



HILLANDALE TRANSPORTATION PLANNING ANALYSIS

MONTGOMERY COUNTY, MD
MONTGOMERY COUNTY DEPARTMENT OF TRANSPORTATION



November 13, 2020



Hillandale Transportation Planning Analysis

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1 Introduction

The Montgomery County Department of Transportation (MCDOT) directed Gannett Fleming, Inc. to conduct engineering and transportation planning analysis for the Hillandale area of White Oak to evaluate potential intersection treatments to achieve Subdivision Staging Policy (SSP) adequacy, which would reduce average delay to less than 80 seconds per vehicle, at the intersections of MD 650 and Powder Mill Road, MD 650 and Elton Road, and Powder Mill Road and Riggs Road, in order to improve traffic operations at these locations while considering impacts to residents and businesses in the area. In addition, other intersections and roadways in the Hillandale neighborhood were evaluated to determine if improvements were needed to improve traffic operations and alleviate cut-through traffic.

This document describes the previous studies performed; the information gathered, and analysis used to identify transportation needs; describes the proposed improvements; and estimates associated costs.

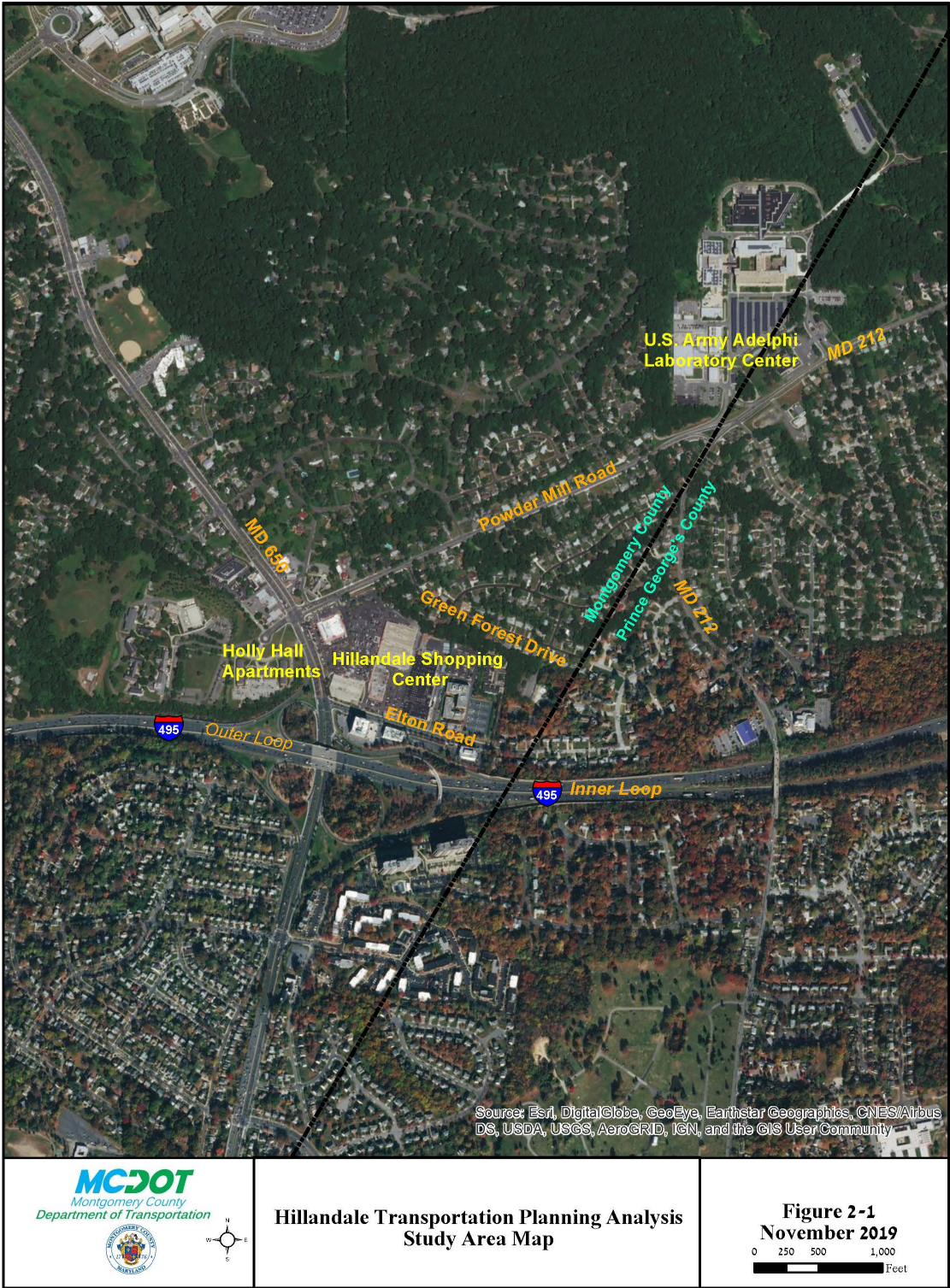


2 Study Area

The Hillandale area is located in the southeastern area of Montgomery County, Maryland; and is bounded by Powder Mill Road on the north, Riggs Road (MD 212) on the east, I-495 on the south, and New Hampshire Avenue (MD 650) on the west. The intersection of Powder Mill Road and MD 212 is located on the border of Montgomery County and Prince George's County, and a portion of Elton Road falls within Prince George's County. The area includes a residential neighborhood; a shopping center along MD 650; a commercial/business corridor along Elton Road that includes office buildings, a hotel, a Coca-Cola distribution facility; and the Holly Hall apartments and Tommy Douglas Conference Center along the west side of Powder Mill Road. The U.S. Army Adelphi Laboratory Center, located at 2800 Powder Mill Road, is adjacent to Hillandale. See **Figure 2-1** for a Study Area Map of Hillandale.



Figure 2-1: Hillandale Study Area Map



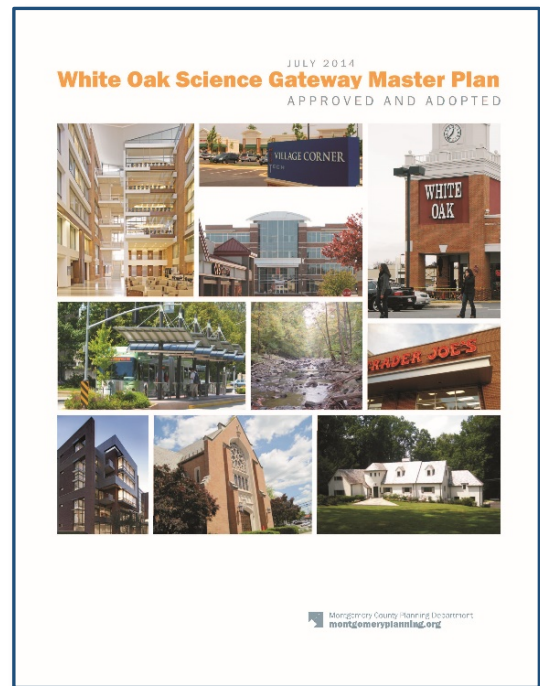


3 Previous Studies

3.1 White Oak Science Gateway Master Plan (July 2014)

The *White Oak Science Gateway (WOSG) Master Plan* envisioned the major centers of White Oak evolving from conventional, auto-dependent suburban shopping centers, business parks, and light industrial areas into vibrant, mixed-use, transit-served nodes.

In the Hillandale area, the planned introduction of bus rapid transit (BRT) along MD 650 should promote redevelopment that consolidates existing commercial frontages into an organized village center. If redeveloped, larger properties such the Hillandale Shopping Center and the Tommy Douglas Conference Center should include a mix of uses, public open spaces, and enhanced pedestrian connections. The redevelopment of the Hillandale Shopping Center should continue to provide a significant amount of retail, restaurant, and neighborhood services at street level, and additional commercial development is strongly encouraged.



3.1.1 White Oak Science Gateway Master Plan Transportation Recommendations

The *WOSG Master Plan* recommended the Local Area Transportation Review (LATR) standard be raised from 1475 critical lane volume (CLV) to 1600 CLV (1.00 volume/capacity) within the Plan area. The rationale for a 1600 CLV (1.00 volume/capacity) standard stems from the Plan-recommended BRT network that would serve the area and offer a viable alternative to automobile travel. This is consistent with the County's policy of accepting greater levels of roadway congestion in areas where high quality transit options are available.

This Plan recommended a 25 percent Non-Auto Driver Mode Share (NADMS) goal for all new development, residential and commercial, in the White Oak Center and Hillandale Center of the Plan area based on the area's future transit service (assuming BRT) and connectivity opportunities.

The *WOSG Master Plan* also recommended that the intersection of MD 650 and Powder Mill Road add an eastbound left turn lane from Holly Hall; a westbound right turn lane on Powder Mill Road; and a southbound left turn lane on MD 650.

3.2 White Oak Local Area Transportation Review Intersection Improvement Cost Evaluation (September 2016)

Implementation of the White Oak Master Plan is expected to cause intersections within and surrounding the plan boundaries to exceed the County's Local Area Transportation Review (LATR) Policy Area



standards under future conditions. Following approval of the *WOSG Master Plan*, this analysis identified potential LATR-scale costs for inclusion in a proposed per-trip fee that may be paid by new development in lieu of performing a complete LATR analysis and independently mitigating individual development's traffic impacts.

3.3 White Oak Science Gateway LATR/LATIP Cost Estimating Analysis (December 2016, Updated December 2017 and May 2019)

Following approval of the *WOSG Master Plan*, the County Council directed that MCDOT estimate costs for recommended transportation treatments across the entire White Oak policy area and develop a per-trip fee for proposed developments in the master plan area, referred to as the Local Area Transportation Improvement Program (LATIP) fee. The LATIP fee would be applied for every new vehicle-trip a development generates. The applicant would pay the associated fee, satisfying the LATIP requirements. This document was originally completed in December 2016, and then updated in 2017 and again in May 2019.

3.3.1 White Oak Science Gateway LATR/LATIP Cost Estimating Analysis Transportation Recommendations

The *White Oak Science Gateway LATR/LATIP Cost Estimating Analysis* identified treatments at 13 intersections in the policy area that were included in the LATIP fee. The only improvements that fall within the Hillandale area are the intersection of MD 650 at Powder Mill Road and widening of Elton Road.

The proposed widening of a short 300-foot long segment of the residential portion of Elton Road to provide for one travel lane and one parking lane in each direction was noted as unlikely to proceed unless there was strong community demand. Minor pedestrian treatments along the business section of Elton Road were also included in the *LATR/LATIP Analysis* but also were noted as unlikely to proceed without strong community demand.

Most importantly, differing findings were noted at the intersection of MD 650 at Powder Mill Road between the *LATR/LATIP Analysis*, the *WOSG Master Plan*, and proposed Maryland Department of Transportation State Highway Administration (MDOT SHA) improvements. Therefore, no specific recommendations were made and \$5,000,000 was included as a placeholder to cover the cost of proposed improvements. In the May 2019 Update, it was recognized that treatments for MD 650 at Powder Mill Road may also necessitate treatments at MD 650 and Elton Road.



White Oak Science Gateway LATR / LATIP Cost Estimating Analysis White Paper

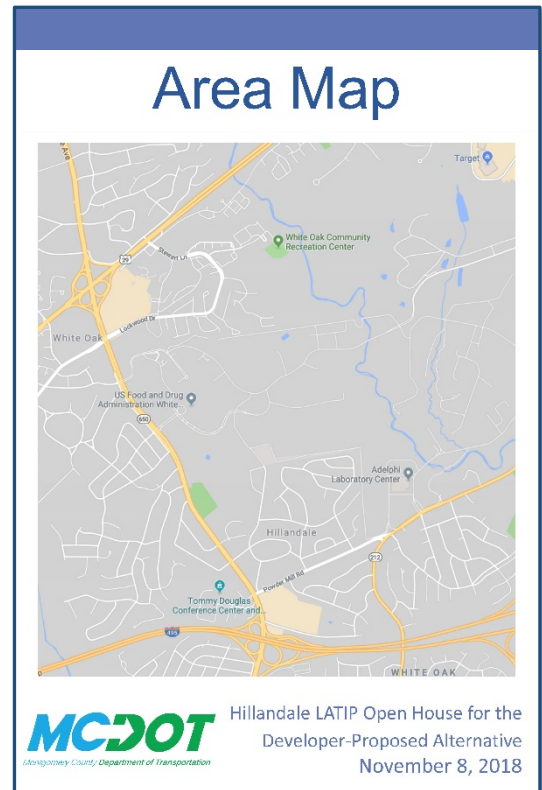
December 2016
Updated May 2019



3.4 White Oak LATIP Public Hearing Technical Report (November 2018)

The *White Oak LATIP Public Hearing Technical Report* was developed to support a Public Hearing held on November 15, 2018 to present developer proposed alternatives at the intersection of MD 650 and Powder Mill Road, the intersection of MD 650 and Elton Road, and additional traffic calming measures in the Hillandale neighborhood. This is to support the development of the Hillandale Gateway project along the west side of MD 650 at the Holly Hall Apartments and a development along Elton Road. As part of the County's Development Review process, the developer prepared a proposal to replace the \$5 million placeholder in the LATIP with a newly analyzed set of proposed treatments.

