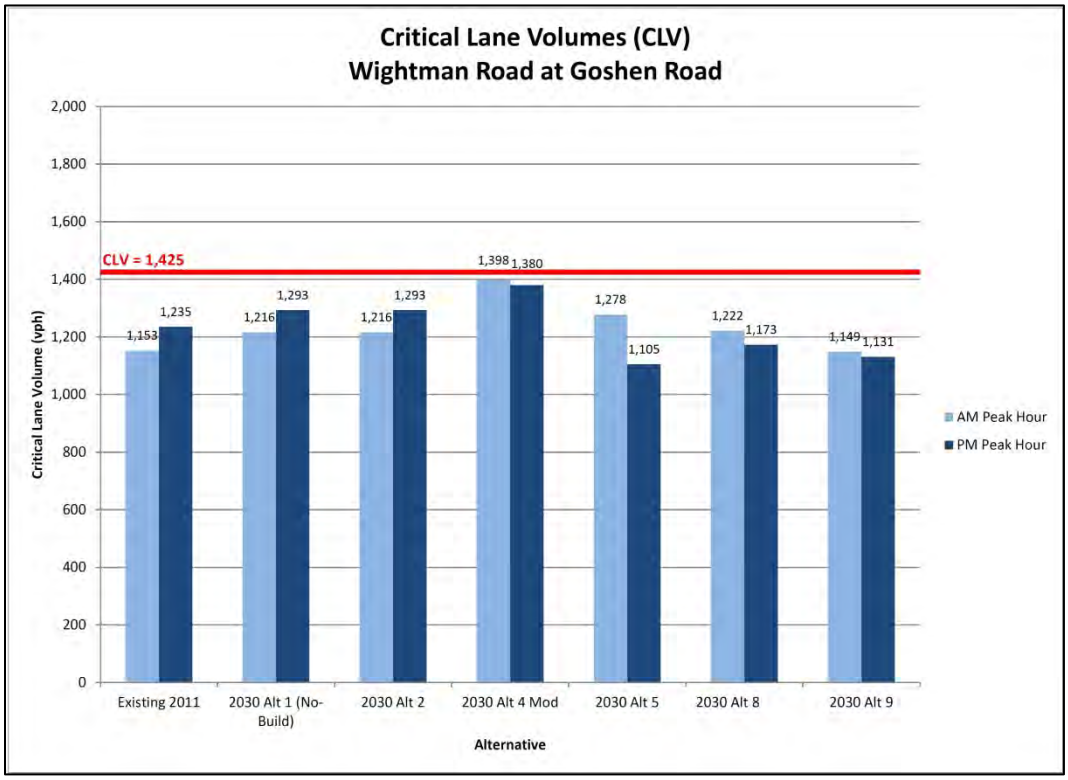


Figure 4-11: Critical Lane Volumes for Wightman Road at Montgomery Village Avenue

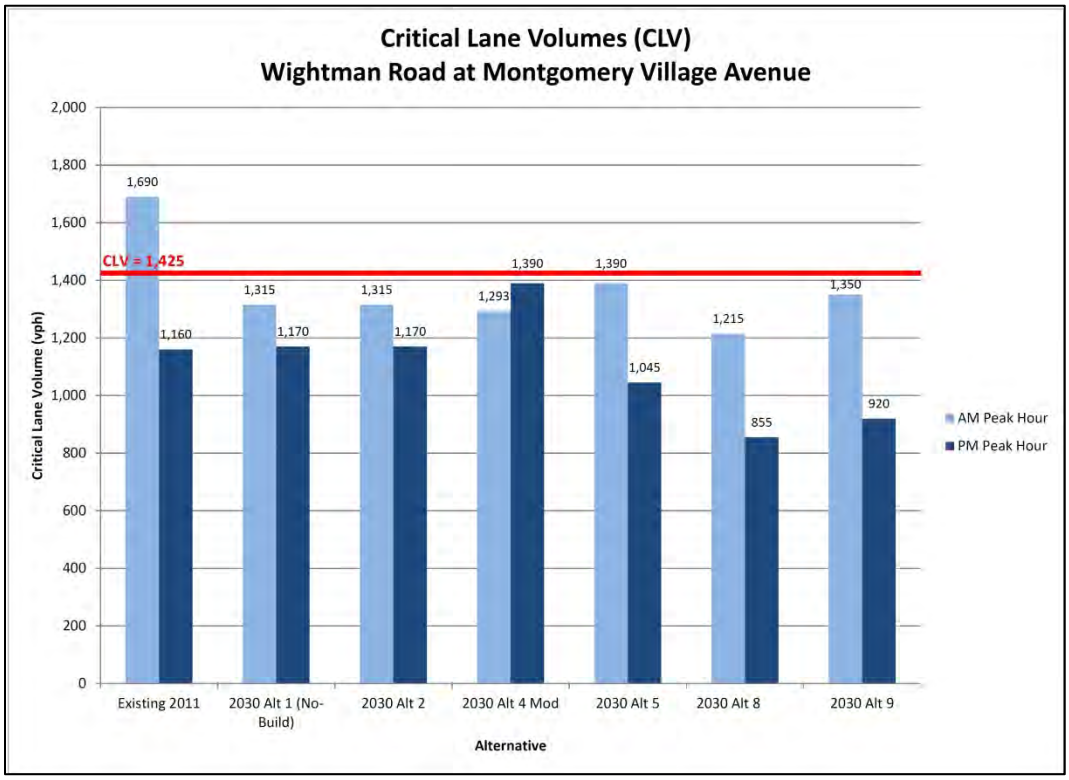


Figure 4-12: Critical Lane Volumes for Midcounty Highway at Goshen Road

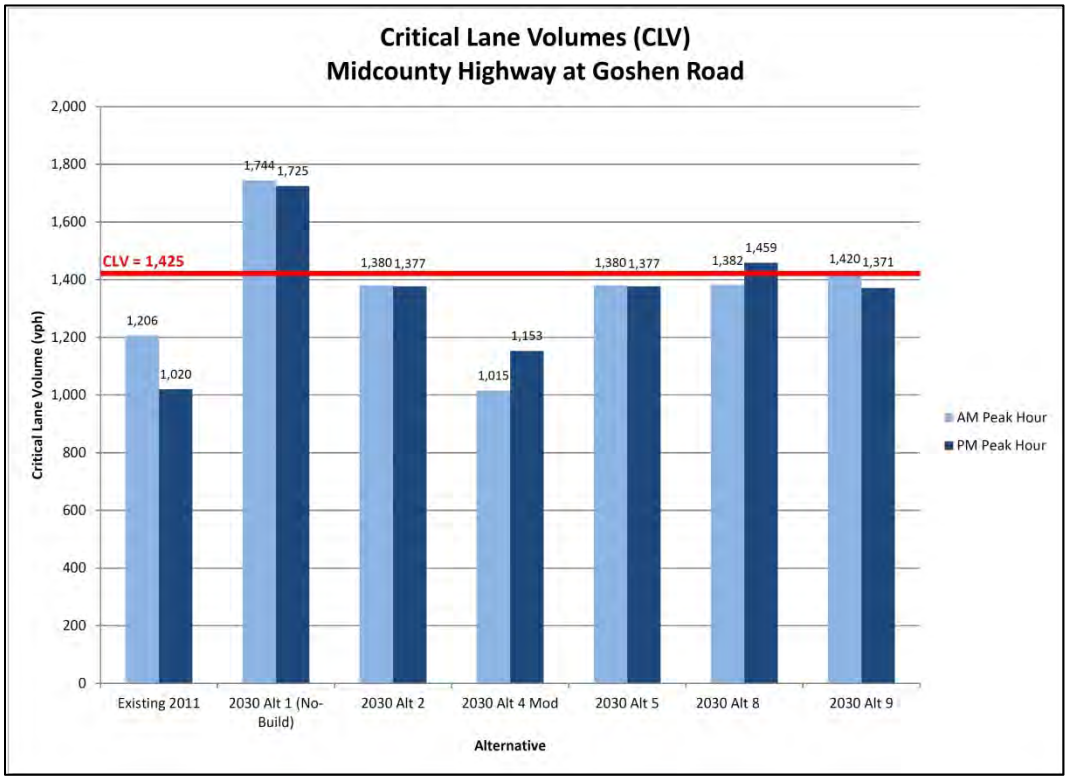


Figure 4-13: Critical Lane Volumes for Midcounty Highway at Montgomery Village Ave

