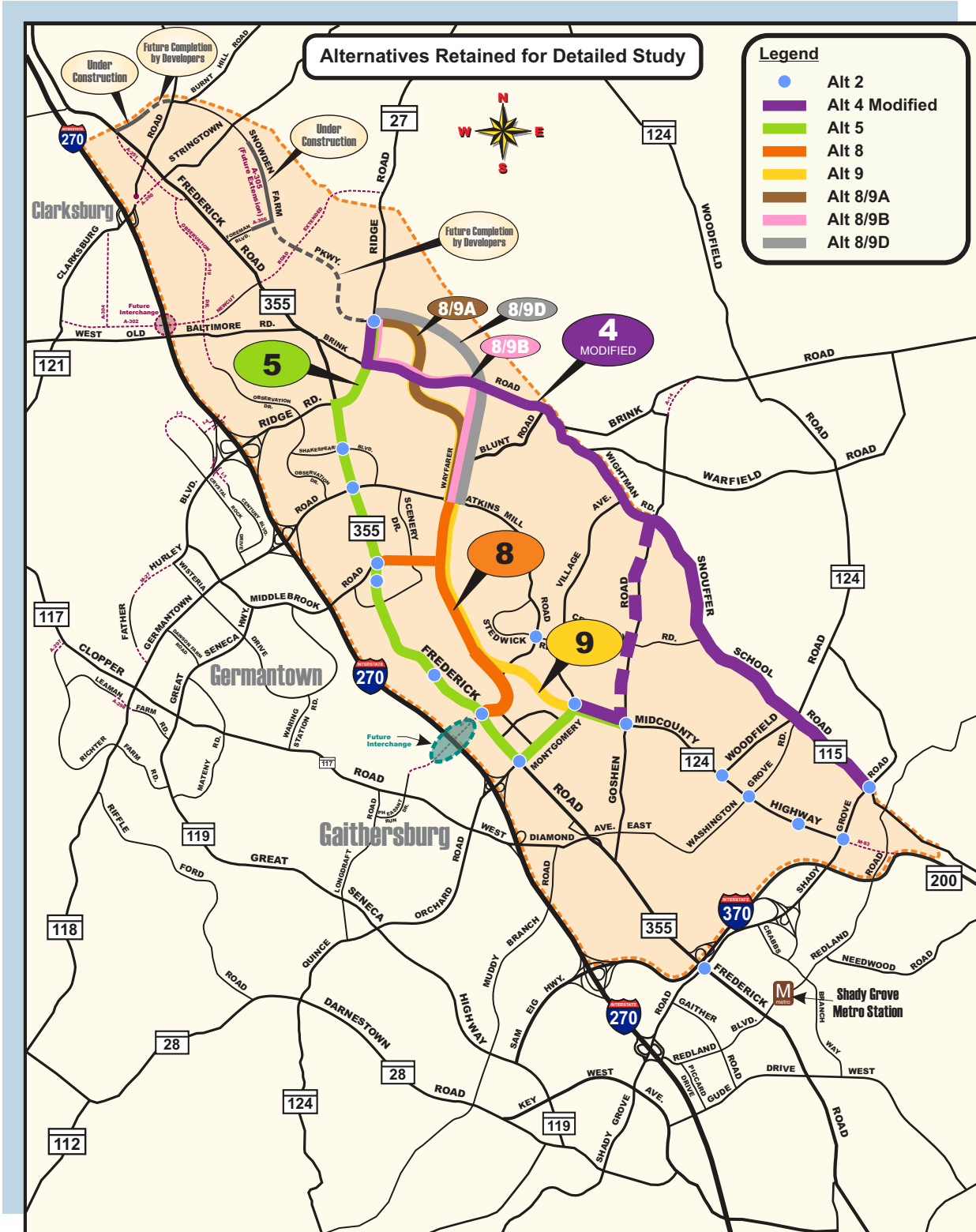


TRANSPORTATION MEASURES OF EFFECTIVENESS





IV. TRANSPORTATION MEASURES OF EFFECTIVENESS

Alternatives were developed to satisfy the following design parameters:

- A 40 MPH design/posted speed;
- A divided highway to enhance safety;
- Accommodation of pedestrians and bicyclists consistent with MCDOT’s *Complete Streets Policy*; and
- To adhere to the approved Montgomery County Congestion Standards.