The developer contracted with Lenhart Traffic Consulting, Inc. to perform a traffic analysis of the Hillandale area. This analysis focused on intersections of MD 650 and Powder Mill Road and MD 650 and Elton Road. The analysis was reviewed by both MCDOT as well as MDOT SHA, who found that the evaluation and its findings were technically sound and that the proposed treatments met the technical criteria established for the area by the SSP.



3.4.1 Revised White Oak LATIP Supplemental Transportation Analysis (November 2018)

The traffic analysis prepared by Lenhart Traffic Consulting identified four distinct components, including two treatments at the intersection of MD 650 and Powder Mill Road; a slip ramp to the I-495 outer loop and queue jump at Elton Road; and traffic calming along Elton Road.

The *Revised White Oak LATIP Supplemental Transportation Analysis* notes that the specific anomalies identified in the original December *LATR/LATIP Analysis* included the omission of a substantial volume of u-turning traffic along northbound MD 650 at Powder Mill Road, as well as the incorrect coding of volumes within the traffic model. These inconsistencies resulted in a recommended LATIP improvement that, when updated with correct traffic volumes, did not improve average delay to less than 80 seconds at the intersection.

Consequently, Lenhart Traffic Consulting conducted additional traffic analysis in order to determine improvements that would reduce delay at the intersection of MD 650 and Powder Mill Road to less than the 80 second per vehicle threshold, meeting the LATIP requirement. The results of this analysis led to the development of the alternatives presented at the November 2018 Public Hearing.



4 Purpose of the Current Study

As part of the *White Oak Local Science Gateway LATR/LATIP Cost Estimating Analysis*, MCDOT evaluated the White Oak policy area and identified intersection needs. However, in the Hillandale area, near MD 650 and Powder Mill Road, findings differed between the *LATR/LATIP Analysis*, the *White Oak Science Gateway Master Plan*, and the *Lenhart Traffic Analysis*.

As part of this current study, the traffic analyses performed in the previous studies described in **Chapter 3** were reviewed, additional traffic data was gathered to verify and supplement the project team's understanding of area travel patterns, and a new traffic analysis was performed and verified with field observations.

Based on the results of the updated traffic analysis, the project team determined proposed improvements at the project area intersections to reduce delay to less than 80 seconds per vehicle, which would achieve SSP adequacy consistent with the LATR/LATIP guidelines.

Additionally, residents have expressed concern regarding cut-through traffic in the residential segment of the Hillandale neighborhood. In the Prince George's County portion of the neighborhood, traffic calming measures have already been installed including speed humps along Elton Road and Wooded Way. Based on field observation and new traffic data and analysis described in **Chapter 5**, additional measures have been proposed to deter cut-through traffic. These measures, in addition to improvements at intersections to achieve SSP adequacy, should reduce the impetus for traffic to divert through the neighborhood.

5 Traffic Analysis

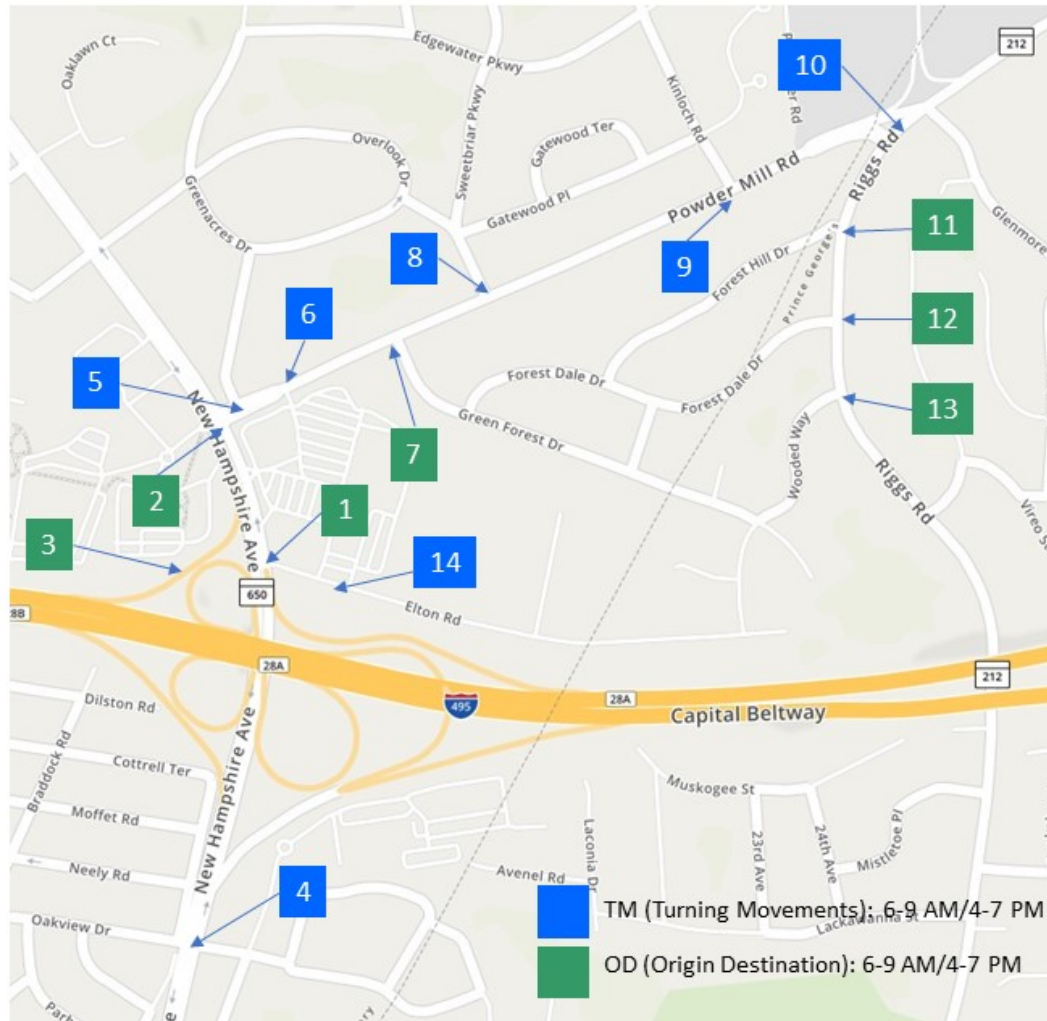
In order to adequately develop concepts for and analyze the locations identified above, intersection weekday peak hour turning movement counts and weekday peak hour origin-destination (O/D) studies were obtained to supplement the available traffic data, including counts from the previous studies and the MDOT SHA I-TMS website. The counts provided the study team with current traffic volumes using the study's intersections and roadways, and the O/D data indicated how much traffic cuts through the Hillandale neighborhood and may divert to other routes with potential improvement scenarios. This information was used to inform the analysis models on the volumes each intersection would need to accommodate for the scenarios analyzed. Turning movement counts were performed at seven locations and O/D studies were performed at another seven locations as displayed in **Figure 5-1**.

5.1 Traffic Operations Analysis

Analysis was performed at the project area intersections using Synchro software to determine levels of service (LOS) and average vehicle delay based on Highway Capacity Manual (HCM) methodologies. As noted elsewhere in this report, the potential improvements analyzed for this report were developed with the goal of reducing signalized intersection delays to less than 80 seconds per vehicle. The Synchro software determines these measures by modeling anticipated traffic operations based on inputs such as traffic volumes, number and type (through, turning, U-turn) of lanes, traffic signal timing, and travel speeds.



Figure 5-1: Data Collection Locations



1. OD MD 650 and Elton Road (WBR)
2. OD MD 650 and Powder Mill Road (WBL, NBU)
3. OD MD 650 and ramp onto Outer Loop (SBR)
4. TM MD 650 Oakview Drive
5. TM Powder Mill Road and Greenacres Drive
6. TM Powder Mill Road and Hillandale Shopping Center Driveway (any entering/exiting shopping center)
7. OD Powder Mill Road and Green Forest Drive (any entering/exiting Green Forest)
8. TM Powder Mill Road and Sweetbriar Parkway
9. TM Powder Mill Road and Kinloch Road
10. TM Powder Mill Road and Riggs Road
11. OD Riggs Road and Forest Hill Drive (any entering/exiting Forest Hill)
12. OD Riggs Road and Forestdale Drive (any entering/exiting Forestdale)
13. OD Riggs Road and Wooded Way (any entering/exiting Wooded Way)
14. TM Elton Road and Hillandale Shopping Center West Driveway (all movements)



Year 2019 and 2040 traffic volumes were developed for the project area intersections combining updated traffic counts (including intersection counts on MD 650 performed by MDOT SHA, forecasted increases in travel demand from the White Oak area development (for 2040 only), observed O/D patterns through the Hillandale residential neighborhood, and assumptions for diverting traffic to the proposed thru movement to the westbound I-495 ramp at Elton Road. The growth in traffic forecasted to 2040 for the White Oak area was obtained from several related sources, including:

1. *Revised White Oak LATIP Supplemental Transportation Analysis* (November 2018) prepared by Lenhart Traffic Consulting, Inc.
2. *White Oak Science Gateway LATR/LATIP Cost Estimating Analysis White Paper* (December 2017) prepared by MCDOT
3. *White Oak Local Area Transportation Review Intersection Improvement Cost Evaluation* (September 2016) prepared by Sabra, Wang & Associates, Inc.

The *White Oak LATIP Supplemental Analysis – Cut-through Traffic* (November 2018) prepared by Lenhart Traffic Consulting, Inc., was also referenced by the study team for information pertaining to traffic cutting through the Hillandale community streets. The diagrams in **Appendix A-3** demonstrate the step by step approach of volume development, including:

1. Comparing recent intersection counts to develop existing 2019 volumes (**Appendix A-3, Figures 1 to 3**).
2. Determining background growth in volumes based on the previous forecasts done in the other area studies that include the White Oak Science Gateway development (**Appendix A-3, Figures 4 to 6**). This current analysis considers Non-Auto Drive Mode Share (NADMS) goals to the extent that this measure was identified in the previous studies used for forecasting area growth. As noted on Page 7 of the *White Oak Science Gateway LATR/LATIP Cost Estimating Analysis White Paper*, “The master plan sets the Non-Auto Driver Mode Share (NADMS) at between 25% and 30% for all new development. Our analysis did not explicitly factor in this NADMS value as an input, though the analysis does generate an NADMS as an output. The model estimated that based on the inputted infrastructure and development, an NADMS of 32.7% would be achieved.”
3. Proposed development traffic from the Holly Hall property (**Appendix A-3, Figures 7 to 8**). Combining Items 1 through 3 provided forecasted 2040 No-Build volumes (**Appendix A-3, Figure 9**).
4. Estimated diversions to a proposed slip ramp to the I-495 Outer Loop from Elton Road and potential restrictions to westbound traffic on Elton Road from the residential neighborhood (**Appendix A-3 Figures 10 to 14**).
5. Estimated diversion of Hillandale neighborhood traffic from the intersection and O/D counts (**Appendix A-3 Figure 15**).



Combining Items 1 through 5 provided forecasted 2040 volumes for the improvement options (**Appendix A-3 Figures 16 to 17**).

5.2 Traffic Results

Synchro files developed for MCDOT as part of the *White Oak Science Gateway LATR/LATIP Cost Estimating Analysis* were updated with the 2019 and 2040 volumes included in **Section 5.1** to determine baseline traffic operations at the project area intersections without improvements.

The area intersections were analyzed under existing conditions, 2040 No-Build, and six primary 2040 scenarios to assist with the development of improvement options, as follows:

1. Existing Traffic
2. **No-Build** - 2040 Traffic with Existing Roadway System
3. **Alternative 1** - 2040 Traffic / Existing Roadway System / Elton Road Slip Ramp
4. **Alternative 2** - 2040 Traffic / Intersection Improvements at MD 650 at Powder Mill Road / Elton Road Slip Ramp
5. **Alternative 3** - 2040 Traffic / Existing Roadway System / Elton Road Slip Ramp / Improvements to Eastbound Powder Mill Road at MD 650
6. **Alternative 4** - 2040 Traffic / Intersection Improvements at MD 650 at Powder Mill Road / Elton Road Slip Ramp / Improvements to Eastbound Powder Mill Road at MD 650
7. **Alternative 5** – 2040 Traffic / Existing Roadway System / No Elton Road Slip Ramp / Improvements to Eastbound Powder Mill Road at MD 650
8. **Alternative 6** - 2040 Traffic / Intersection Improvements at MD 650 at Powder Mill Road / No Elton Road Slip Ramp / Improvements to Eastbound Powder Mill Road at MD 650

The results are summarized in the following sections.