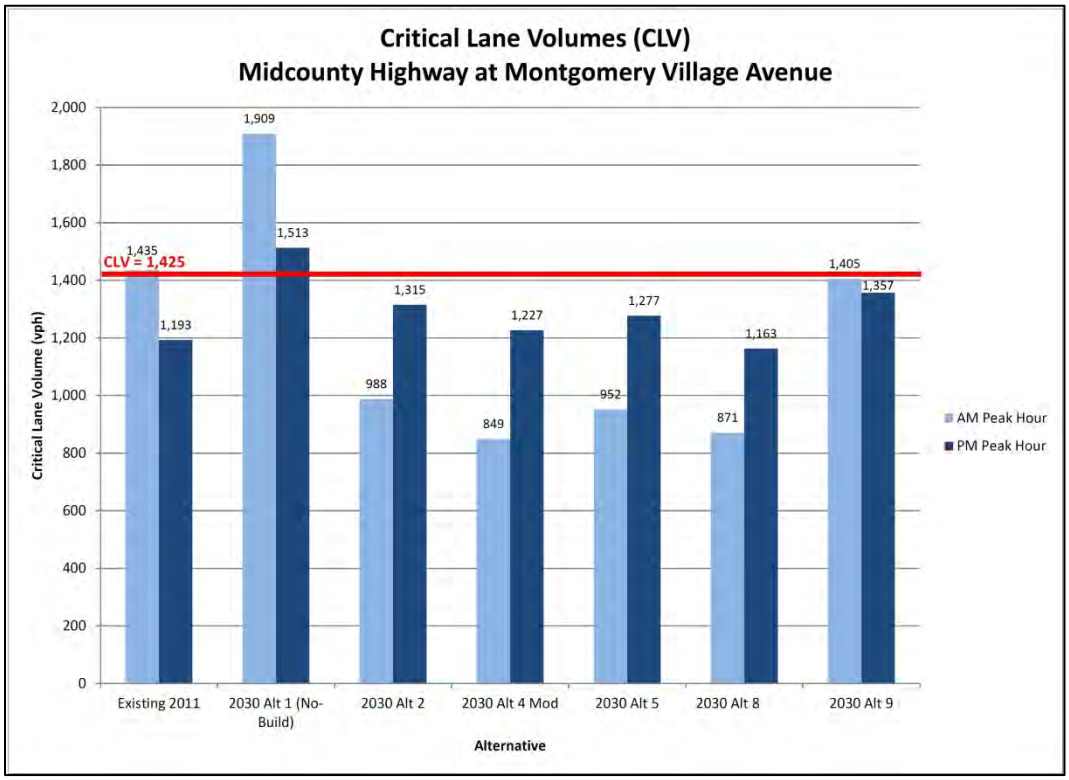


Figure 4-14: Critical Lane Volumes for Midcounty Highway at Watkins Mill Road

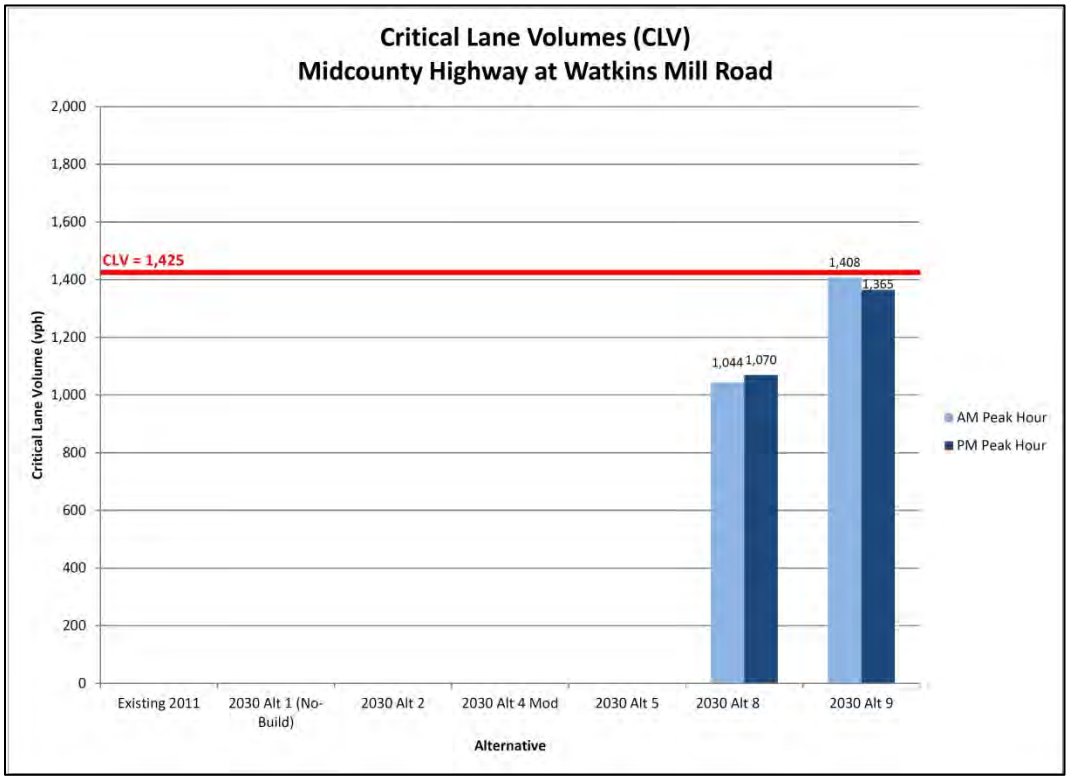


Figure 4-15: Critical Lane Volumes for Midcounty Highway at Middlebrook Road

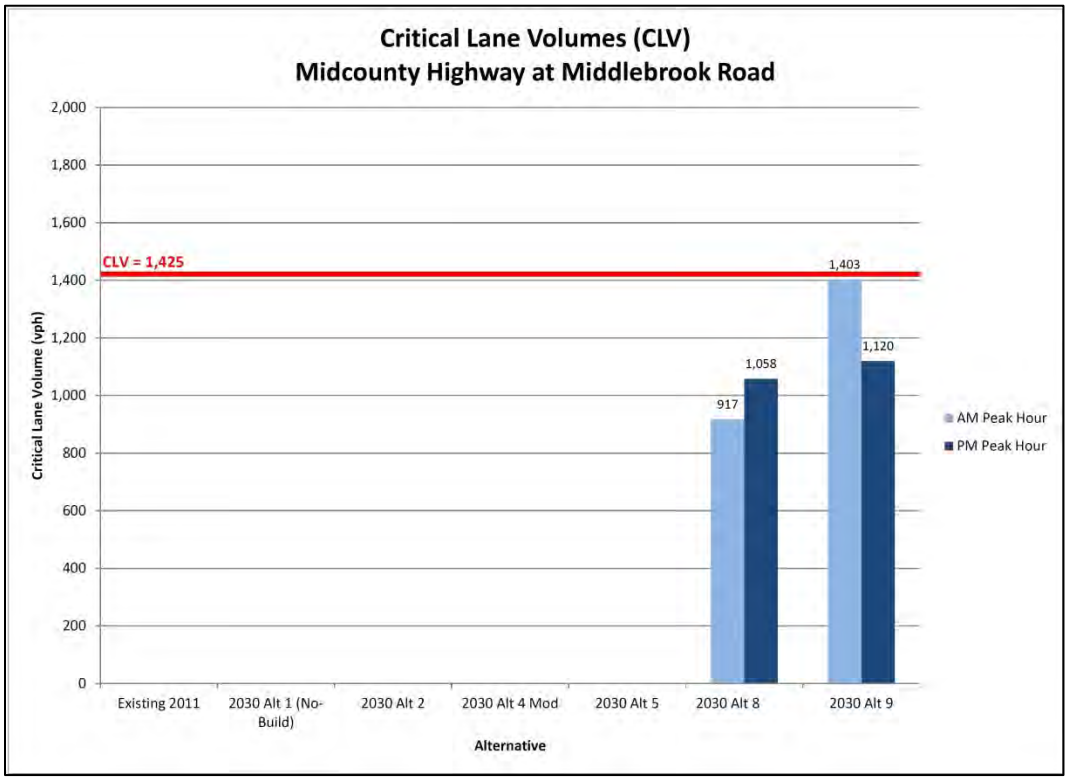


Figure 4-16: Critical Lane Volumes for Midcounty Highway at Germantown Road

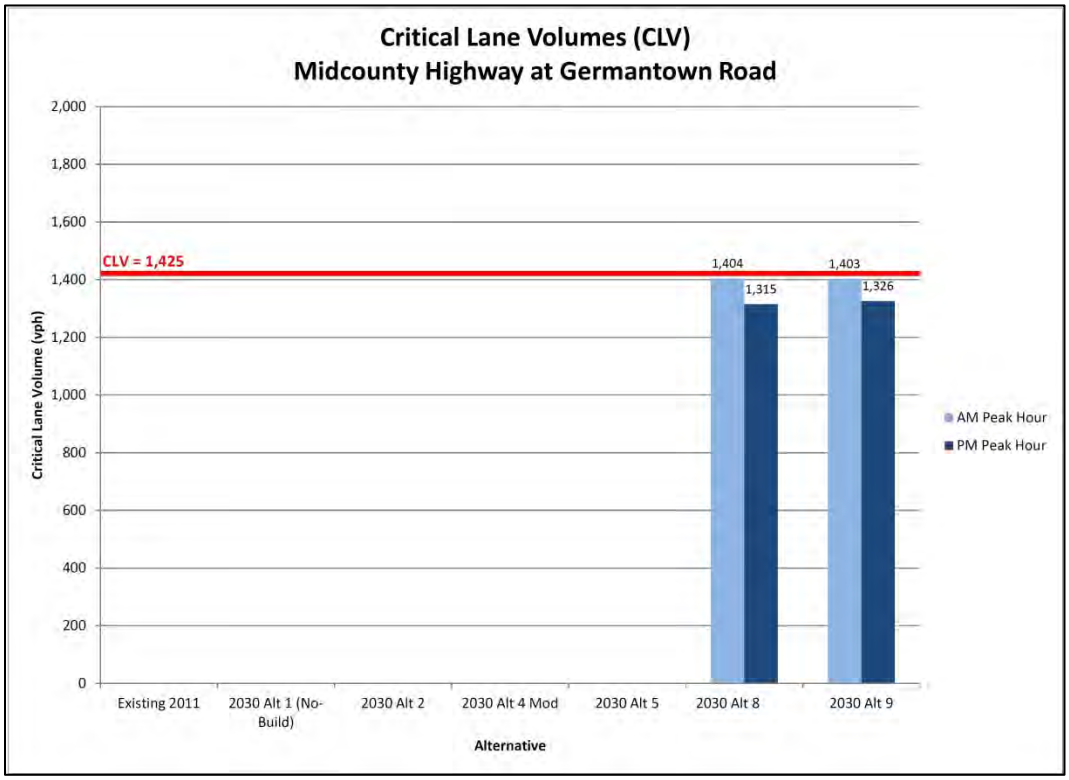


Figure 4-17: Critical Lane Volumes for Midcounty Highway at Brink Road

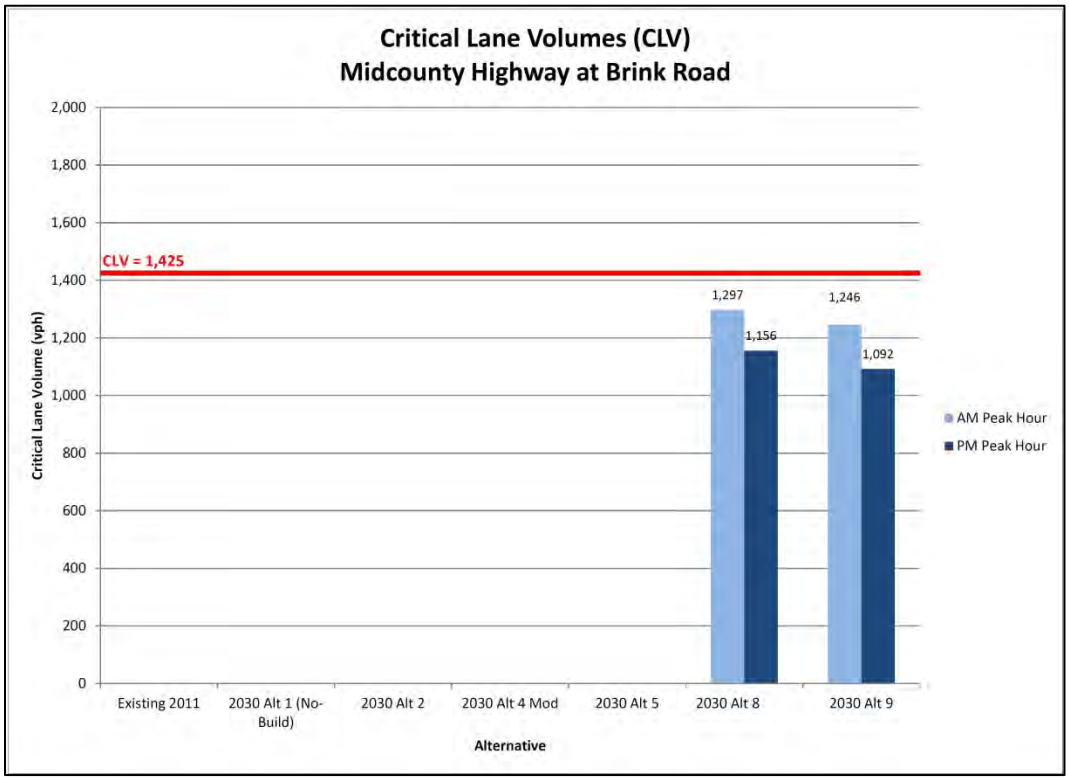


Table 4-1: Number of Peak Hours of Acceptable Intersection CLVs by Alternative

	Major Intersection	Alternatives											
		1		2		4-Mod		5		8		9	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Existing	Frederick Road at Montgomery Village Avenue			✓				✓	✓	✓	✓	✓	
	Frederick Road at Watkins Mill Road							✓	✓		✓		✓
	Frederick Road at Middlebrook Road			✓	✓			✓		✓	✓	✓	✓
	Frederick Road at Germantown Road							✓					✓
	Frederick Road at Ridge Road	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Ridge Road at Brink Road	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
	Ridge Road at Snowden Farm Parkway	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Muncaster Mill Road at Shady Grove Road			✓			✓						
	Snouffer School Road at Woodfield Road	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wightman Road at Goshen Road	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Wightman Road at Montgomery Village Avenue	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Midcounty Highway at Goshen Road	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Proposed	Midcounty Highway at Montgomery Village Ave			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Midcounty Highway at Watkins Mill Road									✓	✓	✓	✓
	Midcounty Highway at Middlebrook Road									✓	✓	✓	✓
	Midcounty Highway at Germantown Road									✓	✓	✓	✓
	Midcounty Highway at Brink Road									✓	✓	✓	✓
Total No. of Peak Hours of acceptable intersection operation at existing major intersections		11		17		15		20		18		19	
Total No. of Peak Hours of acceptable intersection operation at existing and proposed major intersections		13		19		17		22		28		29	

Table 4-1 lists the 13 existing and 4 proposed major study area intersections described above and indicates which alternative would provide the most AM and PM peak hours of intersection operation at or below the County Congestion Standard (CLV = 1,425) for the policy areas that include the Midcounty Corridor Study area. The results of this comparison of the alternatives shows Alternatives 5, 8 and 9 result in the most peak hours of acceptable operation at existing major intersections. When the proposed major intersections along the Master Plan Alignment are included in the comparison, Alternatives 8 and 9 each provide more peak hours of acceptable intersection operation than the other alternatives (with Alternative 9 providing the most of all).

Figures 4-18 through 4-23 are maps of each of the ARDS with the study area intersections marked with colored dots indicating whether the projected CLV at that intersection would be above or below the County's congestion standard for this policy area (which is a CLV of 1,425 vehicles per hour). The CLV represented is for the worst of AM and PM peak hours (i.e., if the intersection would operate below the congestion standard during the AM peak hour and above the congestion standard during the PM peak hour, the dot on the figure will indicate the PM peak hour condition). Several intersections would slightly exceed the 1,425 vehicle congestion standard, but are still considered to be within the acceptable range based on two factors:

1) Historical traffic counts in the study area from the Maryland State Highway Administration indicate that peak hour traffic volumes can fluctuate by up to 10% from one day to the next.