Similarities in design elements do not imply that each alternative equally satisfies the purpose and need. The ability of each alternative to achieve the project purpose and need (as itemized in **Section II**) is summarized below.

A. Accommodate Planned Land Use and Future Growth

Table IV-1 below conveys the difference between the alternatives in terms of the new highway capacity they would provide. M-NCPPC establishes the level of development that can occur in a planning area based on the amount of proposed transportation capacity. The development scenarios currently shown in area master plans were based on the assumption that the Midcounty Highway Master Plan alignment would be constructed. As shown in **Table IV-1**, Alternative 9 would provide the most highway capacity, accommodating the growth outlined in area master plans. The selection of any other alternative would require an amendment of area master plans to curtail the growth previously planned.

Table IV-1: Lane-Miles of New Highway Capacity Provided by Each Alternative

ALTERNATIVE	1	2	4 MOD	5	8	9
Additional Lane-Miles	0	0	18.8	4.9	17.9	22.3

The M-NCPPC employed the tenets of Smart Growth long before the Smart Growth Initiatives were mandated by state law in 1997. Growth has been planned along the MD 355/I-270 corridor, where the interstate system, the WMATA Metro system, and the MARC train provide transportation infrastructure, and the Corridor Cities Transitway (CCT) is proposed as an extension of the Metro. Montgomery County has also established an Agricultural Reserve to preserve farming as a way of life in its rural areas and has implemented a Transfer of Development Rights (TDR) program that enables land owners in the Agricultural Reserve to be compensated for their development rights by allowing higher densities in designated growth areas. By directing growth to specific areas, and through the implementation of specific policies such as the TDR program, development pressure has been greatly reduced within the Agricultural Reserve.



The MD 355/I-270 corridor already accounts for 60% of the County’s jobs, 73% of its industrial acreage, 81% of its office space, and 56% of its retail sales. Of the remaining developable land throughout Montgomery County, 72% of future residential development and 83% of future employment is planned to occur in the MD 355/I-270 corridor. Although the project study area encompasses only a portion of the total MD 355/I-270 corridor, 43% of the projected residential growth and 50% of the growth in employment between 2010 and 2040 would occur in the planning areas encompassed by the study area (based on M-NCPPC’s April 2010 TPAR Report).

As was discussed in Section 3 of the *Draft EER*, both Montgomery County and the State of Maryland have invested considerable funds to promote bioscience in the MD 355/I-270 corridor. As recently as March 2012, Maryland raised \$84 million through an auction of premium tax credits to insurance companies operating in Maryland. The money will be made available to start-up companies under the authority of “Invest Maryland” – an initiative passed by the General Assembly in 2011. Numerous state and county programs have been implemented to provide tax credits, venture capital, bioscience laboratory space for rent, collaboration with universities performing bioscience research, and assistance to start-up companies. Bioscience has become Montgomery County’s economic niche, and is the growth engine for the County. The State of Maryland is competing with California, North Carolina, Massachusetts, New Jersey, and Pennsylvania as centers of bioscience research and development. Providing the transportation infrastructure to accommodate these companies and their employees is of paramount importance both to Montgomery County and the State of Maryland.

B. Reducing Existing and Future Congestion

The Washington, D.C. metropolitan area has been rated number one in the nation for traffic congestion. Motorists spend close to 72 hours annually stuck in gridlock. Reducing traffic congestion is critical to the area’s economy, environment, and quality of life for its residents. Congestion can increase the cost to transport goods and services, affect customer base and market share, disrupt scheduling, increase employee commuting time, increase labor costs, reduce employee satisfaction, reduce traffic safety, and increase the response time of emergency vehicles. Traffic congestion can also increase our carbon footprint with vehicles idling. A traffic analysis of each alternative, including the No-Build Alternative, was initiated in 2011 and completed in 2012 which analyzed LOS at 65 intersections throughout the study area, as well as eight new intersections which would be created under Alternatives 8 and 9. The traffic analysis used the MWCOG regional travel demand model, Version 2.2, with Round 8.0 land use forecasts to project traffic volumes in 2030, the latest version available at the time of analysis. The traffic volumes were used to compute the LOS using the Critical Lane Volume (CLV) method. In Montgomery County, the M-NCPPC’s Local Area Transportation Review Guidelines are used to establish the intersection congestion standards for each of the policy areas. In the policy areas that fall within the project study area, a CLV of 1,425 vehicles would constitute acceptable