5.2.1 MD 650 and Powder Mill Road

The intersection of MD 650 and Powder Mill Road operates at a LOS D(D) in 2019 and a LOS F(F) in 2040 without any mitigation for the AM(PM) peak hours. With the improvement as described in **Chapter 6**, which equates to Alternatives 2, 4, and 6; the 2040 peak hour LOS improves to E(E) with average delays below 80 seconds per vehicle consistent with the LATR/LATIP guidelines.

5.2.2 MD 650 and Elton Road

The intersection of MD 650 and Elton Road operates at LOS B or better for all scenarios, including those with and without the proposed slip ramp extension from westbound Elton Road to the 1-495 Outer Loop.



5.2.3 Powder Mill Road and MD 212

The intersection of Powder Mill Road and MD 212 is shown to operate at an overall LOS D or better in all scenarios. However, with further review it was found that there are other operational issues at the intersection not captured in that model result:

- Multiple individual movements at the intersection show LOS E or F, particularly in the evening peak
- The PM peak hour queue results in the Synchro model show relatively significant queues for the three approaches, including approximately 1,000 feet for westbound Powder Mill Road and almost 700 feet for eastbound MD 212
- A review of Google and RITIS traffic maps indicate queuing is present in the PM peak along eastbound MD 212 beginning at the signalized intersection of MD 212 and Floral Drive in Prince George's County, through the intersection of Powder Mill Road and MD 212, and down toward the bridge over I-495. This was confirmed with field observations performed in September 2019. This likely encourages traffic to cut-through the Hillandale neighborhood to avoid this queue

As the intersections of MD 212 with Powder Mill Road and Floral Drive are partially or totally outside of the county, improvement scenarios would need to be investigated in conjunction with Prince George's County and MDOT SHA staff, which is beyond the scope of the specific analyses for this report. Improvement options for the intersection of Powder Mill Road and MD 212 are discussed in the next section, but with the understanding that improvements beyond the immediate intersection area would also be needed to take advantage of the additional capacity.

6 Proposed Roadway Improvements

Based on the traffic analysis performed in **Chapter 5**, proposed intersection concepts were developed at the following locations to help achieve SSP adequacy:

- MD 650 and Powder Mill Road
- MD 650 and Elton Road
- Riggs Road and Powder Mill Road

Where these improvements would include roadway widening, the limit of disturbance (LOD) was offset ten feet beyond the back of curb or sidewalk to establish the temporary construction area and potential right-of-way needs.

In addition, traffic calming options were identified within the Hillandale neighborhood that may reduce neighborhood cut-through traffic. The proposed improvements are described below.

6.1 MD 650 and Powder Mill Road

MD 650 currently includes three thru lanes and one left turn lane along both northbound and southbound MD 650 at the intersection of MD 650 and Powder Mill Road. Eastbound Powder Mill Road includes one left turn lane, one thru lane, and one right turn lane approaching the intersection; and two thru lanes leaving the intersection. Westbound Powder Mill Road includes two left turn lanes, a shared left-thru lane,

and a right turn lane approaching the intersection; and one thru lane leaving the intersection. See **Figure 6-1** for a photo of the existing intersection.

Figure 6-1: Existing Intersection of MD 650 and Powder Mill Road from the South



The proposed improvements would include an extension of the existing left turn lane along northbound MD 650 from approximately 275 feet to 400 feet to provide additional storage for cars both turning left onto Powder Mill Road west and making the U-turn onto southbound MD 650. This additional storage would be created by shortening the existing left turn lane along southbound MD 650 to Elton Lane, which has excess capacity. The left turn queues are projected to be adequately contained within the shorter southbound turn lane.

An approximately 200-foot long dedicated right turn lane could also be included along northbound MD 650 to eastbound Powder Mill Road. This lane would require roadway widening that would potentially impact approximately 21 parking spaces in the Hillandale Shopping Center. The Subdivision Staging Policy goal is met without the provision of this lane if adjustments are made to the signal timing; however, providing the lane could yield significant additional operational benefits.

Along eastbound Powder Mill Road approaching the intersection, an additional lane would be added to accommodate one left turn lane, one left-thru lane, one right-thru lane, and one right turn lane. It should be noted that the eastbound roadway is planned to be widened to include four eastbound lanes as part of the proposed adjacent development project. This cost has been included in the cost estimate.

The right turn lane along westbound Powder Mill Road is proposed to be extended from the current 90 feet long to 300 feet long. See **Figure 6-2** for a map of the proposed improvements.



These improvements would meet SSP adequacy by reducing the performance threshold to approximately 76 seconds per vehicle delay for the AM peak and 63 seconds per vehicle delay for the PM peak with or without the construction of the slip ramp at Elton Road, which is described in **Section 6.2**.



LEGEND

- PROPOSED FULL DEPTH PAVEMENT
- PROPOSED RESURFACING
- PROPOSED SIDEWALK
- LOD LIMIT OF DISTURBANCE
- EXISTING RIGHT-OF-WAY
- PROPOSED
- EXISTING

DRAFT

HILLANDALE TRANSPORTATION PLANNING ANALYSIS

MD 650 AND POWDER MILL ROAD INTERSECTION IMPROVEMENTS



SCALE:
1" = 60'

NOVEMBER 2019

FIGURE 6-2



6.2 MD 650 and Elton Road

MD 650 currently includes three thru lanes and one right turn lane along northbound MD 650, and three thru lanes and one left turn lane along southbound MD 650 at the intersection of MD 650 and Elton Road. Elton Road currently includes one left turn lane and one shared left and right turning lane in the westbound direction approaching the intersection and one receiving lane in the eastbound direction. See **Figure 6-3** for a photo of the existing intersection.

Figure 6-3: Existing Intersection of MD 650 and Elton Road from the East



This proposed improvement would include a new slip ramp from Elton Road that would provide access directly to the outer loop of I-495. This would relieve traffic that today generally travels through the Powder Mill Road intersection to travel between Elton Road and I-495. In order to accommodate this ramp, the lane configuration along westbound Elton Road would be modified to include one left turn lane and one left-thru-right turn lane. There is adequate pavement to accommodate this restriping. All of the analyzed options, including with and without the slip ramp, would maintain an average intersection delay of below 12.5 seconds per vehicle at this location. See **Figure 6-4** for a map of the proposed improvements.

Table 6-1 details the forecasted 2040 intersection delays and queues in the peak travel hours for the four approaches of the MD 650/Powder Mill Road intersection with and without the construction of the slip ramp from Elton Road and with and without the northbound right turn lane to Powder Mill Road. Key takeaways are:

- While the construction of the slip ramp would reduce peak hour queues for the northbound U-turn to southbound MD 650, as well as reduce the volume along westbound Powder Mill Road that uses the intersection by allowing shopping center traffic to more readily use Elton Road, the overall intersection delay and total queues are not significantly changed.



- The Powder Mill Road intersection will operate below the SSP adequacy threshold (80 seconds of delay per vehicle) with geometric improvements to the eastbound and westbound approaches and the addition of a northbound right turn lane or signal timing adjustments to pedestrian phases as discussed in Section 6.1. It should be noted that the evening northbound queues are projected to be several hundred feet shorter with the added right turn lane versus replacement of that lane addition with signal timing adjustments, and the evening average delay is approximately 16 seconds shorter (79 seconds to 63 seconds per vehicle).
- Northbound MD 650 queues are projected to reach the vicinity of the I-495 interchange with any of the improvement options (the MD 650 underpass of I-495 is approximately 1,000 feet south of the interchange).
- The intersection improvement needs for the MD 212/Powder Mill Road intersection discussed in Section 6.3 do not have a significant direct impact to the operations of the two intersections on MD 650 beyond encouraging use of Powder Mill Road to reach MD 650 versus using local neighborhood streets.

Table 6-1: Projected MD 650 at Powder Mill Road (PMR) Intersection Improvement Operational Measures for the Year 2040

Improvement Scenario	Direction	AM Peak		PM Peak	
		Average Vehicle Delay (Seconds)	95 th Percentile Queue (Feet)	Average Vehicle Delay (Seconds)	95 th Percentile Queue (Feet)
Geometric Improvement at MD 650/ PMR with Signal Timing Adjustments	Total	77.5		79.8	
	NB	81.1	1,365	80.7	1,490
	SB	78.0	1,290	72.4	1,510
	EB	88.3	115	82.3	125
	WB	66.5	640	79.6	335
Geometric Improvement at MD 650/ PMR with NB Right Turn Lane	Total	77.0		62.3	
	NB	81.1	1,235	80.7	1,230
	SB	66.5	1,350	72.4	1,510
	EB	69.2	115	39.1	125
	WB	88.3	585	79.6	335
Geometric Improvement at MD 650/ PMR with Signal Timing Adjustments and Elton Slip Ramp	Total	75.5		79.1	
	NB	81.1	1,235	80.7	1,450
	SB	70.7	1,350	72.1	1,510
	EB	86.2	115	70.5	125
	WB	66.5	500	89.0	355
Geometric Improvement at MD 650/ PMR with NB Right Turn Lane and Elton Slip Ramp	Total	75.7		63.2	
	NB	81.1	1,235	80.7	1,220
	SB	62.8	1,350	72.1	1,510
	EB	67.0	115	34.5	125
	WB	88.3	500	85.0	355



6.2.1 Southbound MD 650 Bus Stop Reconstruction and Queue Jump Lane

Also included at this location would be the reconstruction of the existing bus stop just to the north of the existing stop, and the addition of a queue jump lane along southbound MD 650. A queue jump is a short section of widened roadway that would allow buses to bypass congestion or delays at intersections. In this location, it would be used in conjunction with Transit Signal Priority (TSP) to provide a dedicated signal that would allow the bus to enter the intersection and “jump” ahead of the other vehicles stopped at the signal. This improvement can be implemented independently of the slip ramp to I-495 and is also shown in **Figure 6-4**.





6.3 Powder Mill Road and MD 212

The existing intersection of Powder Mill Road and MD 212, which is located on the border of Montgomery County and Prince George's County, is a T-intersection, where eastbound Powder Mill Road ties into MD 212 with one left turn lane and one right turn lane. Westbound Powder Mill Road (MD 212) includes two lanes with a left turn lane and right turn ramp from MD 212. Riggs Road (also MD 212) is predominantly one lane in each direction but widens traveling northbound toward the intersection to include one left turn lane onto Powder Mill Road. Traveling westbound, MD 212 widens to include a right turn lane to and from Perimeter Road, which is a closed entrance to the U.S. Army Adelphi Laboratory Center. See **Figure 6-5** for a photo of the existing intersection.

Figure 6-5: Existing Intersection of Powder Mill Road and MD 212 from the West



The proposed improvements would reconfigure the existing travel lanes to provide two left turns along the eastbound approach on Powder Mill Road and two receiving lanes along eastbound MD 212, from the intersection of Powder Mill Road to MD 212 to the entrance of Hillandale Baptist Church. In addition, the right turn lane from westbound MD 212 to westbound Powder Mill Road would be extended by approximately 200 feet, as right turning traffic is occasionally blocked by southbound thru traffic stopping at the signal. The majority of these improvements would occur in Prince George's County.

Based on traffic information described in **Chapter 5** and field observations, queuing along north/eastbound MD 212 is caused by the intersection of MD 212 and Floral Drive, which is located in Prince George's County and is the main access point for the U.S. Army Adelphi Laboratory Center. Improvements to this intersection and beyond, such as an adjustment to the signal timing to allow more green time for MD 212 and added lanes, would likely be needed to fully address the traffic concerns along the MD 212 corridor, including at the intersection of Powder Mill Road and MD 212.



This study recommends coordination with Prince George's County and MDOT SHA to discuss improvements along the MD 212 Corridor. See **Figure 6-6** for a map of the proposed improvements.