2) CLVs up to 1,450 vehicles are typically considered to represent non-congested conditions, because this CLV corresponds to the level of service D/E threshold when using the CLV analysis method.

Level of service (LOS) is an industry standard measure of effectiveness for intersection performance, with LOS A through LOS D indicating non-congested conditions and LOS E and F indicating congested conditions with long queue lengths and excessive delays. Although the County's congestion standard for this policy area is slightly less than the industry standard, several intersections whose CLVs would fall just above the County's standard and just below the LOS D/E threshold were deemed to perform acceptably to prevent larger than necessary intersection improvement designs for the ARDS.

The following is a summary of the effects that each alternative would have on the traffic operations at the 13 existing and, for the two master plan alignment alternatives, four (4) proposed major intersections within the study area. This summary includes only the major intersections; each alternative would also have several non-major intersections that would operate with CLVs above the congestion standard. The CLVs for all study area intersections (major and non-major) are provided in the table in ***Appendix A*** for the Existing (2011) Conditions and each Year 2030 alternative.

<u>Alternative 1: No-Build</u>

- Of the 13 existing major intersections, eight (8) would have a CLV that exceeds that county's congestion standard for this policy area (1,425 vehicles) during the AM and/or PM peak hour(s).
- Of the 8 congested major intersections, 7 would have CLVs that exceed the congestion standard by more than 175 vehicles during one or both peak hours.

<u>Alternative 2: Localized Capacity Improvements Within Available Right-of-Way</u>

- Five (5) of the 13 existing major intersections would continue to have CLVs that exceed the county's congestion standard during the AM and/or PM peak hour(s).
- Of the 5, three (3) would have CLVs that exceed the congestion standard by more than 175 vehicles during one or both peak hours.

Alternative 4 Modified: Muncaster Mill/Snouffer School/Wightman/Brink/Ridge Road Alignment

- Five (5) of the 13 existing major intersections would continue to have CLVs that exceed the county's congestion standard during the AM and/or PM peak hour(s).
- Of the 5, three (3) would have CLVs that exceed the congestion standard by more than 175 vehicles during one or both peak hours.

Alternative 5: MD 124/MD 355/MD 27 Alignment

- Of the 13 existing major intersections, three (3) would have a CLV that exceeds that county's congestion standard for this policy during the AM and/or PM peak hour(s).
- Of the 3 congested major intersections, one (1) would have CLVs that exceed the congestion standard by more than 175 vehicles, during the AM peak hour only.

Alternative 8: Partial Master Plan Alignment

- Four (4) of the 17 existing and proposed major intersections would continue to have CLVs that exceed the county's congestion standard during the AM and/or PM peak hour(s).
- Of the 4, one (1) would have CLVs that exceed the congestion standard by more than 175 vehicles, during both the AM and PM peak hours.

Alternative 9: Master Plan Alignment

- Four (4) of the 17 existing and proposed major intersections would continue to have CLVs that exceed the county's congestion standard during the AM and/or PM peak hour(s).
- Of the 4, one (1) would have CLVs that exceed the congestion standard by more than 175 vehicles, during the AM peak hour only.

The existing intersection lane configurations and the recommended lane configurations for each alternative (corresponding to the specific alignment for each alternative, if applicable) are shown in ***Appendices B through H***.