congestion. In the City of Gaithersburg, a slightly less restrictive CLV of 1,450 vehicles would be acceptable. Both numbers correspond to a low LOS D.

The intersections along each build alternative were designed so they would satisfy these congestion standards. In many cases, the intersections were required to have multiple left turn lanes, free right turn lanes, or auxiliary through lanes in order to make them function at the required LOS; as discussed in greater detail in **Section VII** of this report. The traffic analysis for each alternative identifies what the congestion level would be at the remaining intersections throughout the study area, assuming the other programmed projects shown in blue and red on **Figure III-1**, page III-4 are constructed. **Table IV-2** is a summary of the results of the traffic analysis.

Table IV-3 specifically focuses on the major intersections for each alternative, reporting the results separately for AM and PM peak hours.

A review of the data tabulated in **Table IV-2** and **Table IV-3** indicates that Alternatives 1 and 4 Modified are the least effective in addressing intersection congestion and that Alternatives 2, 5, and 9 are the most effective at reducing congestion in the study area.

Table IV-2: Congestion Analysis (2030)

ALTERNATIVE	1	2	4 MOD	5	8	9
Total Number of Intersections Analyzed	64 ¹	64 ¹	64 ¹	63 ²	72 ³	72 ³
Study Area Intersections Meeting the Congestion Standard in both the AM and PM peak hours	46	53	46	54	56	61
Additional Intersections that are Marginally Acceptable	2	3	2	2	2	2
Intersections with Unacceptable Congestion	16	8	16	7	14	9
% of Total Intersections with Acceptable LOS	75	88	75	89	81	88

¹ During the course of the traffic study, the intersection at MD 355/Monument Office Park was closed.

² The improvements proposed under Alternative 5 would close the intersection at MD 355/Lockheed Martin South.

³ Alternatives 8 and 9 and their options would result in eight new intersections.



Table IV-3: Major Intersections Having Acceptable Operations during Peak Hours

MAJOR INTERSECTION	ALTERNATIVE RETAINED FOR DETAILED STUDY											
	1		2		4 MOD		5		8		9	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Frederick Rd at Mont. Village Ave.			✓	✓			✓	✓	✓	✓	✓	
Frederick Rd at Watkins Mill Rd							✓	✓	✓	✓		✓
Frederick Rd at Middlebrook Rd			✓	✓		✓	✓	✓	✓	✓	✓	✓
Frederick Rd at Germantown Rd							✓	✓				✓
Frederick Rd at Ridge Rd	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ridge Rd at Brink Rd	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ridge Rd at Snowden Farm Pkwy.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Muncaster Mill Rd at Shady Grove Rd			✓		✓	✓			✓			✓
Snouffer Sch. Rd-Muncaster Rd at Woodfield Rd	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wightman –Snouffer School Rd at Goshen Rd	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wightman Rd at Mont. Village Ave.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Midcounty Hwy. at Shady Grove Rd												
Midcounty Hwy. at Goshen Rd			✓	✓	✓	✓	✓	✓	✓		✓	✓
Midcounty Hwy. at Mont. Village Ave			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Midcounty Hwy. at Watkins Mill Rd*									✓	✓	✓	✓
Midcounty Hwy. at Middlebrook Rd*									✓	✓	✓	✓
Midcounty Hwy. at Germantown Rd*									✓	✓	✓	✓
Midcounty Hwy. at Brink Rd*									✓	✓	✓	✓
Total Number of Peak Hours of Acceptable Intersection Operation	12		21		19		24		30		30	

* These are proposed new intersections that would occur only with Alternatives 8 and 9.