6.4 Additional Traffic Calming Measures

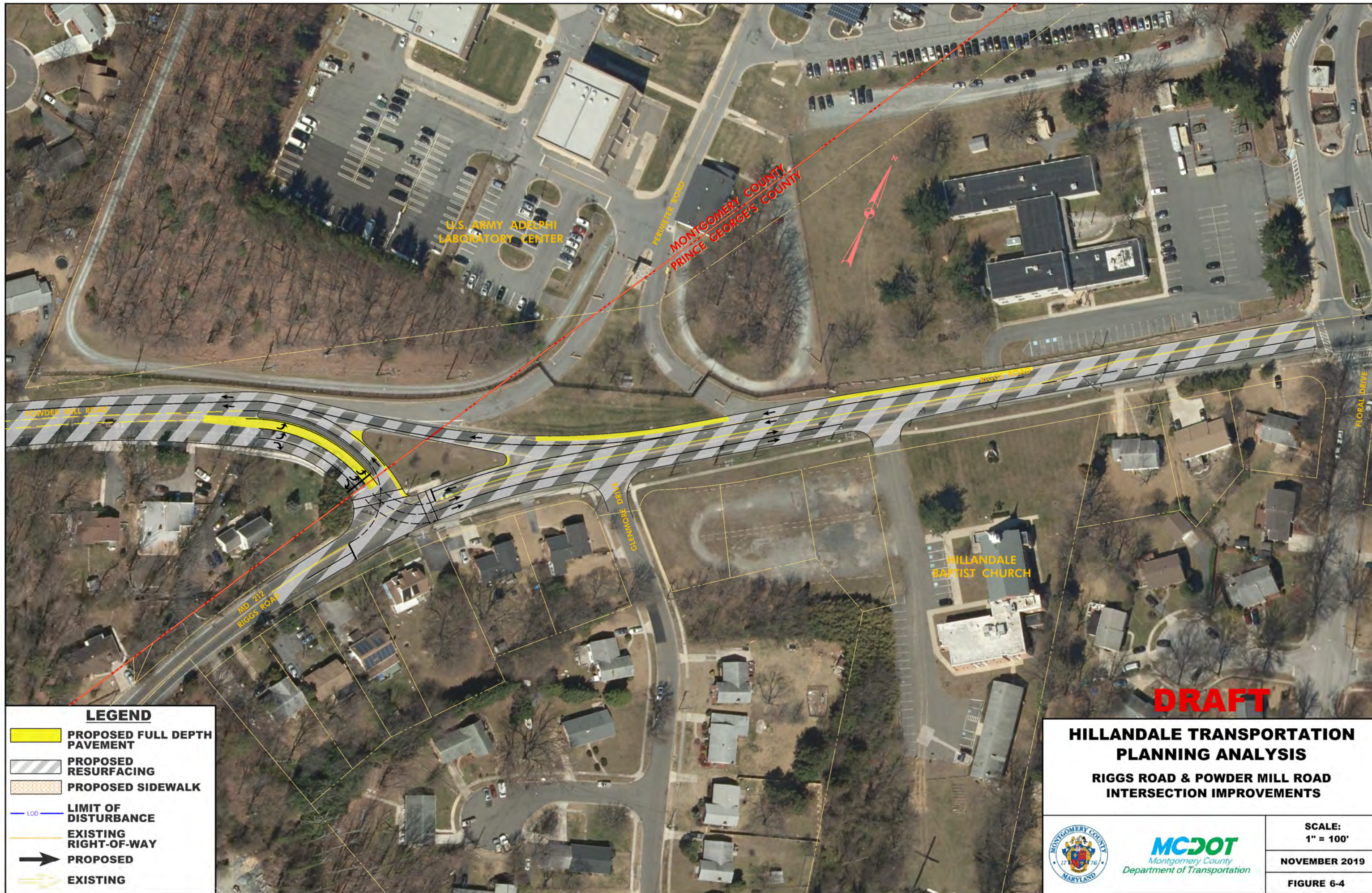
As described in **Chapter 4**, residents have expressed concern regarding cut-through traffic in the residential segment of the Hillandale neighborhood using roads such as Green Forest Drive and Wooded Way. Field observations and O/D data described in **Chapter 5** showed that some traffic is likely using neighborhood streets to avoid the intersection delays at MD 650 and Powder Mill Road, Powder Mill Road at MD 212, and Floral Drive and MD 212.

In the PM peak, dozens of vehicles per hour from MD 212 divert to Wooded Way and then onto Elton Road to access MD 650 or the Hillandale Shopping Center, or onto Wooded Way, Forestdale Drive, and Forest Hill Drive to Green Forest Drive to Powder Mill Road to access MD 650.

Speed humps have already been installed in the Prince George's County portion of Elton Road and Wooded Way. Additional measures to deter cut-through traffic could include:

- Convert the intersection of Wooded Way and Green Forest Drive from a two-way stop-controlled intersection to a four-way stop-controlled intersection;
- Add speed humps on Green Forest Drive and Forest Dale Drive;
- Add additional traffic calming on the Montgomery County portion of Elton Road, including speed humps, neckdowns, and islands to meter speeds; and
- Consider making all or a portion of the approximately 300-foot long residential portion of Elton Road within Montgomery County one-way eastbound. This would prevent MD 212 drivers from using Wooded Way, Green Forest Drive, and other streets in the residential Hillandale neighborhood to access the commercial portion of Elton Road and MD 650. In this study, the analyses for the proposed slip ramp from Elton Road to the I-495 Outer Loop assume that this measure is in place to prevent added cut-through trips from MD 212 to the I-495 Outer Loop on neighborhood streets.

These measures, in addition to improvements at intersections to achieve SSP adequacy, should reduce the neighborhood cut-through traffic. However, as discussed in **Section 6.3**, improvements to the intersection of Powder Mill Road and MD 212 and the intersection of MD 212 and Floral Drive in Prince George's County would also assist in these efforts, and this study recommends coordination with the Maryland Department of Transportation State Highway Administration and Prince George's County to discuss opportunities for improvements along the MD 212 corridor. The analyses in this report conservatively assume that 100 percent of observed cut-through traffic currently using Green Forest Drive, and much of the cut-through traffic using Elton Road to get to southbound MD 650, would divert to use Powder Mill Road in the worst-case scenario for the intersections of MD 650 and Powder Mill Road and Powder Mill Road and MD 212.



LEGEND

- PROPOSED FULL DEPTH PAVEMENT
- PROPOSED RESURFACING
- PROPOSED SIDEWALK
- LIMIT OF DISTURBANCE
- EXISTING RIGHT-OF-WAY
- PROPOSED
- EXISTING

HILLDALE TRANSPORTATION PLANNING ANALYSIS

RIGGS ROAD & POWDER MILL ROAD INTERSECTION IMPROVEMENTS



MCDOT
Montgomery County
Department of Transportation

SCALE:
1" = 100'

NOVEMBER 2019

FIGURE 6-4



6.5 Comparison of Study Results to the Revised White Oak LATIP Analysis

As noted in **Section 3.4.1**, the *Revised White Oak LATIP Supplemental Transportation Analysis (November 2018)* recommended improvements to the MD 650 at Powder Mill Road intersection as well as a slip ramp from Elton Road to the ramp to the I-495 Outer Loop to reduce projected delays at the intersection of Powder Mill Road with MD 650 to less than the 80 seconds per vehicle threshold to meet LATIP requirements. The analysis conducted for this current report (as documented in **Table 6.1**) found that the addition of the slip ramp to the proposed improvements was not necessary to meet the threshold. A review of the differences between the two sets of analyses (See **Table 6-2**) reveals the following:

- Projected 2040 AM and PM peak volumes for the Powder Mill Road intersection are 300 to 350 hundred vehicles per hour higher (total of all approaches) in this report than in the 2018 study due to adjustments made in updating volumes with current counts and balancing volumes along the MD 650 corridor. Details of the volume differences are shown in **Appendix A-3**.
- Operational analyses for the 2040 No-Build improvements condition in this report included the short existing right-turn lane on westbound Powder Mill Road, whereas the 2018 report did not. This results in the PM delay being less for that condition in the new analyses than for the 2018 study. The AM No-Build delay is still worse in this new analysis than in 2018 due to the higher volumes noted above.
- The current report manually optimized the signal timing (phase lengths and offsets) of the Powder Mill Road intersection for all 2040 model results, while the 2018 study used existing signal timings for all analyses. It is assumed here that timings will be adjusted over time as volumes grow and change patterns.
- In addition to the adjustment of the signal timing, this report allows for the overlap of yellow and pedestrian signal times at the Powder Mill Road intersection for improvement options without the northbound MD 650 right turn lane. Both (signal overlap and the right turn lane) result in delays under 80 seconds with Synchro, but the PM delay increases from around 65 seconds with the right turn lane to just under 80 with the overlap. The northbound queue would also increase from around 500 feet on average to close to 1,250 feet.
- With the Slip Ramp at Elton Road, the westbound traffic restriction on Elton Road would increase the Powder Mill Road westbound traffic as traffic is rerouted there. Therefore, the addition of the Elton Road slip ramp would only decrease the average intersection delay at Powder Mill Road by approximately two seconds in the AM peak and one second in the PM peak. The westbound restriction to control cut-through traffic on Elton is assumed to be in place in all analyses in this report where the slip ramp is added. While northbound left turn queues at Powder Mill Road are also reduced with the addition of the slip ramp, it does not need to be included to remain under the 80 seconds of delay threshold.


Table 6-2: Comparison of Current Study and Previous Study LOS Analyses

Intersections	Alternatives		2018 Previous Study		GF Study		Notes
			AM	PM	AM	PM	
MD 650 & Powder Mill Rd (PMR)	2040 No Build Slip Ramp	LOS	E	F	F	F	GF Study included the WB Right Turn lane in analysis and used the adjusted signal timing input.
		Delay	76.9	125.0	96.1	96.5	
	2040 I-495 Slip Ramp with PMR Improvements*	LOS	D	E			
		Delay	46.0	71.2			
	2040 I-495 Slip Ramp with PMR Improvements* and WB Restriction on Elton Rd	LOS	E	E	E	E	GF Alt. 4A**
		Delay	55.2	78.4	75.5	79.1	
	2040 No Build Slip Ramp with PMR Improvements*	LOS			E	E	GF Alt. 6A**
		Delay			77.5	79.8	
	2040 No Build Slip Ramp with PMR Improvements*, adding NB Right Lane	LOS			E	E	GF Alt. 6
		Delay			77.0	62.3	
MD 650 & Elton Rd	2040 No Build Slip Ramp	LOS	A	A	A	B	
		Delay	4.8	9.6	6.2	12.4	
	2040 I-495 Slip Ramp with PMR Improvements*	LOS	A	B			
		Delay	10.0	9.4			
	2040 I-495 Slip Ramp with PMR Improvements* and WB Restriction on Elton Rd	LOS	A	A	A	A	GF Alt. 4A
		Delay	5.8	5.4	6.2	8.6	
	2040 No Build Slip Ramp with PMR Improvements*	LOS			A	B	GF Alt. 6A
		Delay			6.6	12.4	
	2040 No Build Slip Ramp with PMR Improvements*, adding NB Right Lane	LOS			A	B	GF Alt. 6
		Delay			6.4	12.4	

Note:

* For MD 650/Powder Mill Rd, the improvements include

WB approach: Extend the existing Right Turn lane to 300 ft from 90 ft.

EB approach: 4 lanes with one lane addition (L-L/Th-Th/R-R).

** Alt. 4A and 6A do not add the NB right turn lane at MD 650/Powder Mill Road (PMR).



7 Cost Estimates

Conceptual Cost estimates for each of the improvement concepts described in **Chapter 6** were developed using MDOT SHA's Major Quantities Estimate Methodology. They include contingency factors for items that do not have enough details to develop estimate quantities such as maintenance of traffic (MOT); drainage and stormwater management; utilities; and landscape and environmental design. In addition, due to the preliminary nature of this design, an overall project contingency of 50% was added. These contingencies were applied before adding in estimated right-of-way costs.

Table 7-1 includes the estimated costs for the proposed intersection improvements. Detailed Cost Estimates are included in **Appendix B**.

It is expected that all values, particularly items covered by contingencies, could change should a project enter into detailed design. Future reassessment of project costs would be expected to consider the most accurate and precise information available, refining these costs over time.