Figure 4-18: Alternative 1 Intersection CLV-Based Performance

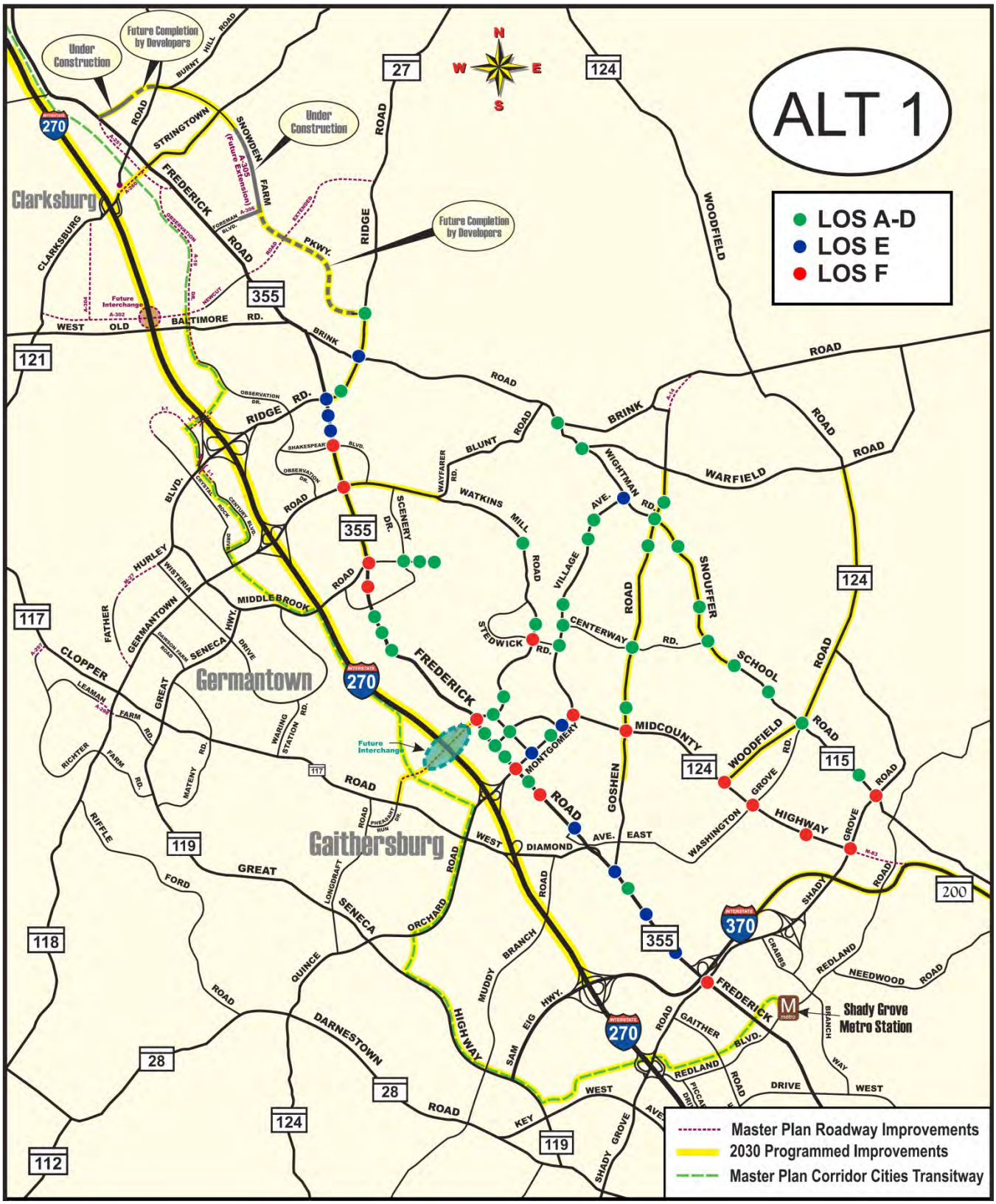


Figure 4-19: Alternative 2 Intersection CLV-Based Performance

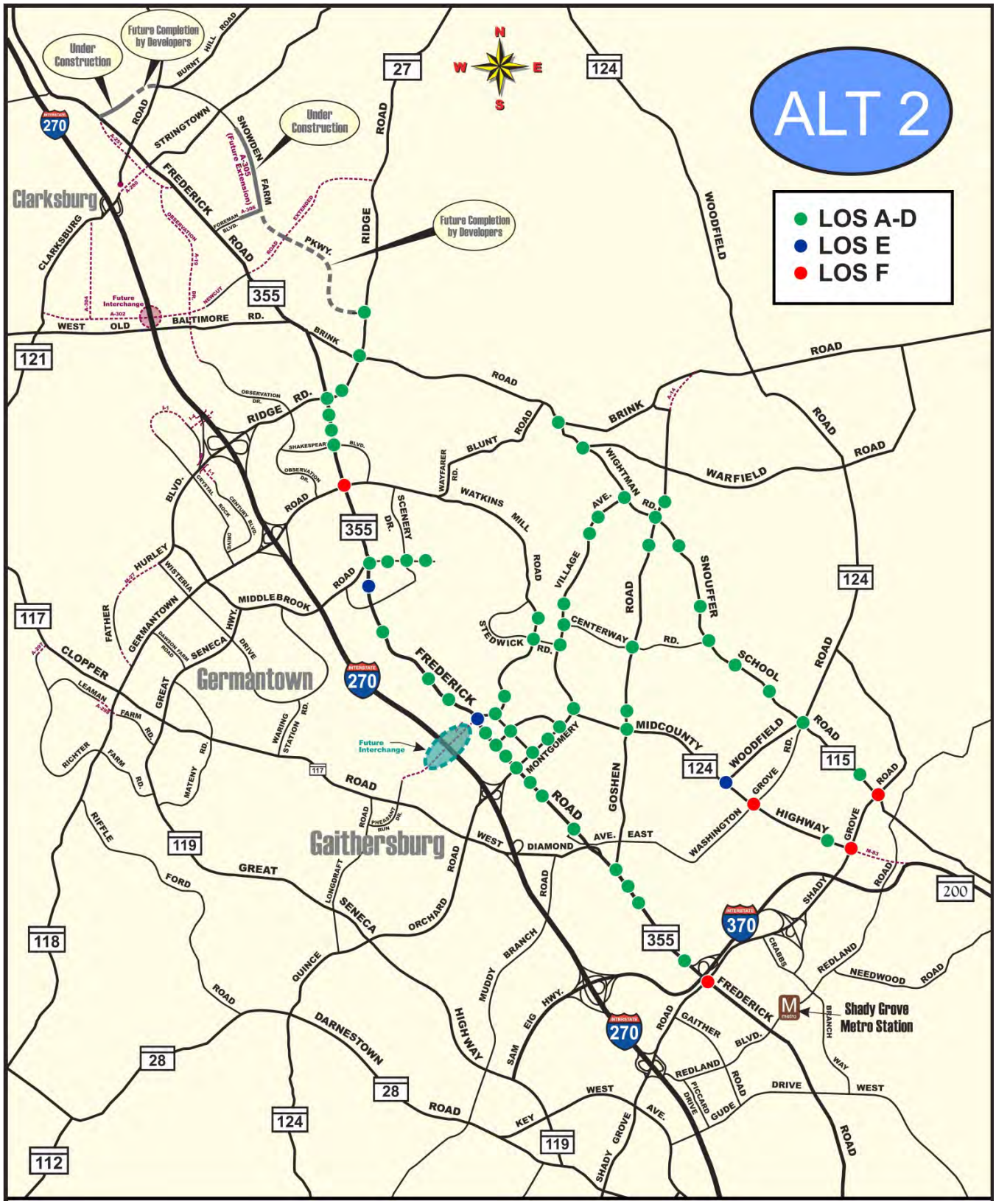


Figure 4-20: Alternative 4 Modified Intersection CLV-Based Performance

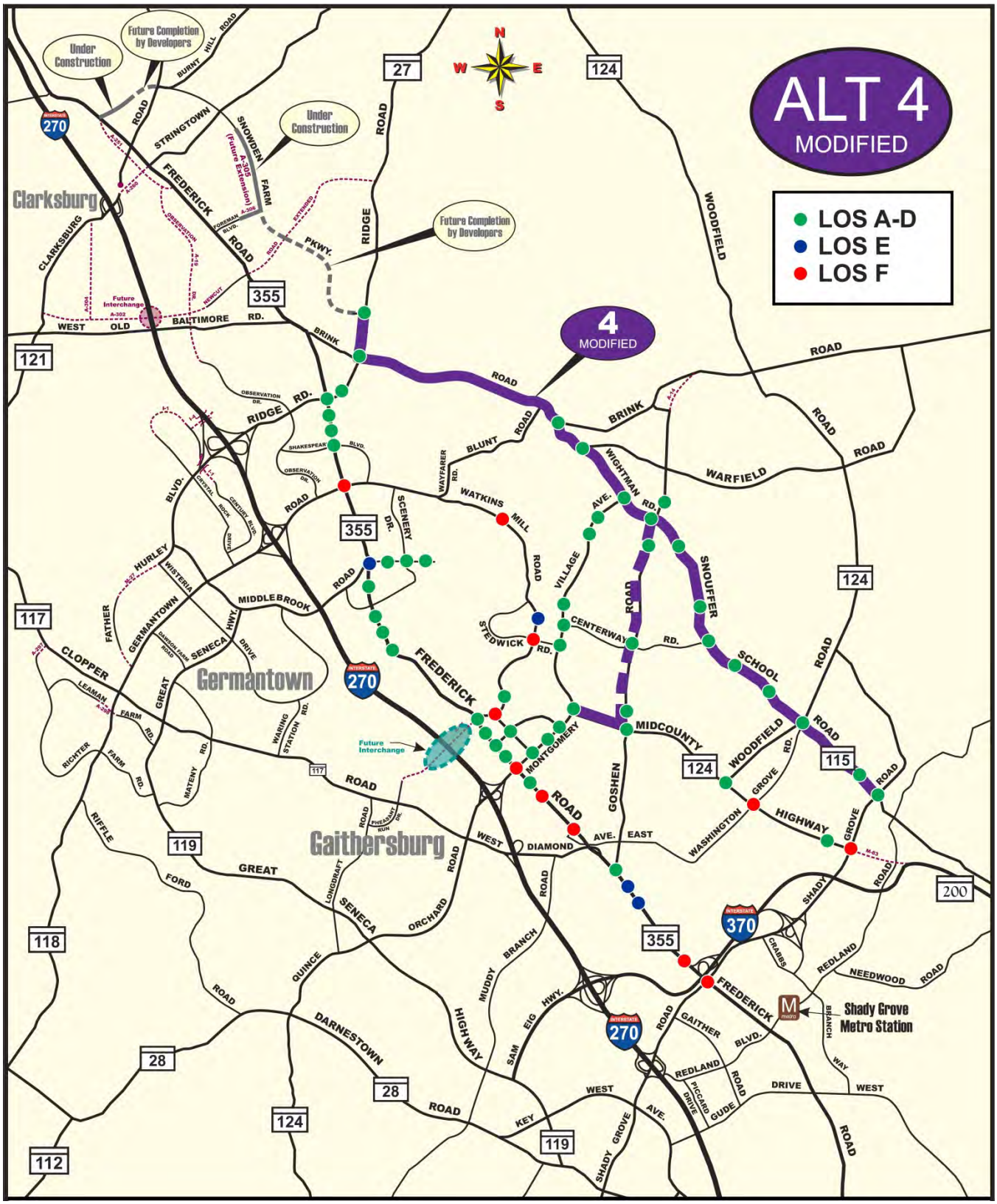


Figure 4-21: Alternative 5 Intersection CLV-Based Performance

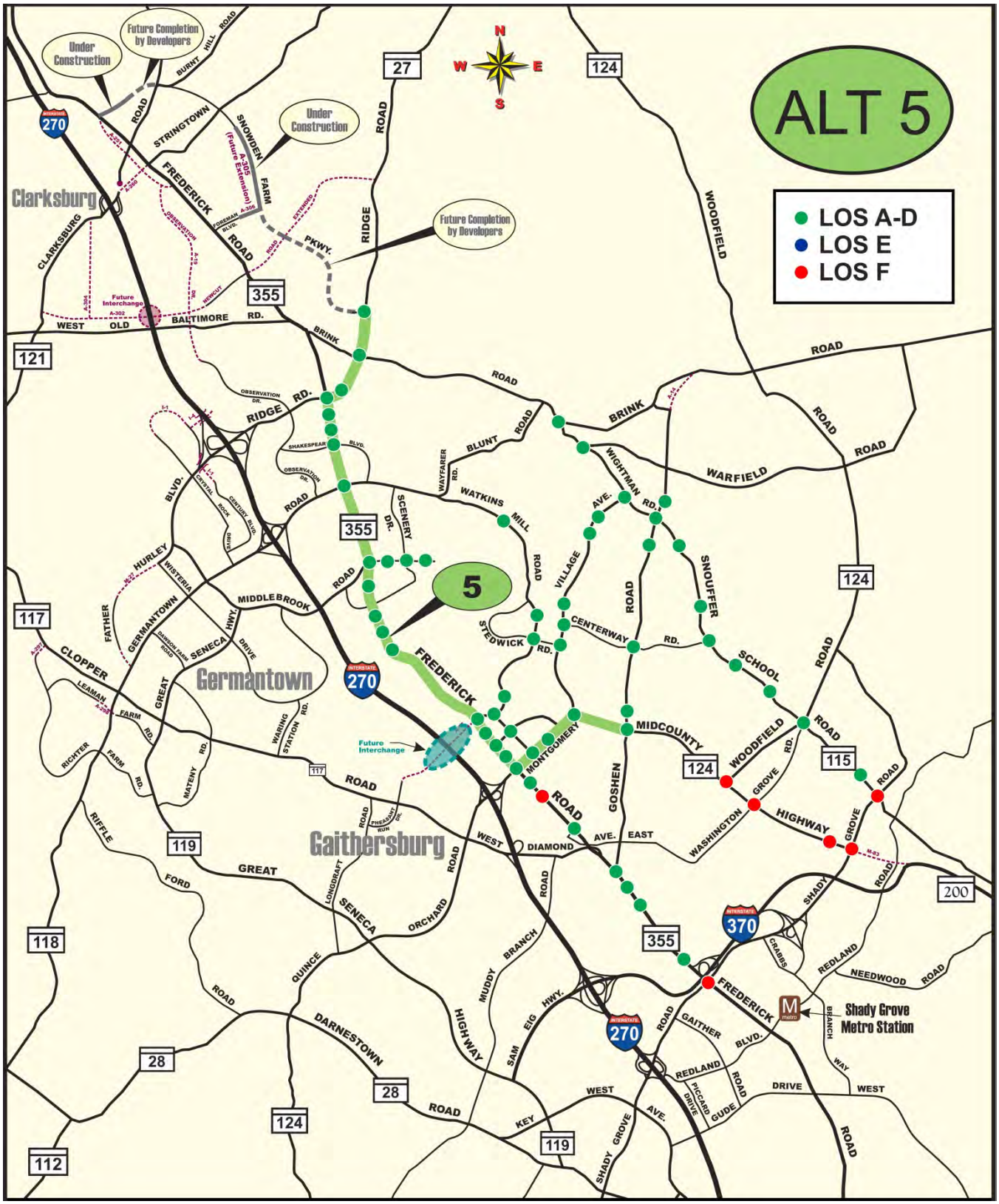


Figure 4-22: Alternative 8 Intersection CLV-Based Performance

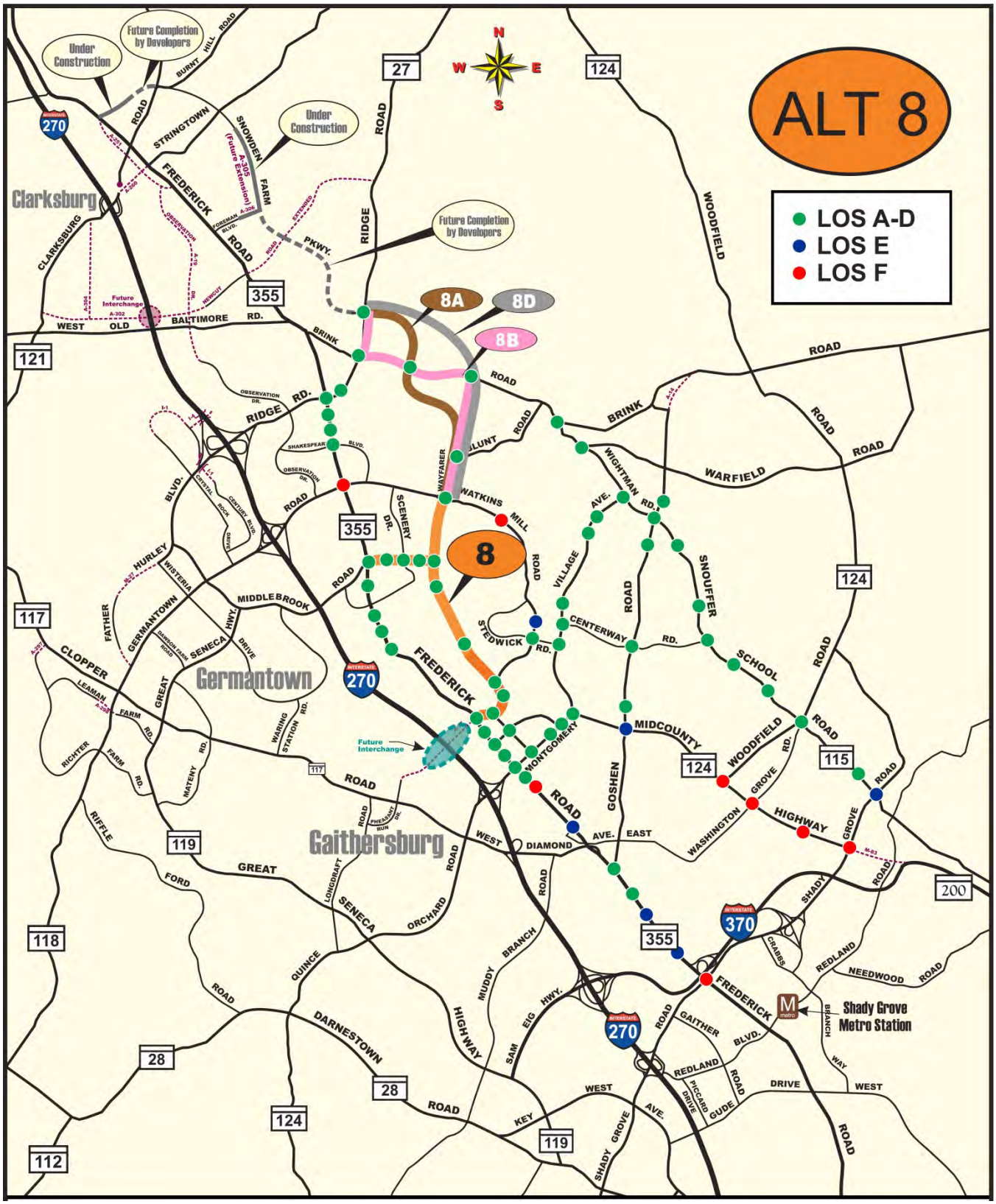
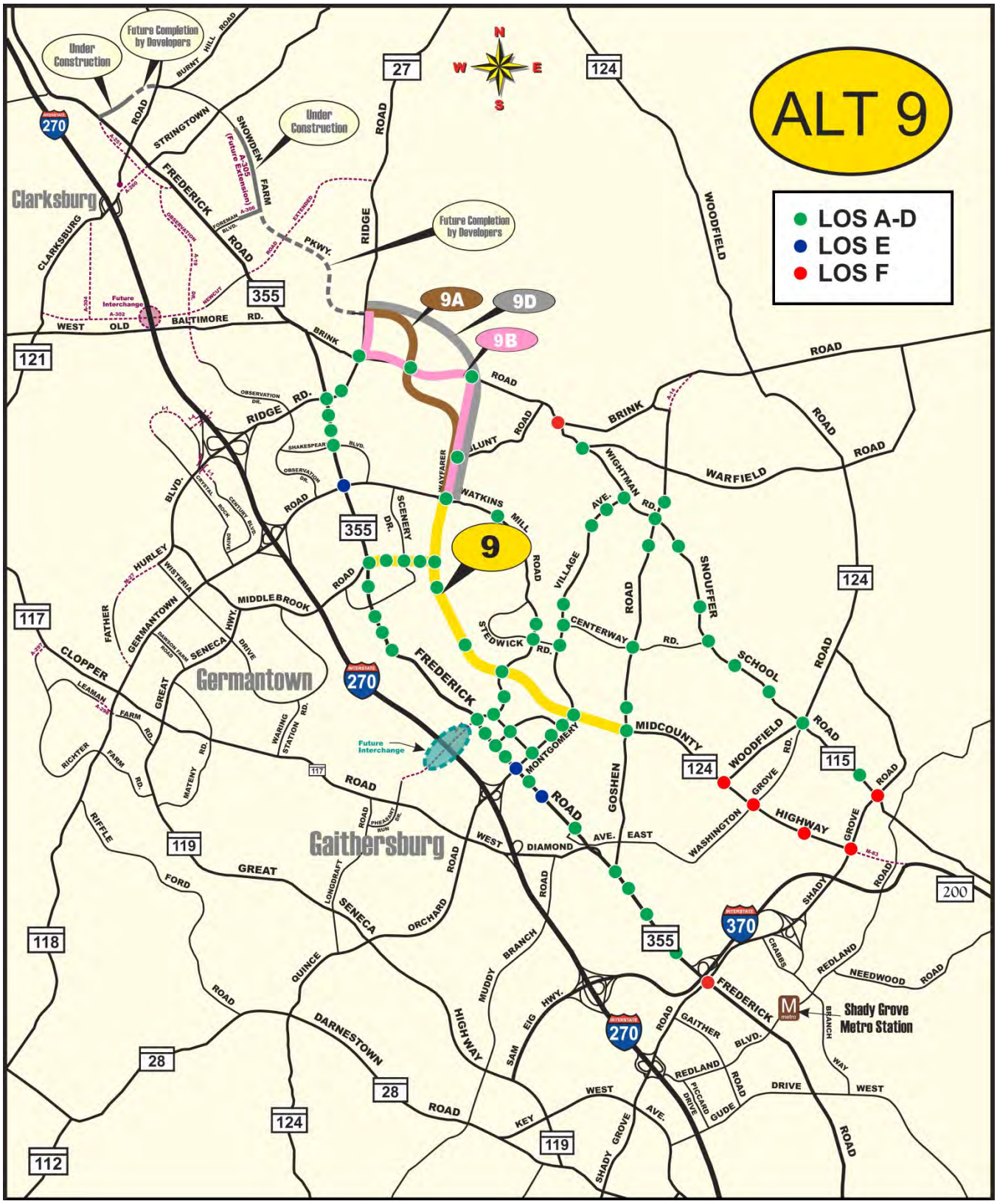


Figure 4-23: Alternative 9 Intersection CLV-Based Performance



V. Travel Time Evaluation

Synchro was used to estimate the travel times along four main north-south corridors through the study area. The travel times were estimated for the northbound and southbound directions during both the AM and PM peak hours for each of the Alternatives Retained for Detailed Study (ARDS). The four north-south corridors are as follows:

Corridor #1 – Master Plan Alignment: Starting at the intersection of Midcounty Highway and Goshen Road, this corridor heads west to Montgomery Village Avenue, then continues north along the Master Plan Alignment for M-83, terminating at the intersection of Ridge Road and the proposed Snowden Farm Parkway. This corridor exactly matches the Alternative 9 alignment.