C. Enhance Network Efficiency and Connections between Economic Centers

An efficient network is one in which the full spectrum of highway classifications is represented; from collector road to minor arterial to major arterial to freeway. When the higher classifications (major arterials and freeways) are part of the network, they will be used by regional traffic, leaving the collector roads and minor arterials to serve local traffic. Aside from I-270, the main roads in the study area have no access control. Consequently, I-270 has become the corridor of



choice for not only interstate traffic, but also for trips of intermediate length, such as between Clarksburg and Gaithersburg.

As reported in the Technical Appendix of the *June 1994 Clarksburg Master Plan*, 42% of the trips originating in Clarksburg are projected to have destinations in Germantown or Gaithersburg, while 40% of the trips with destinations in Clarksburg are projected to originate in Germantown or Gaithersburg. These intermediate-length trips currently have the choice of using either I-270, which frequently has average speeds significantly slower than the posted speed limit during rush hours, or to divert to roads having no access control, which results in a mixing of local and regional traffic. The build alternatives that widen existing roads will reduce congestion, but in doing so, will attract the intermediate length trips that have longer-range destinations. These vehicles will conflict with slower-moving local traffic which make turns to and from the schools, residences, and businesses along the corridor, resulting in a greater potential for crashes. The build alternatives that result in a new highway corridor would be constructed with access controls that substantially reduce the number of entrances and driveways, thereby reducing the potential for crashes among automobiles, bicyclists, and pedestrians

The goal of connecting economic centers can be accomplished by improving the highways that currently connect these centers or by constructing a new highway with partial access control that has quick, convenient connections between the new highway and the economic centers. The build alternatives (8 and 9) that utilize the master plan alignment would have intersections with the same east-west roads – Ridge Road, Germantown Road, Middlebrook Road, Watkins Mill Road, and Montgomery Village Avenue – that have interchanges with I-270. This “ladder” configuration makes it possible to use Alternatives 8 and 9 as a convenient alternative route to and from the businesses in the MD 355/I-270 corridor, encouraging motorists to use Midcounty Highway for a portion of their commuting pattern, or as an alternative to sections of I-270 and MD 355 that are mired in congestion due to traffic demand or a traffic incident.

D. Improve Vehicular Safety

According to the 2008-2010 crash data, obtained from the Maryland State Highway Administration (SHA), nearly all of the existing roadway corridors along the alignments of the build alternatives have crash rates higher than the statewide average. Key factors contributing to the high rate of crashes are the heavy traffic congestion within the corridor, the lack of access controls (i.e., the high number of entrances, driveways, and intersecting roadways along the corridors), inadequate sight distance, and conflicts with truck traffic. Access control offers significant benefits to improving traffic safety and reducing crash rates. For example, the category of *Urban Divided Highways with Four or More Lanes and No Access Control* has a statewide average crash rate of 206.9 crashes per 100-million vehicle miles traveled. The category of *Urban Divided Highways with Four or More Lanes and Partial Access Control* has a



statewide average crash rate of 132.6 crashes per 100-million vehicle miles traveled, which is a crash rate reduction of approximately 36%.

Using the statewide average crash rates compiled by SHA for various highway types, it is possible to estimate future trends in highway crashes along an alternative based on the type of highway proposed for the alternative. For example, Alternative 4 Modified would have a cross section and access control that is typical of the highways that SHA has grouped into the category of *Urban Divided Highways with Four or More Lanes and No Access Control*. Alternative 9 would have a cross section and access control that is typical of the highways that SHA has grouped into the category of *Urban Divided Highways with Four or More Lanes and Partial Access Control*.

Alternative 8 would be a composite of several different highway types; therefore, the projected crash rate for the overall alternative was based on a composite of the corresponding statewide average crash rates. Alternative 5 would include service roads to consolidate the number of driveways, thereby reducing the number of potential conflict points along the alternative. SHA does not compile specific crash statistics for multi-lane highways with service roads. However, the AASHTO Highway Safety Manual has guidance on the reduction in crash rates that could be expected with the addition of service roads. The AASHTO guidance was used to project the crash rate for the portion of Alternative 5 along MD 355.