Table 7-1: Proposed Intersection Improvement Costs

Location	Proposed Improvements	Estimated Cost
MD 650 and Powder Mill Road	• Extend left turn lane on NB MD 650 to Powder Mill Road • Add dedicated right turn lane on NB MD 650 to EB Powder Mill Road • Extend right turn lane on SB MD 650 to the Outer Loop • Add lane on EB Powder Mill Road to create one left turn lane, one left-thru lane, one right-thru lane, and one right turn lane • Extend right turn lane along WB Powder Mill Road to NB MD 650	\$2,868,900
MD 650 and Elton Road	• Slip ramp from Elton Road to Outer Loop	\$453,200
MD 650 Southbound Bus Stop Reconstruction and Queue Jump Lane	• Reconstruction of existing bus stop • Addition of queue jump lane	\$341,400
Powder Mill Road and MD 212	• Add additional left turn on Powder Mill Road to EB MD 212 • Add two thru lanes on EB MD 212 • Extend right turn lane on WB MD 212 to Powder Mill Road	\$1,014,000
TOTAL COST PROPOSED ROADWAY IMPROVEMENTS		\$4,677,500



Appendices



Appendix A

Traffic Information



Appendix A-1

Traffic Counts

Start Date: 6/4/2019
Start Time: 6:00:00 AM

Site Code: POWDER MILL RD @ RIGGS RD TMC

Start Time	RIGGS RD From North					DRIVEWAY From East					RIGGS RD From South					POWDER MILL RD From West					Total Veh.
	Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		
06:00	0	96	161	0	257	0	0	2	0	2	16	93	0	1	109	20	1	6	0	27	395
06:15	0	94	191	0	285	0	0	0	0	0	22	95	0	0	117	41	0	6	0	47	449
06:30	0	102	170	1	272	1	0	0	0	1	15	110	0	0	125	51	0	5	0	56	454
06:45	0	126	152	0	278	0	0	0	0	0	20	128	0	0	148	57	0	11	0	68	494
07:00	0	125	152	0	277	0	0	0	0	0	32	106	0	0	138	65	0	8	0	73	488
07:15	0	109	163	1	272	0	0	0	0	0	26	150	0	0	176	53	0	13	0	66	514
07:30	0	107	167	0	274	0	0	0	0	0	28	136	0	2	164	52	0	15	1	67	505
07:45	0	125	156	0	281	0	0	0	0	0	23	108	0	0	131	61	0	17	0	78	490
08:00	0	149	130	0	279	0	0	0	0	0	14	100	0	0	114	71	0	12	0	83	476
08:15	1	134	140	0	275	1	0	0	0	1	27	107	0	0	134	52	0	13	0	65	475
08:30	0	162	136	9	298	0	0	0	0	0	21	109	0	0	130	44	1	10	0	55	483
08:45	1	183	135	8	319	0	0	0	0	0	17	79	0	0	96	47	0	20	0	67	482
	2	1512	1853	19	3367	2	0	2	0	4	261	1321	0	3	1582	614	2	136	1	752	5705
16:00	0	121	95	1	216	0	0	0	0	0	18	162	0	0	180	75	2	15	0	92	488
16:15	0	174	84	2	258	0	0	1	0	1	32	172	0	0	204	79	0	20	2	99	562
16:30	0	157	100	0	257	0	0	0	0	0	33	168	0	0	201	109	0	18	0	127	585
16:45	0	184	102	1	286	0	0	0	0	0	24	198	0	0	222	88	0	22	0	110	618
17:00	0	163	87	2	250	1	0	0	2	1	29	183	0	0	212	112	0	29	0	141	604
17:15	0	219	139	1	358	0	0	0	0	0	27	191	0	0	218	81	0	19	0	100	676
17:30	0	201	101	0	302	0	0	0	0	0	40	195	0	0	235	106	0	33	0	139	676
17:45	0	209	112	0	321	0	0	0	0	0	27	222	0	0	249	105	3	28	0	136	706
18:00	1	183	116	0	300	0	0	0	0	0	20	191	0	0	211	103	0	25	1	128	639
18:15	0	169	114	0	283	0	0	0	0	0	25	171	0	0	196	96	1	14	0	111	590
18:30	0	160	100	2	260	0	0	0	0	0	20	127	0	0	147	81	0	17	0	98	505
18:45	0	172	94	0	266	0	0	0	0	0	23	146	2	0	171	67	0	11	0	78	515
	1	2112	1244	9	3357	1	0	1	2	2	318	2126	2	0	2446	1102	6	251	3	1359	7164
AM Pea	0	467	634	1	1101	0	0	0	0	0	106	520	0	2	626	227	0	47	1	274	2001
PM Pea	1	812	468	1	1281	0	0	0	0	0	114	799	0	0	913	395	3	105	1	503	2697
AM PHF					0.99					#####					0.89					0.94	0.97
PM PHF					0.89					#####					0.92					0.90	0.96

Start Date: 5/29/2019

Start Time: 6:00:00 AM

Site Code: POWDER MILL RD @ GREENACRES RD TMC

Start Time	GREENACRES DR From North					POWDERMILL RD From East					From South					POWDERMILL RD From West					Total Veh.
	Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		
06:00	0	0	10	0	10	0	145	0	2	145	0	0	0	0	0	0	39	0	0	39	194
06:15	0	0	6	0	6	0	173	2	1	175	0	0	0	0	0	0	55	0	0	55	236
06:30	0	0	5	0	5	0	206	4	0	210	0	0	0	0	0	0	33	0	0	33	248
06:45	0	0	3	0	3	0	189	2	0	191	0	0	0	0	0	0	49	0	0	49	243
07:00	0	0	8	0	8	0	178	5	0	183	0	0	0	0	0	0	47	0	0	47	238
07:15	0	0	6	0	6	0	171	2	0	173	0	0	0	0	0	0	44	0	0	44	223
07:30	0	0	7	0	7	0	188	1	0	189	0	0	0	0	0	0	54	0	0	54	250
07:45	0	0	8	0	8	0	215	8	0	223	0	0	0	0	0	0	61	0	0	61	292
08:00	0	0	8	0	8	0	185	2	0	187	0	0	0	0	0	0	72	0	2	72	267
08:15	0	0	11	0	11	0	183	4	0	187	0	0	0	0	0	0	59	0	0	59	257
08:30	0	0	4	0	4	0	197	9	0	206	0	0	0	0	0	0	73	0	0	73	283
08:45	0	0	7	0	7	0	175	4	0	179	0	0	0	0	0	0	75	0	0	75	261
	0	0	83	0	83	0	2205	43	3	2248	0	0	0	0	0	0	661	0	2	661	2992
16:00	0	0	2	0	2	0	148	7	0	155	0	0	0	0	0	0	101	0	0	101	258
16:15	0	0	6	0	6	0	140	5	0	145	0	0	0	0	0	0	92	0	1	92	243
16:30	0	0	1	0	1	0	123	10	3	133	0	0	0	0	0	0	112	0	1	112	246
16:45	0	0	4	0	4	0	164	5	0	169	0	0	0	0	0	0	116	0	0	116	289
17:00	0	0	8	0	8	0	151	1	0	152	0	0	0	0	0	0	108	0	0	108	268
17:15	0	0	10	0	10	0	136	6	0	142	0	0	0	0	0	0	119	0	0	119	271
17:30	0	0	9	0	9	0	179	7	0	186	0	0	0	0	0	0	123	0	0	123	318
17:45	0	0	10	0	10	0	157	6	0	163	0	0	0	0	0	0	99	0	1	99	272
18:00	0	0	13	0	13	0	174	6	0	180	0	0	0	0	0	0	117	0	2	117	310
18:15	0	0	7	0	7	0	194	5	0	199	0	0	0	0	0	0	94	0	0	94	300
18:30	0	0	4	0	4	0	185	4	0	189	0	0	0	0	0	0	96	0	3	96	289
18:45	0	0	5	0	5	0	196	7	0	203	0	0	0	0	0	0	105	0	0	105	313
	0	0	79	0	79	0	1947	69	3	2016	0	0	0	0	0	0	1282	0	8	1282	3377
AM Ped	0	0	31	0	31	0	780	23	0	803	0	0	0	0	0	0	265	0	2	265	1099
PM Ped	0	0	39	0	39	0	704	24	0	728	0	0	0	0	0	0	433	0	3	433	1200
AM PHF					0.70					0.90					#####					0.91	0.94
PM PHF					0.75					0.91					#####					0.88	0.94

Start Date: 5/30/2019

Start Time: 6:00:00 AM

Site Code: POWDER MILL RD @ HILLANDALE SHOPPING CENTER

Start Time	From North					POWDER MILL RD From East					HILLANDALE SHOPPING CENTER					POWDER MILL RD From West					Total Veh.
	Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		
06:00	0	0	0	0	0	12	167	0	1	179	12	0	9	0	21	0	30	4	0	34	234
06:15	0	0	0	0	0	5	203	0	0	208	13	0	8	0	21	0	39	9	0	48	277
06:30	0	0	0	0	0	5	206	0	4	211	5	0	7	1	12	0	43	7	0	50	273
06:45	0	0	0	0	0	8	202	0	4	210	10	0	9	0	19	0	44	10	0	54	283
07:00	0	0	0	0	0	4	204	0	0	208	13	0	10	0	23	0	34	6	0	40	271
07:15	0	0	0	0	0	11	208	0	1	219	12	0	16	0	28	0	41	14	1	55	302
07:30	0	0	0	0	0	10	181	0	2	191	9	0	19	0	28	0	43	7	0	50	269
07:45	0	0	0	0	0	4	194	0	1	198	7	0	20	1	27	0	38	13	1	51	276
08:00	0	0	0	0	0	9	216	0	0	225	13	0	11	0	24	0	33	7	1	40	289
08:15	0	0	0	0	0	8	186	0	0	194	8	0	14	0	22	0	49	10	0	59	275
08:30	0	0	0	0	0	6	167	0	1	173	15	0	15	0	30	0	48	14	0	62	265
08:45	0	0	0	0	0	14	165	0	2	179	17	0	19	0	36	0	36	17	0	53	268
	0	0	0	0	0	96	2299	0	16	2395	134	0	157	2	291	0	478	118	3	596	3282
16:00	0	0	0	0	0	6	116	0	0	122	36	0	30	0	66	0	68	29	0	97	285
16:15	0	0	0	0	0	11	95	0	1	106	37	0	26	0	63	0	65	20	0	85	254
16:30	0	0	0	0	0	15	123	0	0	138	41	0	24	0	65	0	75	22	0	97	300
16:45	0	0	0	0	0	23	140	0	1	163	39	0	26	0	65	0	71	26	0	97	325
17:00	0	0	0	0	0	20	103	0	0	123	48	0	32	0	80	0	83	23	0	106	309
17:15	0	0	0	0	0	12	166	0	1	178	44	0	31	3	75	0	78	25	0	103	356
17:30	0	0	0	0	0	16	124	0	2	140	55	0	45	0	100	0	73	18	1	91	331
17:45	0	0	0	0	0	17	149	0	0	166	35	0	28	0	63	0	66	14	0	80	309
18:00	0	0	0	0	0	22	117	0	1	139	39	0	39	0	78	0	55	20	0	75	292
18:15	0	0	0	0	0	20	154	0	2	174	41	0	31	0	72	0	64	21	0	85	331
18:30	0	0	0	0	0	16	152	0	1	168	38	0	36	0	74	0	73	26	0	99	341
18:45	0	0	0	0	0	29	119	0	1	148	34	0	32	0	66	0	68	19	0	87	301
	0	0	0	0	0	207	1558	0	10	1765	487	0	380	3	867	0	839	263	1	1102	3734
AM Ped	0	0	0	0	0	34	799	0	4	833	41	0	66	1	107	0	155	41	3	196	1136
PM Ped	0	0	0	0	0	71	533	0	4	604	186	0	134	3	320	0	305	92	1	397	1321
AM PHF					#####					0.93					0.96					0.89	0.94
PM PHF					#####					0.85					0.80					0.94	0.93