Corridor #2 – MD 124/MD 355/MD 27: Starting at the intersection of Midcounty Highway (MD 124) and Goshen Road, this corridor heads west to Montgomery Village Avenue, then turns west along Montgomery Village Avenue to Frederick Road (MD 355). The route then heads north along Frederick Road to Ridge Road (MD 27), continues north along Ridge Road, and terminates at the intersection of Ridge Road and the proposed Snowden Farm Parkway. This corridor exactly matches the Alternative 5 alignment.

Corridor #3 – Goshen/Wightman/Brink: Starting at the intersection of Midcounty Highway and Goshen Road, this corridor heads north along Goshen Road to Wightman Road, then turns northwest along Wightman Road and Brink Road to Ridge Road. At Ridge Road, the corridor turns north along Ridge Road, terminating at the intersection of Ridge Road and the proposed Snowden Farm Parkway. This corridor follows a portion of the Alternative 4 Modified alignment, but uses a portion of Goshen Road such that it has the same southern terminus as Corridors #1 and #2.

Corridor #4 – Alternative 4 Modified: This corridor does not share the same southern terminus as the other three corridors. The southern terminus of this corridor is located at the intersection of Muncaster Mill Road (MD 115) and Shady Grove Road. From this point, the corridor heads northwest along Muncaster Mill Road, Snouffer School Road, Wightman Road, and Brink Road to Ridge Road. At Ridge Road, the corridor turns north along Ridge Road, terminating at the intersection of Ridge Road and the proposed Snowden Farm Parkway. This corridor exactly matches the Alternative 4 Modified alignment.

Figure 5-1 is a map showing the four travel time corridors described above, with terminal locations. ***Table 5-1*** summarizes the AM and PM peak hour travel times estimated using Synchro along each of the four north-south corridors shown in Figure 5-1. The length of each corridor is also shown. While the lengths between the endpoint intersections are identical in both directions along the same corridor, the travel time analysis uses different lengths for the northbound direction versus the southbound direction (see the "Distance" row in **Table 5-1**). This is because the measurement of travel time begins on the approach to each endpoint intersection, and the southbound approach to one endpoint intersection is longer than the northbound approach to the other endpoint intersection. The blue-shaded cells contain the travel times for the highest-volume direction of travel during the specified time period. The Synchro analysis reports are provided in ***Appendices B through H***.

Figure 5-1: Map of the Travel Time Corridors

Figures 5-2 and 5-3 each present a graphical depiction of the same information that is shown in Table 5-1 for the peak travel direction during the AM and PM peak hours, to more easily compare the differences in travel times among the ARDS. Traffic volumes are highest in the southbound direction during the AM peak hour, and in the northbound direction during the PM peak hour.

The following trends are evident based on the travel time analyses summarized in Figures 5-2 and 5-3, as well as the individual roadway segment travel time and delay results provided in the Appendix:

- Drivers traveling along the Master Plan Alignment (officially designated as M-83 in the Plan, and shown in solid purple in Figure 5-1) under Alternative 9 would experience the shortest peak direction, peak hour travel times versus the other parallel corridors under this alternative.
- Drivers using M-83 under Alternative 9 would also experience shorter travel times than users of *any corridor* under the other alternatives.
- Under Alternative 1 (No-Build), the travel times along the Goshen-Wightman-Brink (blue) corridor and the Alternative 4 Modified (yellow) corridor would not increase as much as the travel times along the MD 124-MD 355-MD 27 (red) route (vs. Year 2011 conditions) because portions of the blue and yellow corridors (i.e., Goshen Road and Snouffer School Road) are assumed to be widened under separate projects by 2030, while MD 355 would remain in its Year 2011 configuration.

Table 5-1: Summary of Synchro Estimated Travel Times, by Alternative

			Master Plan Alignment (M-83) [#1]		MD 124-MD 355-MD 27 Route [#2]		Goshen-Wightman-Brink Route [#3]		Alternative 4 Mod. Route** [#4]	
			NB	SB	NB	SB	NB	SB	NB	SB
Existing (2011)	Distance	(miles)			6.6	7.2	6.0	6.7	7.5	8.2
	AM	(mins)			14.8	19.2	11.2	15.9	13.5	17.8
	PM	(mins)			20.4	17.6	12.8	13.6	14.4	16.4
2030 Alt. 1 - No Build	Distance	(miles)			7.0	7.2	6.4	6.7	7.9	8.2
	AM	(mins)			17.4	25.9	12.5	15.0	14.7	16.2
	PM	(mins)			26.1	19.9	13.5	16.4	15.2	16.4
2030 Alt. 2 - Spot Improvements	Distance	(miles)			7.0	7.2	6.4	6.7	7.9	8.2
	AM	(mins)			14.3	21.2	12.6	14.7	14.7	16.8
	PM	(mins)			20.2	18.6	12.7	14.6	15.8	20.0
2030 Alt. 4 Mod. - Brink/Wightman	Distance	(miles)			7.0	7.2	6.4	6.7	7.9	8.2
	AM	(mins)			15.4	20.6	13.0	13.5	12.7	14.8
	PM	(mins)			20.8	17.9	22.1	12.8	17.5	14.3
2030 Alt. 5 - MD 355 Improvements	Distance	(miles)			7.0	7.2	6.4	6.7	7.9	8.2
	AM	(mins)			15.2	18.7	12.2	14.1	14.3	16.2
	PM	(mins)			16.9	19.7	13.4	13.7	14.7	16.4
2030 Alt. 8. - Partial Master Plan Alignment	Distance	(miles)	7.3	7.6	7.0	7.2	6.4	6.7	7.9	8.2
	AM	(mins)	15.8	17.4	15.6	18.3	13.1	14.8	16.2	17.0
	PM	(mins)	17.5	18.6	18.5	17.9	13.2	14.5	15.4	15.8
2030 Alt. 9 - Master Plan Alignment	Distance	(miles)	6.1	6.3	7.0	7.2	6.4	6.7	7.9	8.2
	AM	(mins)	9.7	12.1	15.2	19.0	12.6	14.7	15.0	16.5
	PM	(mins)	11.1	12.3	16.1	18.2	13.3	14.3	15.3	16.3

Note: Cells shaded blue contain the travel times for the highest-volume travel direction during the specified peak hour.

- Under Alternative 4 Modified, during the PM peak hour, the peak direction travel times along the MD 115-Snouffer-Wightman-Brink (yellow) corridor and the Goshen-Wightman-Brink (blue) corridor would be significantly worse than under Alternative 1 (No-Build).
    - This increase in travel time would result from the increased volume of traffic that would use the MD 115-Snouffer-Wightman-Brink (yellow) corridor under Alternative 4 Modified, causing higher delays at the Wightman Road/Goshen Road and Ridge Road/Brink Road intersections.
    - Although the increased traffic volume would increase delays at these intersections, these two intersections would still operate below the county's congestion standard critical lane volume (CLV).

- The additional travel distance incurred under Alternative 8 due to the circuitous route (the dashed purple line in Figure 5-1) around the omitted segment of M-83 at the southern end of the Master Plan Alignment would result in significantly longer travel times compared to Alternative 9.
- Under all of the 2030 Alternatives during both the AM and PM peak hours, the Goshen-Wightman-Brink (blue) corridor and the MD 115-Snouffer-Wightman-Brink (yellow) corridor travel times would remain relatively constant among the alternatives, with the exception of Alternative 4 Modified during the PM peak hour. Alternative 4 Modified would result in the longest travel time of any alternative along the both the blue and yellow corridors, which follow part or all of the Alt 4 Modified build alignment.

Based on the results of the travel time analysis, Alternative 9 would be the preferred alternative, since it would provide a north-south corridor with the shortest travel times compared to the other alternatives. Alternative 9 has the added advantage of not only improving travel time in the red corridor but also providing a new corridor with a faster travel time between Points A and B on Figure 5-1 than any other alternative. Also, Alternatives 5, 8 and 9 result in lower (i.e., better) travel times along the MD 124-MD 355-MD 27 (red) corridor than either Alternative 2 or Alternative 4 Modified during both the AM and PM peak hours.