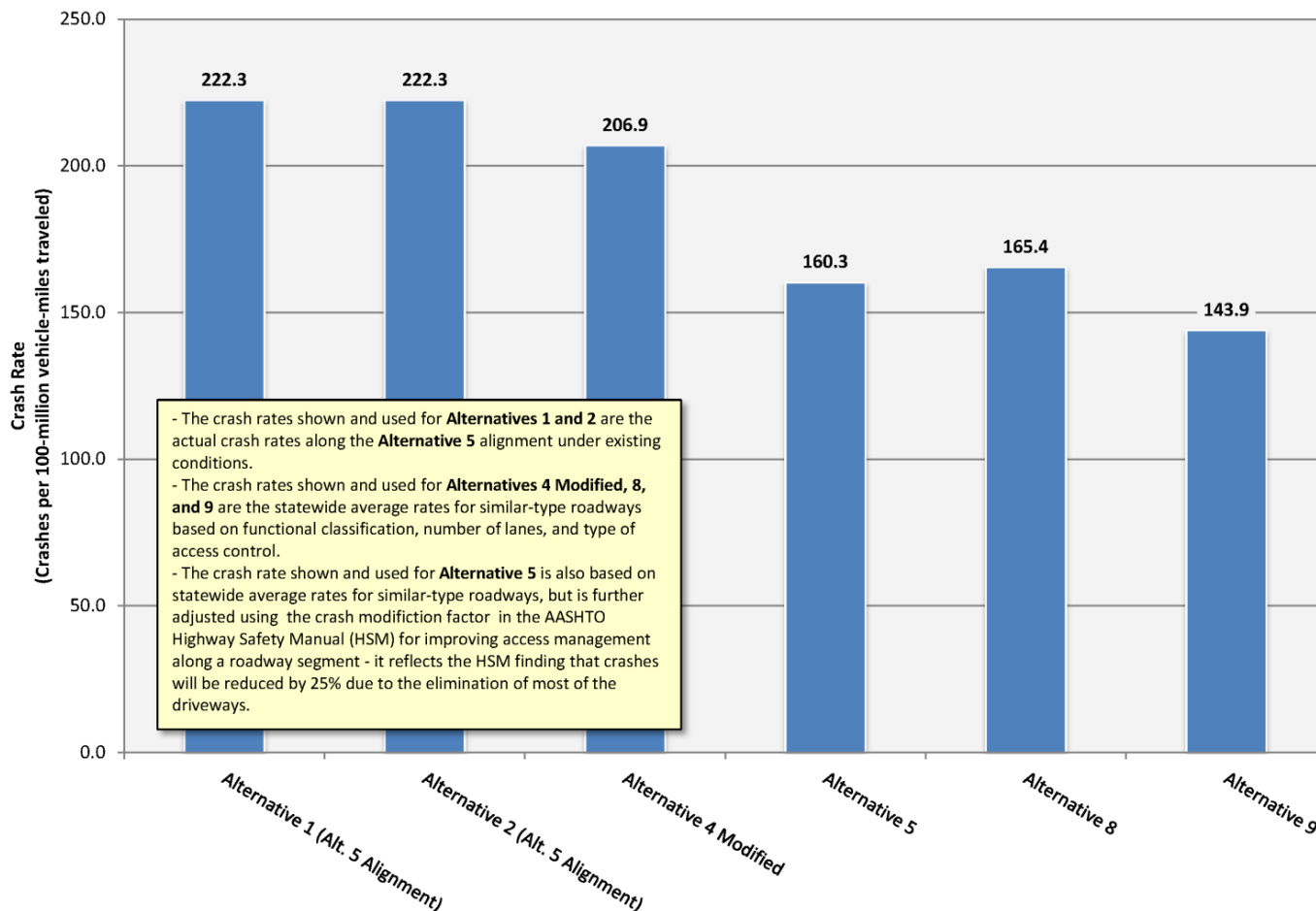
Applying the appropriate SHA statewide average crash rate to each build alternative (or to each segment of a build alternative for those alternatives that have more than one type of access control), **Chart IV-1** shows the relative differences in the crash potential of each alternative. Those alternatives having no access control are projected to have higher crash rates. Those alternatives having partial access control, or service roads that reduce the number of access points, are projected to have lower crash rates.