Start Date: 6/4/2019

Start Time: 5:45:00 AM

Site Code: POWDER MILL RD @ KINLOCH RD TMC

Start Time	KINLOCH RD From North					POWDER MILL RD From East					From South					POWDER MILL RD From West					Total Veh.
	Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		
05:45	0	0	0	1	0	0	186	2	0	188	0	0	0	0	0	0	34	0	0	34	222
06:00	0	0	4	0	4	0	211	0	0	211	0	0	0	0	0	1	31	0	0	32	247
06:15	4	0	4	0	8	0	189	0	1	189	0	0	0	0	0	1	43	0	0	44	241
06:30	0	0	1	0	1	0	168	1	0	169	0	0	0	0	0	0	48	0	1	48	218
06:45	2	0	4	0	6	0	183	0	1	183	0	0	0	0	0	3	66	0	0	69	258
07:00	3	0	5	0	8	0	175	2	0	177	0	0	0	0	0	0	61	0	0	61	246
07:15	5	0	3	0	8	0	190	1	1	191	0	0	0	0	0	0	58	0	0	58	257
07:30	1	0	2	0	3	0	165	2	0	167	0	0	0	0	0	4	51	0	2	55	225
07:45	5	0	2	0	7	0	144	0	0	144	0	0	0	0	0	2	64	0	0	66	217
08:00	2	0	5	0	7	0	161	2	0	163	0	0	0	0	0	2	53	0	0	55	225
08:15	6	0	3	4	9	0	131	0	0	131	0	0	0	0	0	3	65	0	0	68	208
08:30	3	0	7	1	10	0	137	0	0	137	0	0	0	0	0	4	53	0	1	57	204
08:45	0	0	1	0	1	0	123	0	0	123	0	0	0	0	0	1	62	0	0	63	187
	31	0	41	6	72	0	2163	10	3	2173	0	0	0	0	0	21	689	0	4	710	2955
16:00	4	0	1	5	5	0	106	8	2	114	0	0	0	0	0	9	79	0	0	88	207
16:15	2	0	0	0	2	0	121	2	0	123	0	0	0	0	0	7	96	0	5	103	228
16:30	4	0	3	0	7	0	125	2	0	127	0	0	0	0	0	3	98	0	1	101	235
16:45	0	0	2	0	2	0	119	5	3	124	0	0	0	0	0	6	105	0	0	111	237
17:00	0	0	1	0	1	0	161	6	2	167	0	0	0	0	0	4	114	0	1	118	286
17:15	2	0	5	0	7	0	129	3	1	132	0	0	0	0	0	4	110	0	1	114	253
17:30	1	0	3	1	4	0	132	5	1	137	0	0	0	0	0	3	109	0	1	112	253
17:45	1	0	1	0	2	0	138	6	0	144	0	0	0	0	0	3	111	0	2	114	260
18:00	0	0	0	0	0	0	117	4	0	121	0	0	0	0	0	5	82	0	0	87	208
18:15	0	0	1	0	1	0	116	3	0	119	0	0	0	0	0	1	62	0	3	63	183
18:30	1	0	0	0	1	0	121	6	3	127	0	0	0	0	0	4	75	0	2	79	207
18:45	1	0	1	0	2	0	108	4	0	112	0	0	0	0	0	4	65	0	0	69	183
	16	0	18	6	34	0	1493	54	12	1547	0	0	0	0	0	53	1106	0	16	1159	2740
AM Peak	11	0	14	0	25	0	713	5	2	718	0	0	0	0	0	7	236	0	2	243	986
PM Peak	4	0	10	1	14	0	560	20	4	580	0	0	0	0	0	14	444	0	5	458	1052
AM PHF					0.78					0.94					#####					0.88	0.96
PM PHF					0.50					0.87					#####					0.97	0.92

Start Date: 5/30/2019

Start Time: 6:00:00 AM

Site Code: POWDER MILL ROAD @ SWEETBRIAR PARKWAY

Start Time	SWEETBRIAR PKWY From North					POWDER MILL RD From East					From South					POWDER MILL RD From West					Total Veh.
	Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		
06:00	3	0	5	0	8	0	183	0	0	183	0	0	0	0	0	1	38	0	0	39	230
06:15	4	0	6	0	10	0	198	0	2	198	0	0	0	0	0	1	50	0	0	51	259
06:30	1	0	7	0	8	0	192	2	2	194	0	0	0	0	0	2	43	0	1	45	247
06:45	5	0	1	2	6	0	185	1	1	186	0	0	0	0	0	0	54	0	0	54	246
07:00	9	0	5	1	14	0	187	0	0	187	0	0	0	0	0	0	49	0	0	49	250
07:15	8	0	6	0	14	0	163	4	1	167	0	0	0	0	0	3	57	0	1	60	241
07:30	8	0	6	0	14	0	181	1	0	182	0	0	0	0	0	2	50	0	0	52	248
07:45	3	0	7	2	10	0	169	0	0	169	0	0	0	0	0	2	62	0	2	64	243
08:00	6	0	12	0	18	0	180	1	1	181	0	0	0	0	0	7	51	0	0	58	257
08:15	6	0	5	0	11	0	144	3	2	147	0	0	0	0	0	2	60	0	0	62	220
08:30	8	0	2	0	10	0	150	1	0	151	0	0	0	0	0	3	56	0	1	59	220
08:45	12	0	4	0	16	0	132	1	1	133	0	0	0	0	0	2	52	0	0	54	203
	73	0	66	5	139	0	2064	14	10	2078	0	0	0	0	0	25	622	0	5	647	2864
16:00	7	0	5	0	12	0	94	1	0	95	0	0	0	0	0	6	91	0	0	97	204
16:15	5	0	6	0	11	0	112	1	1	113	0	0	0	0	0	7	82	0	0	89	213
16:30	5	0	3	0	8	0	134	0	1	134	0	0	0	0	0	5	97	0	0	102	244
16:45	8	0	6	0	14	0	149	3	0	152	0	0	0	0	0	3	76	0	0	79	245
17:00	5	0	3	0	8	0	165	5	0	170	0	0	0	0	0	6	108	0	3	114	292
17:15	8	0	3	0	11	0	125	1	0	126	0	0	0	0	0	3	83	0	0	86	223
17:30	7	0	3	0	10	0	140	0	0	140	0	0	0	0	0	4	117	0	0	121	271
17:45	10	0	9	0	19	0	136	1	0	137	0	0	0	0	0	4	107	0	1	111	267
18:00	8	0	7	0	15	0	161	3	0	164	0	0	0	0	0	7	87	0	2	94	273
18:15	4	0	6	1	10	0	149	0	2	149	0	0	0	0	0	11	84	0	1	95	254
18:30	13	0	4	1	17	0	133	4	0	137	0	0	0	0	0	4	80	0	2	84	238
18:45	6	0	5	0	11	0	142	2	0	144	0	0	0	0	0	4	68	1	1	73	228
	86	0	60	2	146	0	1640	21	4	1661	0	0	0	0	0	64	1080	1	10	1145	2952
AM Peak	19	0	19	3	38	0	762	3	5	765	0	0	0	0	0	3	196	0	1	199	1002
PM Peak	30	0	18	0	48	0	566	7	0	573	0	0	0	0	0	17	415	0	4	432	1053
AM PHF					0.68					0.97					#####					0.92	0.97
PM PHF					0.63					0.84					#####					0.89	0.90

Start Date: 5-Jun

Start Time: 6:00:00 AM

Site Code: ELTON RD @ HILLANDALE SHOPPING CENTER

Start Time	SHOPPING CENTER DRIVEWAY					ELTON RD From East					FROM SOUTH					ELTON RD From West					Total Veh.
	Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		
06:00	0	0	4	0	4	0	11	4	3	15				0		3	7	0	0	10	29
06:15	2	0	9	1	11	0	22	1	1	23				0		6	10	0	0	16	50
06:30	1	0	7	0	8	0	15	2	0	17				1		5	8	0	0	13	38
06:45	2	0	10	1	12	0	19	4	1	23				1		13	20	0	0	33	68
07:00	0	0	13	1	13	0	18	1	0	19				0		18	18	0	0	36	68
07:15	1	0	16	0	17	0	17	4	1	21				4		16	28	0	1	44	82
07:30	3	0	12	2	15	0	12	2	0	14				2		13	16	0	0	29	58
07:45	5	0	14	5	19	0	18	3	0	21				0		22	43	0	1	65	105
08:00	2	0	10	0	12	0	14	0	0	14				2		11	41	0	0	52	78
08:15	2	0	14	2	16	0	16	0	4	16				0		6	34	0	0	40	72
08:30	4	0	9	1	13	0	18	0	0	18				2		13	34	0	0	47	78
08:45	1	0	11	3	12	0	15	3	0	18				0		15	42	0	0	57	87
	23	0	129	16	152	0	195	24	10	219				12		141	301	0	2	442	813
16:00	9	0	40	6	49	0	29	6	1	35				2		41	41	0	0	82	166
16:15	9	0	32	1	41	0	35	9	0	44				0		33	38	0	0	71	156
16:30	12	0	46	0	58	0	39	7	2	46				1		45	43	0	0	88	192
16:45	10	0	33	0	43	0	37	9	1	46				2		50	33	0	0	83	172
17:00	4	0	31	1	35	0	37	7	0	44				0		47	35	0	0	82	161
17:15	5	0	26	0	31	0	49	9	1	58				0		48	39	0	0	87	176
17:30	11	0	45	0	56	0	28	9	0	37				0		33	50	0	0	83	176
17:45	6	0	30	0	36	0	41	10	5	51				1		45	48	0	1	93	180
18:00	8	0	37	1	45	0	48	9	2	57				2		65	54	0	2	119	221
18:15	9	0	42	1	51	0	47	12	0	59				0		32	48	0	0	80	190
18:30	16	0	30	1	46	0	33	3	0	36				0		55	48	0	0	103	185
18:45	12	0	45	1	57	0	51	7	1	58				0		44	38	0	0	82	197
	111	0	437	12	548	0	474	97	13	571				8		538	515	0	3	1053	2172
AM Peak	11	0	52	7	63	0	61	9	1	70	0	0	0	8	0	62	128	0	2	190	323
PM Peak	45	0	154	4	199	0	179	31	3	210	0	0	0	2	0	196	188	0	2	384	793
AM PHF					0.83					0.83					#####					0.73	0.77
PM PHF					0.87					0.89					#####					0.81	0.90

Start Date: 5/29/2019

Start Time: 6:00:00 AM

Site Code: MD 650 @ OAKVIEW DR TMC

	MD 650 From North						OAKVIEW DR From East						MD 650 From South						OAKVIEW DR From West						
Start Time	Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		Left	Thru	Right	Peds		Total Veh.				
06:00	13	524	5	0	542	20	3	48	13	71	9	525	3	1	537	35	1	9	2	45	1195				
06:15	14	536	8	2	558	17	2	77	10	96	4	551	2	2	557	38	0	4	4	42	1253				
06:30	12	604	16	0	632	32	1	74	22	107	1	508	4	1	513	21	3	13	2	37	1289				
06:45	16	648	14	3	678	20	1	52	7	73	5	487	1	3	493	42	2	7	3	51	1295				
07:00	13	655	34	1	702	28	2	73	13	103	7	442	5	5	454	47	2	5	2	54	1313				
07:15	15	679	36	0	730	24	3	58	7	85	7	473	3	5	483	54	1	9	2	64	1362				
07:30	17	646	26	0	689	30	1	64	6	95	4	434	1	3	439	48	4	3	3	55	1278				
07:45	15	737	31	1	783	25	4	40	8	69	4	436	2	1	442	38	1	6	4	45	1339				
08:00	19	715	34	0	768	19	8	36	6	63	4	532	3	1	539	50	2	4	0	56	1426				
08:15	14	730	37	2	781	26	3	32	4	61	9	466	4	3	479	32	5	7	0	44	1365				
08:30	19	693	39	0	751	29	5	44	9	78	2	438	2	2	442	53	5	9	0	67	1338				
08:45	14	736	28	0	778	28	5	47	6	80	5	441	2	2	448	58	8	3	0	69	1375				
	181	7903	308	9	8392	298	38	645	111	981	61	5733	32	29	5826	516	34	79	22	629	15828				
16:00	46	671	47	0	764	18	2	51	5	71	4	603	3	9	610	35	4	13	3	52	1497				
16:15	52	633	48	1	733	13	1	80	4	94	7	608	2	8	617	22	1	11	3	34	1478				
16:30	51	673	52	3	776	9	0	76	3	85	4	606	4	4	614	28	1	9	0	38	1513				
16:45	47	522	28	1	597	17	2	74	7	93	6	568	2	1	576	26	1	2	5	29	1295				
17:00	59	510	22	1	591	16	2	95	4	113	2	619	5	9	626	43	2	3	0	48	1378				
17:15	61	642	37	4	740	18	1	85	0	104	6	598	4	2	608	44	5	2	2	51	1503				
17:30	74	668	33	1	775	13	0	71	4	84	6	659	2	6	667	32	3	8	0	43	1569				
17:45	67	588	56	3	711	25	1	82	4	108	4	595	3	4	602	25	1	5	2	31	1452				
18:00	72	700	70	2	842	31	3	79	1	113	7	639	3	1	649	42	4	4	1	50	1654				
18:15	68	771	80	0	919	33	1	72	2	106	5	616	2	3	623	26	2	5	0	33	1681				
18:30	70	645	51	1	766	19	2	68	2	89	7	569	1	2	577	39	5	3	0	47	1479				
18:45	71	617	53	1	741	22	1	69	6	92	11	517	2	1	530	30	1	4	4	35	1398				
	738	7640	577	18	8955	234	16	902	42	1152	69	7197	33	50	7299	392	30	69	20	491	17897				
AM Pea	66	2777	127	1	2970	98	16	198	27	312	19	1875	9	10	1903	190	8	22	9	220	5405				
PM Pea	281	2727	239	6	3247	102	5	304	11	411	22	2509	10	14	2541	125	10	22	3	157	6356				
AM PHF					0.95					0.82					0.88					0.86	0.95				
PM PHF					0.88					0.91					0.95					0.79	0.95				