Figure 5-2: AM Peak Hour Southbound Travel Time Comparison

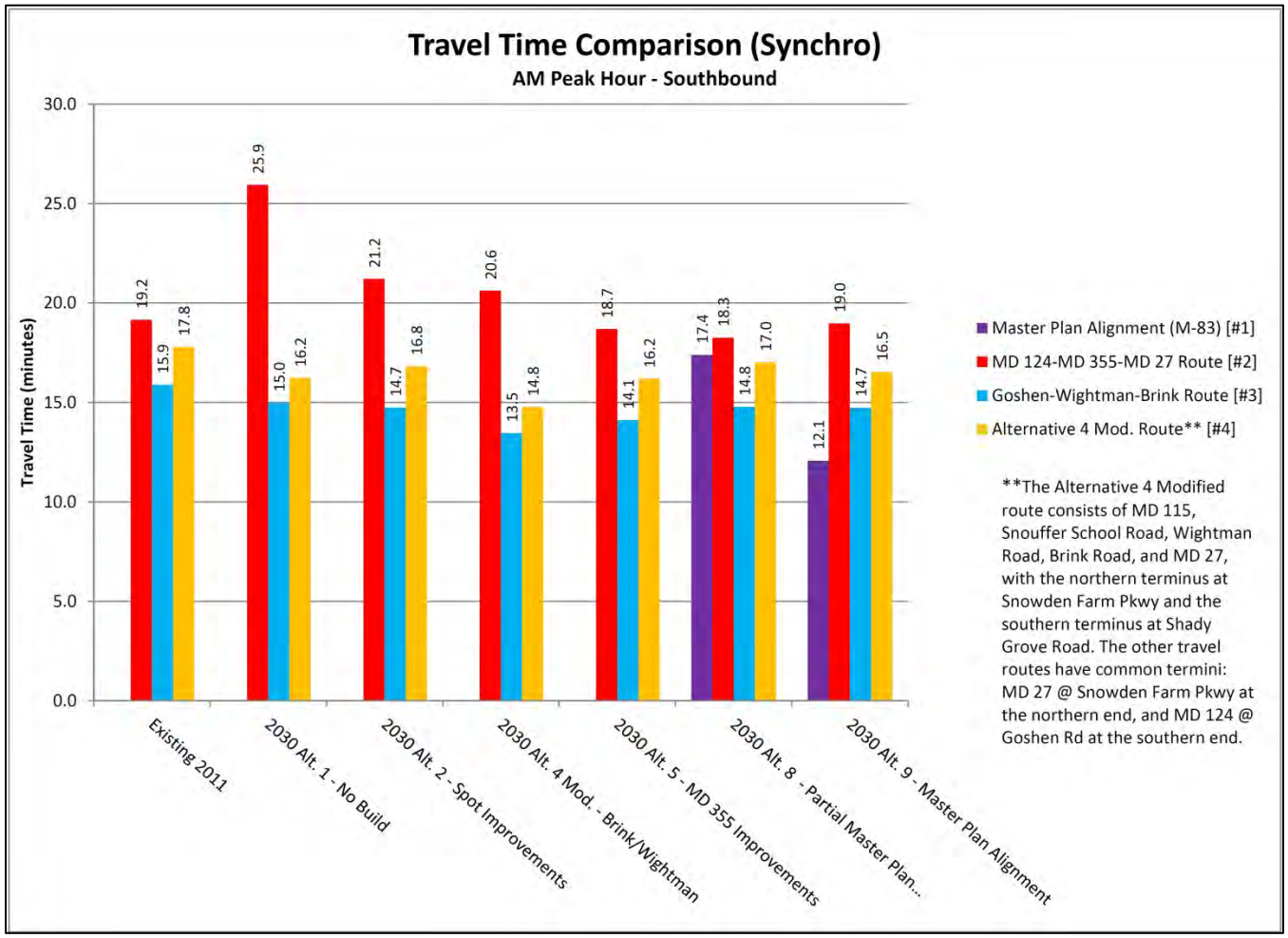
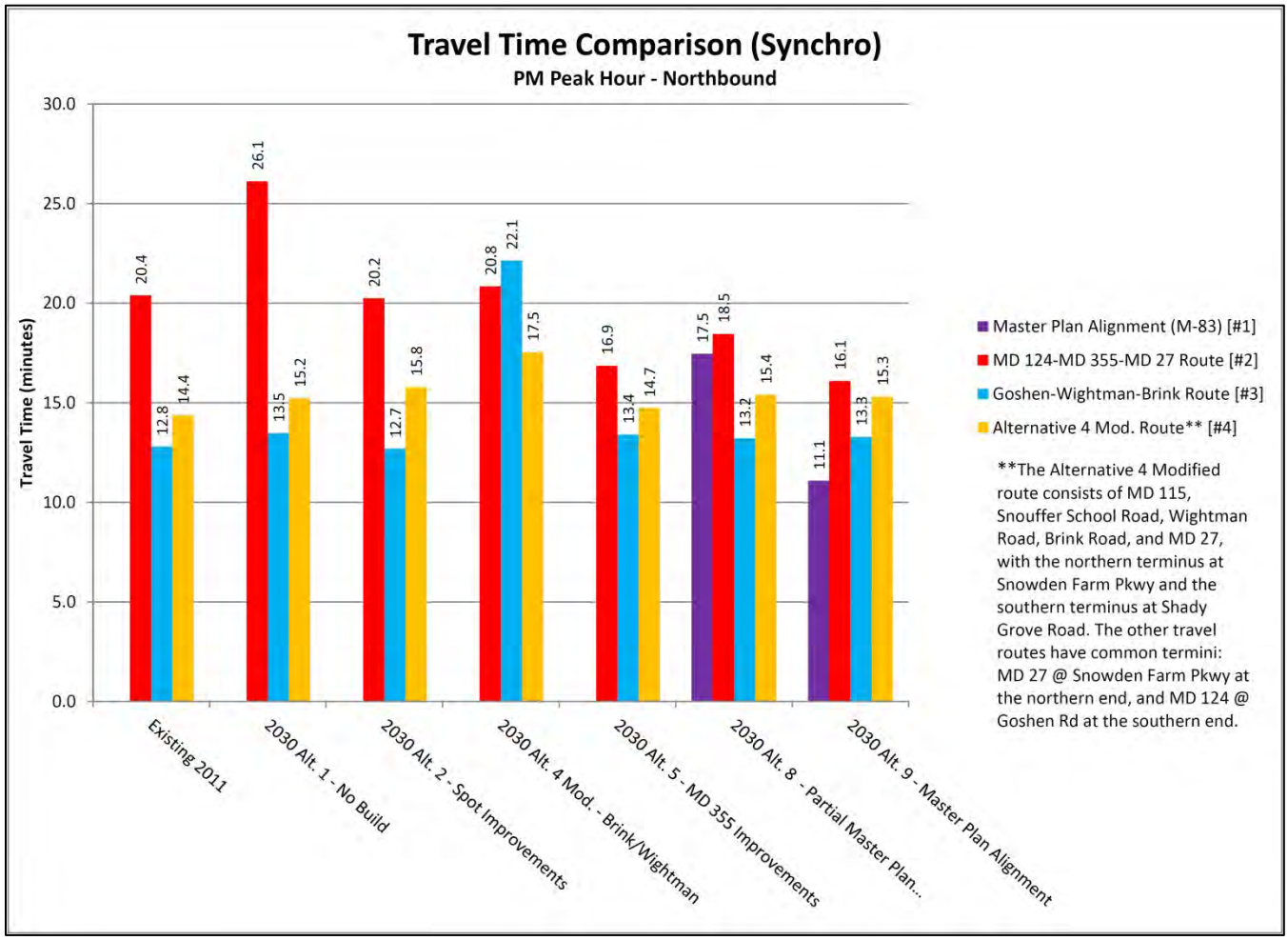


Figure 5-3: PM Peak Hour Northbound Travel Time Comparison



VI. Screenline Volume Analysis

A screenline volume analysis was performed to determine how each of the Alternatives Retained for Detailed Study (ARDS) would affect the number of vehicles traveling north and south through the study area during the AM and PM peak hours and throughout the entire day. Three screenlines (A, B and C) were established across the northern, middle, and southern portions of the study area, respectively, crossing each of the primary north-south roadways in each of those areas. ***Figure 6-1*** is a map showing the screenline locations and the nodes where each screenline crosses a primary roadway. The traffic volumes used in this evaluation correspond to these nodes. ***Appendix I*** includes a spreadsheet showing the peak hour and daily volumes crossing each screenline at each node.