E. Facilitate and Provide Bicycle and Pedestrian Connections

The safe and efficient accommodation of pedestrians and cyclists is a priority for Montgomery County. Bicycle facilities and sidewalks enrich the livability of a community, provide economic, environmental and health benefits, and serve as critical links in the transportation network by providing pedestrian and bicycle access to neighborhoods, transit, commercial districts, schools, parks and other recreation areas.



Chart IV-1: Projected Crash Rates along the Build Alignments (2030)



The 1994 Household Travel Survey, developed by MWCOG, revealed that there were approximately 10,300 bicycle trips within, to, and from Montgomery County every weekday. A 1995 MWCOG survey at three trails and three Metro stations revealed the average bicycle trip to a Metro station was 2.6 miles. Because 76% of County residents live within a three-mile radius of a Metro station, the March 2005 *Countywide Bikeways Functional Master Plan* recognizes the “tremendous opportunity to increase the number of people who travel to transit by bicycle.” In support of this objective, all Metro stations in the County include bicycle racks and lockers.

Montgomery County is implementing a “bike share” program by constructing 29 bike share stations through the down-county region. The stations will be located near Metro stations and other public areas to enhance transit usage and to provide an alternative means of transportation between transit stops and nearby destinations. Montgomery County Ride-On buses and Metro buses are equipped with mounted bicycle racks. Bicycles are permitted on Metro trains during non-peak hours.



MCDOT designs bicycle facilities for two different types of users: the commuter and the recreationalist. Commuter cyclists tend to be more experienced, travel to work on bicycle at speeds of 20 miles per hour and prefer to travel on the roadway. The recreational user generally travels at lower speeds and prefers not to mix with motor vehicles, favoring off-road facilities such as shared use paths.

Following is a synopsis of the effectiveness of each alternative in facilitating bicycle and pedestrian connections.

- All build alternatives except Alternative 2 would provide a shared use path along the entire length of the corridor. Under Alternative 2, the existing MD 355 corridor typically has a shared use path between Montgomery Village Avenue and Ridge Road. However, missing segments of the path totaling approximately 0.6 mile render the path discontinuous along the total 4.2-mile long corridor.
- Alternative 4 Modified, 8, and 9 would accommodate on-street bicycle travel through the construction of bike lanes or bike-accessible shoulders.
- The bicycle facilities along Alternative 4 Modified and Alternative 5 would be accessible at a large number of locations due to the larger number of intersections along these alternatives. However, Alternatives 5 and 9 would intersect a greater number of existing bicycle paths.
- Alternative 5 does not provide on-street bicycle facilities as they are not recommended in the *Countywide Bikeways Functional Master Plan*.
- Alternatives 4 Modified, 5, 8, and 9 would provide connections to the Seneca Creek Greenway Trail.
- Build alternatives 4 Modified, 8, and 9 are designed with a 40 MPH design posted speed. MD 355 was previously built out to its full six lane section by SHA with a 50 mph design speed and has posted speed of 40-45 mph. Consequently, Alternatives 4 Modified, 8 and 9 are anticipated to have lower travel speeds and offer increased safety for automobiles, bicyclists and pedestrians. Furthermore, the high number of intersecting streets and driveways along Alternatives 2, 4 Modified, and 5 present a greater number of potential conflict points between motorists and bicyclists which is anticipated to result in a corresponding higher crash rate for these alternatives.

F. Enhance Homeland Security

“Homeland Security,” as it relates to transportation, encompasses several factors, including emergency response to hazmat spills, gas leaks, fires, crashes, and reports of crime; and evacuation in the event of a terrorist incident, flood, or hurricane. The Montgomery County Fire and Rescue Service (MCFRS) and the Montgomery County Office of Emergency Management and Homeland Security (OEMHS) manage such services for those who live and work in



Montgomery County. The MCFRS handles over 100,000 emergency calls for service annually. The OEMHS focuses on preparedness, evacuation, and alerts.