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

Station ID: S1999150073

County: Montgomery

Comments:

Date: Thursday 02/01/2018

Town: none

Location: MD 650 at ELTON RD

Weather: Cloudy/Cold

Interval 60 min
(dd):

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		09:00	Montg	5109	B	0.65		18:00	Montg	5164	C	0.78

Hour Ending	MD 650					MD 650					ELTON RD										Grand Total
	From North					From South					From East					From West					
	U.Tur	Left	Through	Right	TOTAL	U.Turn	Left	Throug	Right	TOTAL	U.Turn	Left	Throug	RIGHT	TOTAL	U.Turn	Left	Through	Right	TOTAL	
7:00	1	10	1768	0	1779	1	4	1406	98	1509	0	67	0	13	80	0	0	0	0	0	3368
8:00	1	31	2413	0	2445	1	68	1915	176	2160	0	99	0	19	118	0	0	0	0	0	4723
9:00	3	42	2370	0	2415	0	0	2294	279	2573	2	95	5	24	126	0	0	0	0	0	5114
10:00	3	60	1905	0	1968	2	0	2030	317	2349	0	109	0	22	131	0	0	0	0	0	4448
11:00	2	40	1372	0	1414	2	16	1512	202	1732	1	137	0	36	174	0	0	0	0	0	3320
12:00	7	33	1156	0	1196	0	0	1371	238	1609	1	179	0	70	250	0	0	0	0	0	3055
13:00	1	33	1278	0	1312	2	0	1502	317	1821	4	219	0	55	278	0	0	0	0	0	3411
14:00	3	40	1219	0	1262	6	0	1766	403	2175	1	274	0	104	379	0	0	0	0	0	3816
15:00	4	28	1407	0	1439	0	0	1895	351	2246	2	265	0	86	353	0	0	0	0	0	4038
16:00	1	29	1775	0	1805	0	0	2191	359	2550	0	336	0	80	416	0	0	0	0	0	4771
17:00	3	28	1983	0	2014	1	6	2281	336	2624	14	359	0	85	458	0	0	0	0	0	5096
18:00	4	29	1987	0	2020	0	4	2346	394	2744	0	337	0	67	404	0	0	0	0	0	5168
19:00	1	36	1764	0	1801	1	0	2383	345	2729	0	292	0	57	349	0	0	0	0	0	4879
TOTAL:	34	439	22397	0	22870	16	98	24892	3815	28821	25	2768	5	718	3516	0	0	0	0	0	55207
AM Peak:	3	42	2370	0	2412	0	0	2294	279	2573	2	95	5	24	124	0	0	0	0	0	5109
PM Peak:	4	29	1987	0	2016	0	4	2346	394	2744	0	337	0	67	404	0	0	0	0	0	5164

Station ID: S1999150073

County: Montqomery

Comments:

Date: Thursday 02/01/2018

Town: none

Location: MD 650 at ELTON RD

Weather: Cloudy/Cold

Interval 60 min

(dd):

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		09:00	Montg	5109	B	0.65		18:00	Montg	5164	C	0.78

MD 650

North Leg

MD 650

South Leg

ELTON RD

East Leg

West Leg

Hour Ending	School Children	Pedestrians	Bicycles	School Children	Pedestrians	Bicycles	School Children	Pedestrians	Bicycles	School Children	Pedestrians	Bicycles
7:00	0	0	0	0	4	0	0	0	0	0	0	0
8:00	0	0	0	0	1	0	0	3	0	0	1	0
9:00	0	0	0	0	2	0	0	1	0	0	2	0
10:00	0	0	0	0	2	0	0	1	0	0	2	0
11:00	0	3	1	0	1	0	0	1	0	0	2	0
12:00	0	4	0	0	2	1	0	2	0	0	19	0
13:00	0	2	0	0	1	0	0	8	0	0	21	0
14:00	0	2	0	0	6	0	0	1	0	0	21	0
15:00	0	4	0	0	1	0	0	4	0	0	13	0
16:00	0	2	0	0	2	1	0	10	0	0	11	0
17:00	0	2	0	0	6	0	0	14	1	0	18	0
18:00	0	2	0	0	8	1	0	4	1	0	13	0
19:00	0	2	0	0	6	1	0	6	1	0	9	0
Total:	0	23	1	0	42	4	0	55	3	0	132	0
AM Pe	0	0	0	0	2	0	0	1	0	0	2	0
PM Pe	0	2	0	0	8	1	0	4	1	0	13	0

Station ID: S1999150073

County: Montqomery

Comments:

Date: Thursday 02/01/2018

Town: none

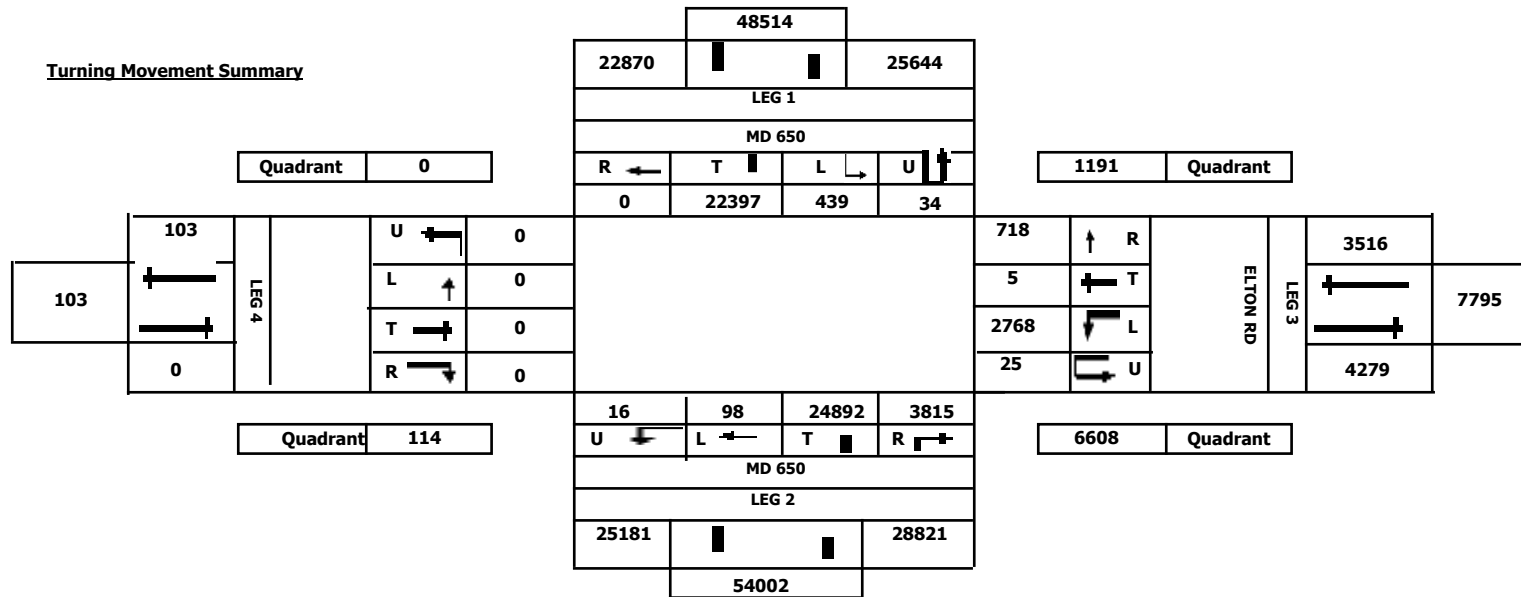
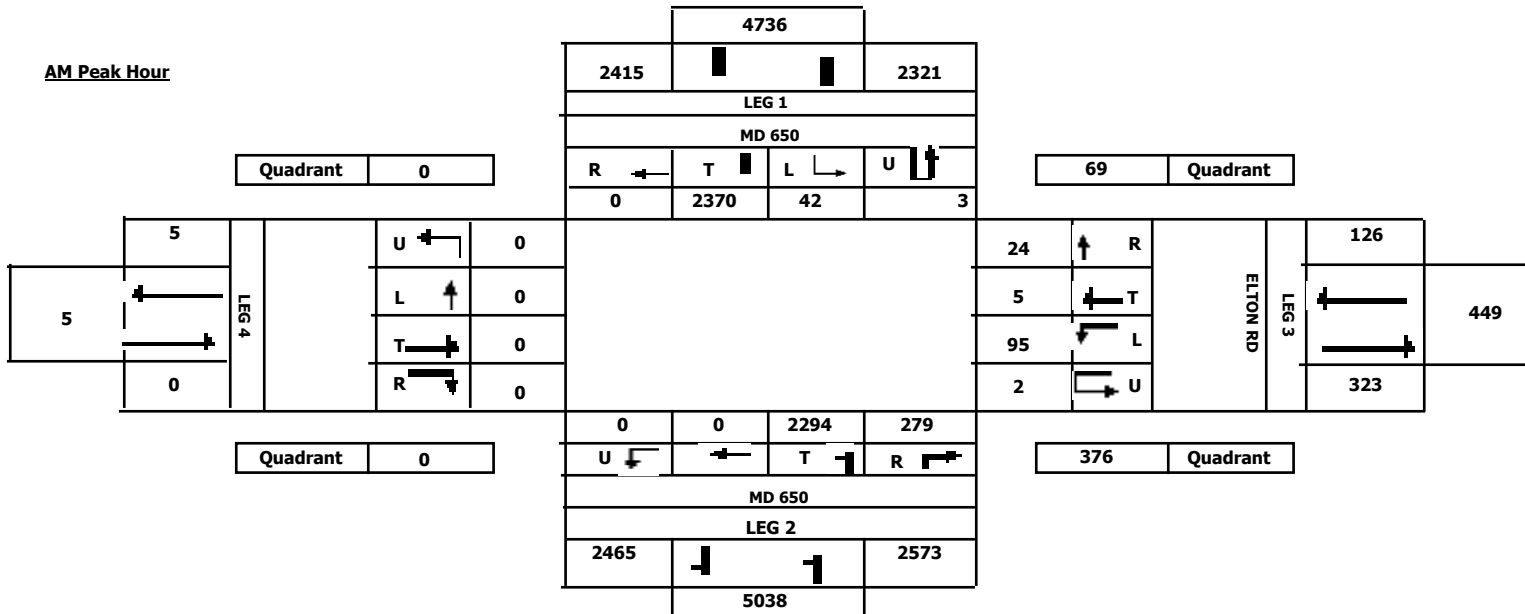
Location: MD 650 at ELTON RD

Weather: Cloudy/Cold

Interval 60 min

(dd):

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start 09:00	End Montg	Volume 5109	LOS B	V/C 0.65	PM PERIOD 12:00PM-19:00P	Start 18:00	End Montg	Volume 5164	LOS C	V/C 0.78
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Turning Movement SummaryAM Peak Hour

Comments:

Town: none

Weather: Cloudy/Cold

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		09:00	Montg	5109	B	0.65		18:00	Montg	5164	C	0.78



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

Station ID: S1999150073

County: Montgomerly

Comments: LOS AM: A(0.62) PM: B(0.63)

Date: Tuesday 01/13/2015

Town: none

Location: MD 650 at ELTON RD

Weather: Sunny

Interval 15 min
(dd):

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		08:00	Montg	4684	A	0.62		17:30	Montg	4436	B	0.63