Figure 6-1: Screenline Locations and Volume Nodes

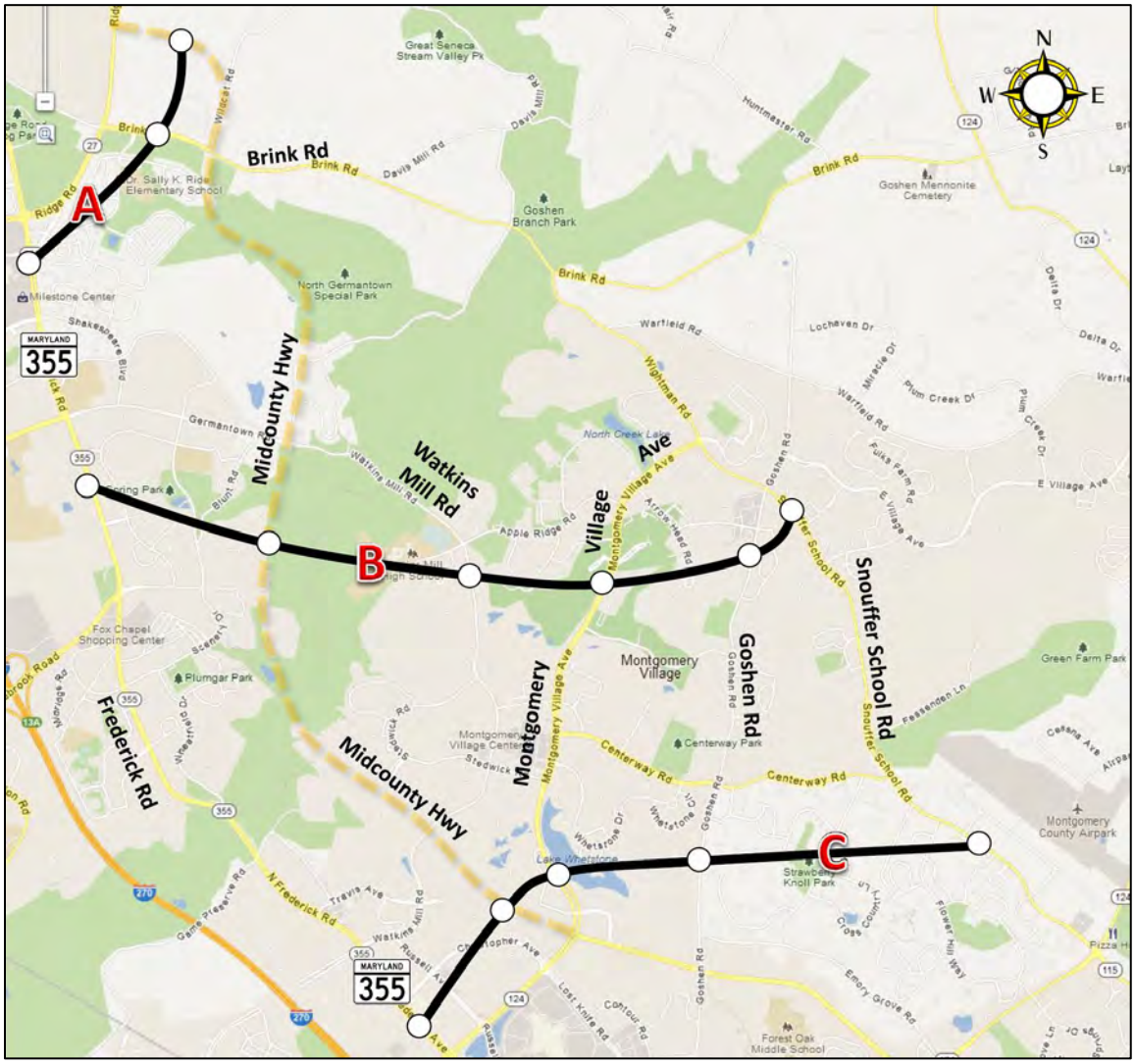


Figure 6-2: AM and PM Peak Hour Traffic Volumes Crossing Screenlines

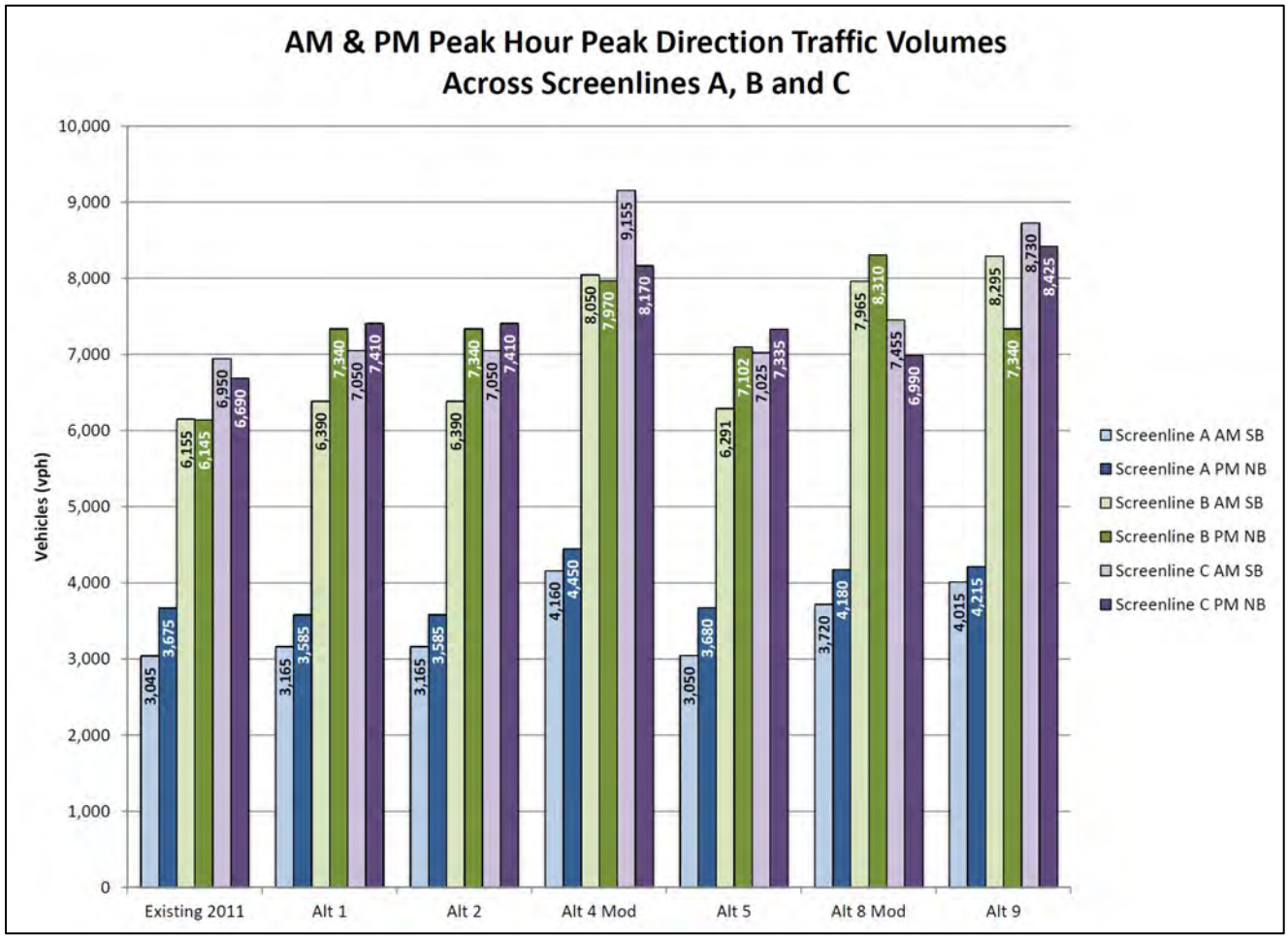
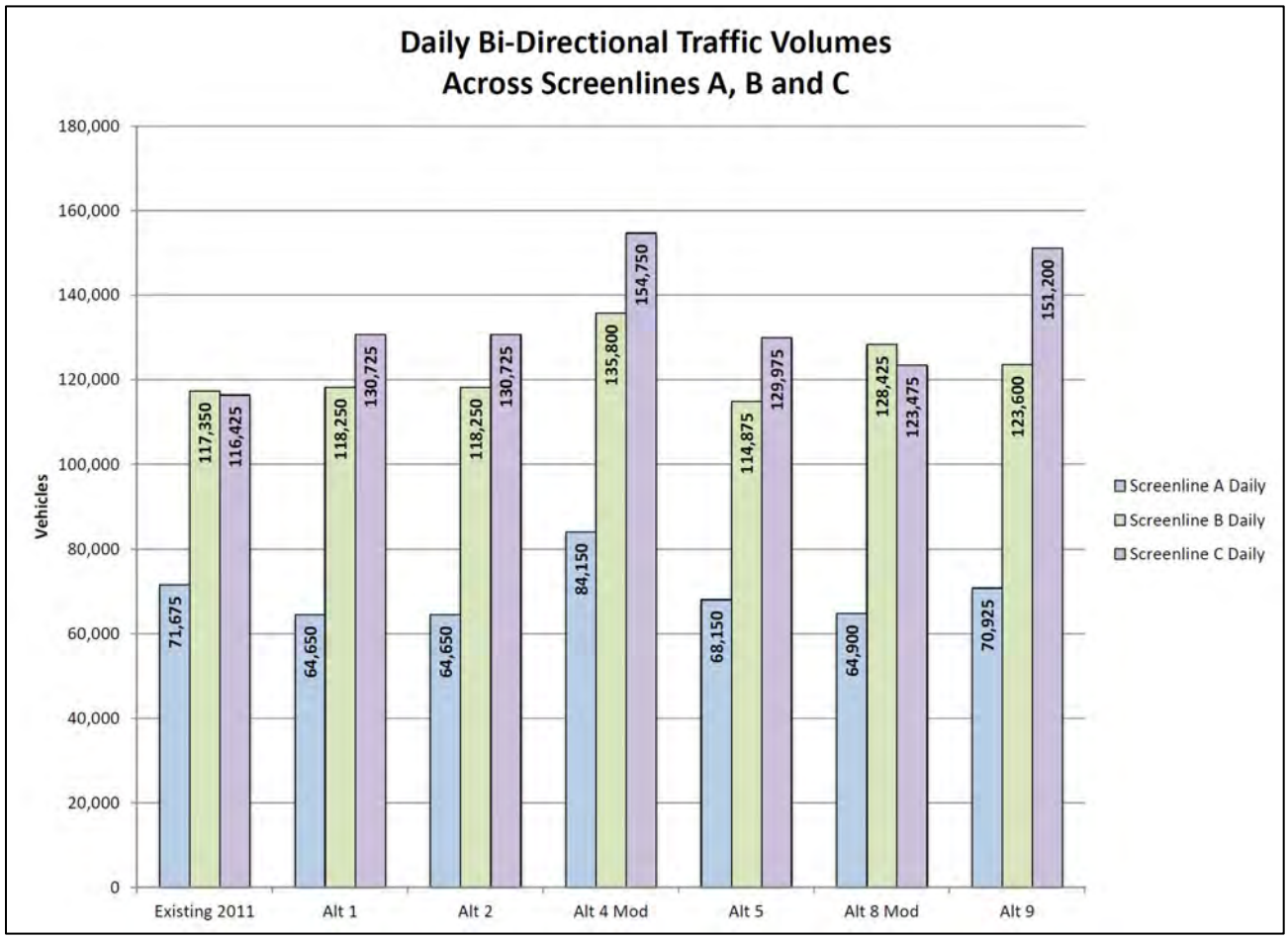


Figure 6-2 is a chart showing the Year 2030 AM and PM peak hour traffic volumes crossing the screenlines at the nodes shown in Figure 6-1. In most cases, Alternative 4 Modified would have the most traffic traveling north and south through the study area during the peak hours, followed by Alternative 9 and Alternative 8. Alternative 4 Modified's alignment follows roads that could be defined as traveling either north-south or east-west (e.g., MD 115 is officially marked as an east-west roadway, and Brink Road is unquestionably an east-west roadway). The proposed improvements that would be implemented along this corridor under Alternative 4 Modified would likely benefit north-south travelers *and* east-west travelers, whereas the alignments for the other alternatives would likely benefit mostly north-south travelers. This explains the slightly higher screenline volumes projected under Alternative 4 Modified versus Alternatives 8 and 9. Alternatives 2 and 5 are similar in that neither would add significant north-south lane capacity within the study area. As a result, the projected volume of traffic traveling north or south through the study area for these alternatives is near or equal to that of the No-Build alternative (Alternative 1).

Figure 6-3 shows the daily traffic volumes crossing the screenlines from Figure 6-1. Most of the trends exhibited in the peak hour screenline volume analysis are also shown in the daily volume analysis. However, whereas Alternative 8 is projected to have some of the highest peak hour volumes traveling north and south through the study area, it is projected to have some of the lowest daily volumes. This indicates that drivers would be willing to travel Alternative 8's circuitous route during the peak hours when alternate parallel routes are more congested, but less likely to travel Alternative 8's longer distance during off-peak hours when the shorter parallel routes are less busy.

Figure 6-3: Daily Traffic Volumes Crossing Screenlines



Of all the alternatives retained for detailed study, Alternative 4 Modified would draw the most traffic into the study area, but all the additional traffic would be confined to using existing roadway alignments. In contrast to Alternative 4 Modified, Alternative 9 draws almost as much traffic into the study area but provides four new lanes of highway capacity on which to accommodate the increase, resulting in less traffic increase on the existing roads.

VII. Conclusions and Recommendations

This study evaluated six (6) alternatives retained for detailed study based on three key measures of effectiveness: Critical Lane Volumes (CLVs), Travel Times, and Screenline Volumes (i.e., number of vehicles served in the study area). Year 2030 projected traffic volumes were used for the analysis. Under Alternative 9 (Master Plan Alignment), more major intersections (i.e., intersections of primary or secondary arterial roadways) would operate below the county's CLV congestion standard of 1,425 vehicles during more peak hours than any of the other alternatives. Alternative 9 would provide the fastest north-south travel route through the study area during the AM and PM peak hours, compared to the other alternatives, and would also reduce travel times along the MD 124-MD 355-MD 27 corridor more than 3 other alternatives during the AM peak hours and more than all the other alternatives during the PM peak hour. Lastly, Alternative 9 would allow greater mobility across the study area while providing a roadway on new alignment to accommodate traffic growth without burdening existing facilities. Based on these findings, **Alternative 9** would provide the most transportation benefits, and is the preferred alternative.