The assessment of the “Homeland Security” need consists of emergency response, evacuation, and incident management. It is difficult to calculate response times by emergency vehicles for the following reasons: (1) a fire truck, ambulance, or police car could be called to respond to any location within the service area of the station, and (2) police cars typically respond from mobile units, not from the station. Therefore, MCDOT cannot provide a quantitative analysis. Instead, any differences between the alternatives in terms of their ability to improve emergency response, evacuation, and incident management are noted in the report.

The build alternatives for the study would differ substantially in their ability to accommodate the emergency response to a highway “incident” (i.e., a crash, disabled vehicle, hazardous material spill). Improvements in intersection operation are not an important factor affecting emergency response time since emergency responders have the ability to bypass stopped traffic at intersections. Of greater importance would be the ability to pass motorists en route to an incident. Alternatives 4 Modified, 8, and 9 would provide a shoulder which would allow motorists to pull over to let emergency responders pass. Alternative 2 would offer no improvement in emergency response time.

The previously-discussed ladder configuration of the arterial road network that would be created with Alternatives 8 and 9 would form an expedient emergency detour route around an incident location if traffic had to be detoured. In addition, the ladder rungs would provide convenient connections between I-270, MD 355, and Alternative 8 or 9 if responders needed to access the incident location along an alternative route. As traffic queues form quickly when a travel lane is blocked by a crash, emergency response is improved by having the choice of an alternative route that can avoid the queue. In addition, the partial control of access and the lower number of intersections along Alternatives 8 and 9 would enable high-speed emergency responders to access an incident with a lower potential for conflicts with turning vehicles and cross traffic.

Several fire departments would directly benefit by some of the alternatives. The additional capacity provided by Alternative 4 Modified would be expected to benefit emergency responders from the Gaithersburg-Washington Grove Fire Company 28, which is located at the intersection of Muncaster Mill Road and Shady Grove Road, at the south end of the alternative. Alternatives 8 and 9 could potentially be used by responders from Gaithersburg-Washington Grove Fire Company 8 (located on Russell Avenue at Montgomery Village Avenue) and Germantown Fire Company 29 (located just west of I-270 near MD 118). The minor capacity improvements along Alternative 5 north of Middlebrook Road would provide some benefit to these same two fire companies and the recently-commissioned Montgomery County Fire and Rescue Service – Station 34 (located on MD 355 at Boland Farm Road).

G. Improve the Quality of Life

Quality of Life is affected by many variables, including, but not limited to: employment, educational opportunities, affordable housing, and time with family, parks and recreation, and cultural venues. For purposes of comparing the alternatives, “travel time” was selected as an appropriate measure of Quality of Life because the time spent in congestion detracts from many of the pursuits that enrich our lives. As previously described, the Washington, D.C. metropolitan area has been rated number one in the nation for traffic congestion.

Travel time along the alternatives would vary considerably due to differences in the number of intersections, the distance between intersections, and intersection delay. Travel time, a quantifiable transportation metric, includes both the drive time and the time spent in a queue at intersections. As travel times increase along a route due to congestion, drivers will modify their travel patterns to seek a less-congested, faster route. Therefore, an alternative with a shorter travel time would typically be expected to divert traffic from more-congested routes. As more vehicles are diverted from the congested route, congestion along that route will be reduced.

Travel times between common starting and ending points were computed for each of the build alternatives using Synchro software. Synchro analyzes intersection operation and determines the amount of delay for each movement and the queue lengths on each leg of the intersection, and factors this information into the projection of travel time. The travel time evaluation was based on a starting point located at the intersection of Ridge Road and future Snowden Farm Parkway, and ending at the intersection of Goshen Road and Midcounty Highway. The results were provided in the *Draft EER*.

Synchro has limited capability to analyze traffic operations between intersections; its focus is on traffic operations at the actual intersections. Knowing the limitations of the Synchro platform, it was suspected that the Synchro model was misrepresenting the effectiveness of the traffic operations at and between two intersections in particular along Alternative 4 Modified, Alternative 8 with Northern Terminus Option B, and Alternative 9 with Northern Terminus Option B: the Ridge Road/Snowden Farm Parkway intersection and the Ridge Road/Brink Road intersection. Following circulation of the *Draft EER*, MCDOT tested the traffic operations at these two locations for the three alternatives using SimTraffic software. SimTraffic is the micro-simulation software companion to Synchro. As a micro-simulation, SimTraffic is capable of measuring the effects of all vehicle interactions along the corridor, including weaving behavior between intersections and the effects of gradually-increasing traffic volumes on a channelized right-turn lane’s performance.

For Alternative 4 Modified, the 2030 travel time analyses generated by Synchro were compared to the travel time analyses generated by SimTraffic. The following is a summary comparing the results.



- Traveling southbound during the AM peak hour, the SimTraffic travel time is 8.5 minutes longer than the Synchro travel time (Synchro = 13.8 minutes; SimTraffic = 22.3 minutes), a 62% increase. All of the additional travel time would occur between Snowden Farm Parkway and the completion of the left-turn movement onto eastbound Brink Road. The SimTraffic results for Northern Terminus Option B for Alternatives 8 and 9 showed similar increases vs. Synchro.
- Traveling northbound during the PM peak hour, the SimTraffic travel time is 10.0 minutes longer than the Synchro travel time (Synchro = 15.5 minutes; SimTraffic = 25.5 minutes), a 65% increase. Most of the additional travel time would occur at the northern end of the alternative. The SimTraffic results for Northern Terminus Option B for Alternatives 8 and 9 showed similar increases vs. Synchro.

The SimTraffic analysis confirmed that Synchro was underestimating the effects of weaving and high-volume right-turn movements on the travel time along Alternative 4 Modified at the north end of the alternative, as well as along Northern Terminus Option B for Alternatives 8 and 9.

Table IV-4 provides a comparison of travel times along the various alternatives from the intersection of Ridge Road and Snowden Farm Parkway to the intersection of Midcounty Highway and Goshen Road, including the results of the supplemental SimTraffic analysis described previously.

Table IV-4 illustrates that Alternative 9A will have the greatest travel time savings since it will reduce travel times in both the morning and evening peak periods by 14 minutes and 15 minutes respectively. This represents a travel time savings of over 50% in both the morning and evening rush hour periods. Alternatives 2, 4 Modified and 8B would have substantially less travel time savings than the other build alternatives.

Table IV-4 also shows that the alternatives that require traffic to weave from right to left across northbound and southbound Ridge Road between Snowden Farm Parkway and Brink Road (i.e., Alternative 4 Modified, Alternative 8 with Northern Terminus Option B, and Alternative 9 with Northern Terminus Option B) would have significantly longer travel times than the other alternatives or northern terminus options. For example, the travel times for Alternatives 8 and 9 with Northern Terminus Option B would be noticeably longer than the travel times for those alternatives with Northern Terminus Options A or D.

The longest travel times for Alternative 9, corresponding to Northern Terminus Option B, would still be shorter than the best travel times for all of the other alternatives and northern terminus options. All of the Build alternatives would provide a reduction in peak hour, peak direction travel times when compared to Alternative 1, which is the No-Build Alternative. However, only Alternative 9 with Northern Terminus Options A or D would provide a travel time reduction in excess of 50% compared to the No-Build Alternative.



Table IV-4: Comparison of Travel Times and Time Savings vs. Alt. 1 (No-Build)

TRAVEL TIME		ALTERNATIVES									
		1*	2*	4 MOD	5	8A	8B	8D	9A	9B	9D
Peak Hour Travel Time (mins) between Ridge Rd/Snowden Farm Pkwy Intersection and Goshen Rd/Midcounty Hwy Intersection	AM	26	26	22	19	17	22	17	12	16	12
			0%	-15%	-27%	-35%	-15%	-35%	-54%	-38%	-54%
	PM	26	24	25	17	18	23	18	11	14	11
			-8%	-4%	-35%	-31%	-12%	-31%	-58%	-46%	-58%

*Travel times are along the MD 124/MD 355/MD 27 corridor.