Hour Ending	MD 650					MD 650					Elton Rd					No Entrance					Grand Total
	From North					From South					From East					From West					
	U.Tur	Left	Through	Right	TOTAL	U.Turn	Left	Thru	Right	TOTAL	U.Turn	Left	Thru	RIGHT	TOTAL	U.Turn	Left	Through	Right	TOTAL	
6:15	0	1	340	0	341	0	0	207	11	218	0	6	0	2	8	0	0	0	0	0	567
6:30	0	1	367	0	368	0	0	304	15	319	0	15	0	2	17	0	0	0	0	0	704
6:45	0	14	488	0	502	0	0	341	38	379	0	15	0	4	19	0	0	0	0	0	900
7:00	0	4	492	0	496	0	0	425	23	448	0	31	0	4	35	0	0	0	0	0	979
7:15	0	2	540	0	542	0	0	475	30	505	0	24	0	8	32	0	0	0	0	0	1079
7:30	0	2	608	0	610	0	0	482	42	524	0	40	0	2	42	0	0	0	0	0	1176
7:45	0	10	573	0	583	2	0	530	34	566	0	32	0	7	39	0	0	0	0	0	1188
8:00	0	16	545	0	561	0	0	572	52	624	0	25	0	9	34	0	0	0	0	0	1219
8:15	0	9	520	0	529	0	0	500	35	535	0	19	0	4	23	0	0	0	0	0	1087
8:30	0	12	606	0	618	0	0	486	30	516	0	25	0	5	30	0	0	0	0	0	1164
8:45	0	12	616	0	628	0	0	513	45	558	0	25	0	3	28	0	0	0	0	0	1214
9:00	0	4	532	0	536	0	0	507	41	548	0	14	0	6	20	0	0	0	0	0	1104
9:15	1	5	393	0	399	0	0	506	41	547	0	28	0	6	34	0	0	0	0	0	980
9:30	0	10	409	0	419	0	0	495	42	537	0	29	0	7	36	0	0	0	0	0	992
9:45	0	16	397	0	413	0	0	366	65	431	0	26	0	6	32	0	0	0	0	0	876
10:00	0	3	387	0	390	0	0	305	70	375	0	28	0	15	43	0	0	0	0	0	808
10:15	0	2	384	0	386	0	0	336	74	410	0	27	0	9	36	0	0	0	0	0	832
10:30	0	2	382	0	384	0	0	286	78	364	0	33	0	10	43	0	0	0	0	0	791
10:45	0	2	293	0	295	0	0	302	62	364	0	52	0	17	69	0	0	0	0	0	728
11:00	0	1	338	0	339	0	0	279	58	337	0	25	0	14	39	0	0	0	0	0	715

Station ID:

S1999150073

Date:

Tuesday 01/13/2015

Location:

MD 650 at ELTON RD

County:

Montgomery

Town:

none

Weather:

Sunny

Comments:

LOS AM: A(0.62) PM: B(0.63)

Interval

15 min

(dd):

PEAK HOURS	AM PERIOD 6:00AM-12:00PM		Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P		Start	End	Volume	LOS	V/C
			08:00	Montg	4684	A	0.62			17:30	Montg	4436	B	0.63

11:15	0	4	265	0	269	0	0	300	61	361	0	32	0	9	41	0	0	0	0	0	671
11:30	0	14	318	0	332	0	0	279	71	350	0	34	0	18	52	0	0	0	0	0	734
11:45	0	5	336	0	341	0	0	301	59	360	0	38	0	15	53	0	0	0	0	0	754
12:00	0	16	308	0	324	0	0	288	73	361	0	32	0	10	42	0	0	0	0	0	727
12:15	2	12	374	0	388	0	0	303	78	381	0	47	0	17	64	0	0	0	0	0	833
12:30	2	12	411	0	425	0	0	300	123	423	0	54	0	11	65	0	0	0	0	0	913
12:45	1	8	402	0	411	1	0	272	112	385	0	62	0	12	74	0	0	0	0	0	870
13:00	0	16	322	0	338	0	0	322	131	453	0	43	0	8	51	0	0	0	0	0	842
13:15	0	9	316	0	325	0	0	329	104	433	0	40	0	6	46	0	0	0	0	0	804
13:30	0	6	311	0	317	0	0	302	118	420	0	36	0	10	46	0	0	0	0	0	783
13:45	0	5	289	0	294	0	0	343	97	440	0	34	0	2	36	0	0	0	0	0	770
14:00	1	5	267	0	273	0	0	327	84	411	0	29	0	3	32	0	0	0	0	0	716
14:15	0	0	260	0	260	0	0	315	85	400	0	35	0	4	39	0	0	0	0	0	699
14:30	0	7	322	0	329	0	0	348	105	453	0	43	0	3	46	0	0	0	0	0	828
14:45	0	4	353	0	357	0	0	302	136	438	0	36	0	10	46	0	0	0	0	0	841
15:00	0	15	315	0	330	0	0	298	149	447	0	22	0	2	24	0	0	0	0	0	801
15:15	0	8	293	0	301	0	0	388	137	525	0	17	0	0	17	0	0	0	0	0	843
15:30	0	5	344	0	349	0	0	406	64	470	0	23	0	1	24	0	0	0	0	0	843
15:45	0	12	397	0	409	0	0	417	58	475	0	43	0	4	47	0	0	0	0	0	931
16:00	0	7	341	0	348	0	0	509	72	581	0	43	0	15	58	0	0	0	0	0	987
16:15	2	13	369	0	384	0	0	486	87	573	0	39	0	12	51	0	0	0	0	0	1008
16:30	0	8	445	0	453	0	0	492	66	558	0	70	0	0	70	0	0	0	0	0	1081
16:45	1	2	399	0	402	0	0	516	65	581	0	47	0	9	56	0	0	0	0	0	1039
17:00	0	4	344	0	348	0	0	495	65	560	0	57	0	5	62	0	0	0	0	0	970
17:15	0	4	440	0	444	0	0	515	91	606	0	62	0	15	77	0	0	0	0	0	1127
17:30	0	3	462	0	465	0	0	561	58	619	0	64	0	11	75	0	0	0	0	0	1159

Station ID:

S1999150073

Date:

Tuesday 01/13/2015

Location:

MD 650 at ELTON RD

County:

Montgomery

Town:

none

Weather:

Sunny

Comments:

LOS AM: A(0.62) PM: B(0.63)

Interval (dd):15 min

PEAK HOURS	AM PERIOD 6:00AM-12:00PM					Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P					Start	End	Volume	LOS	V/C
						08:00	Montg	4684	A	0.62						17:30	Montg	4436	B	0.63

17:45	0	0	346	0	346	0	0	510	91	601	0	43	0	15	58	0	0	0	0	0	1005
18:00	0	6	462	0	468	0	0	537	106	643	0	32	0	1	33	0	0	0	0	0	1144
18:15	0	3	493	0	496	0	0	481	72	553	0	64	0	15	79	0	0	0	0	0	1128
18:30	0	12	375	0	387	0	0	501	54	555	0	68	0	7	75	0	0	0	0	0	1017
18:45	0	11	328	0	339	0	0	472	56	528	0	32	0	4	36	0	0	0	0	0	903
19:00	0	5	257	0	262	0	0	459	31	490	0	18	0	0	18	0	0	0	0	0	770
TOTAL:	10	369	20474	0	20853	3	0	20891	3645	24539	0	1858	0	394	2252	0	0	0	0	0	47644
AM Peak:	0	49	2287	0	2336	0	0	2071	162	2233	0	94	0	21	115	0	0	0	0	0	4684
PM Peak:	0	12	1763	0	1775	0	0	2089	327	2416	0	203	0	42	245	0	0	0	0	0	4436

Station ID: S1999150073

County: Montqomery

Comments: LOS AM: A(0.62) PM: B(0.63)

Date: Tuesday 01/13/2015

Town: none

Location: MD 650 at ELTON RD

Weather: Sunny

Interval 15 min

(dd):

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		08:00	Montg	4684	A	0.62		17:30	Montg	4436	B	0.63

Hour Ending	MD 650 North Leg			MD 650 South Leg			Elton Rd East Leg			No Entrance West Leg		
	School Children	Pedestrians	Bicycles	School Children	Pedestrains	Bicycles	School Children	Pedestrians	Bicycles	School Children	Pedestrians	Bicycles
6:15	0	0	0	0	0	0	0	2	0	0	0	0
6:30	0	0	0	0	1	0	0	0	0	0	0	0
6:45	0	0	0	0	1	0	0	0	0	0	0	0
7:00	0	0	0	0	0	0	0	3	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	0	0	0	1	0	0	1	0	0	0	0
7:45	0	0	0	0	0	0	0	1	0	0	0	0
8:00	0	0	0	0	0	0	0	1	0	0	0	0
8:15	0	0	0	0	0	0	0	0	0	0	0	0
8:30	0	0	0	0	0	0	0	2	0	0	0	0
8:45	0	0	0	0	0	0	0	0	0	0	0	0
9:00	0	0	0	0	1	0	0	2	0	0	0	0
9:15	0	0	0	0	0	0	0	0	0	0	0	0
9:30	0	0	0	0	0	0	0	2	0	0	0	0
9:45	0	0	0	0	1	0	0	2	0	0	0	0
10:00	0	0	0	0	0	0	0	0	0	0	0	0
10:15	0	0	0	0	0	0	0	2	0	0	0	0
10:30	0	0	0	0	0	0	0	2	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	1	0	0	1	0	0	0	0
11:15	0	0	0	0	0	0	0	1	0	0	0	0
11:30	0	0	0	0	0	0	0	3	0	0	0	0
11:45	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	0	0	0	2	0	0	0	0
12:30	0	0	0	0	1	0	0	1	0	0	0	0
12:45	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	2	0	0	0	0

Station ID: S1999150073

County: Montqomery

Comments: LOS AM: A(0.62) PM: B(0.63)

Date: Tuesday 01/13/2015

Town: none

Location: MD 650 at ELTON RD

Weather: Sunny

Interval 15 min

(dd):

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		08:00	Montg	4684	A	0.62		17:30	Montg	4436	B	0.63

13:15	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	0	0	0	0	0
13:45	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	1	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	1	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	1	0	0	0	0
15:30	0	0	0	0	1	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	1	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	0	0	0	0	0	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0
17:45	0	0	0	0	1	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0
18:30	0	0	0	0	1	0	0	0	0	0	0	0
18:45	0	0	0	0	0	0	0	0	0	0	0	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0
Total:	0	0	0	0	13	0	0	31	0	0	0	0
AM Pe	0	0	0	0	0	0	0	3	0	0	0	0
PM Pe	0	0	0	0	1	0	0	0	0	0	0	0

Station ID: S1999150073

County: Montqomery

Comments: LOS AM: A(0.62) PM: B(0.63)

Date: Tuesday 01/13/2015

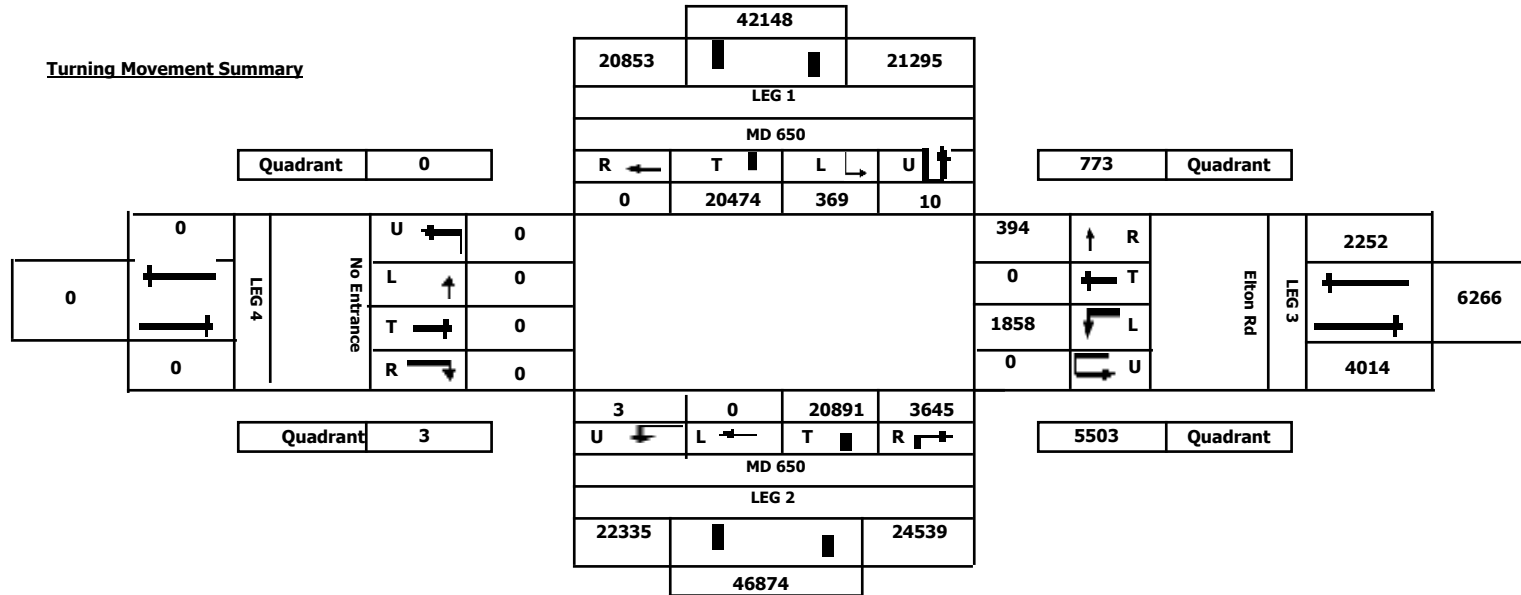
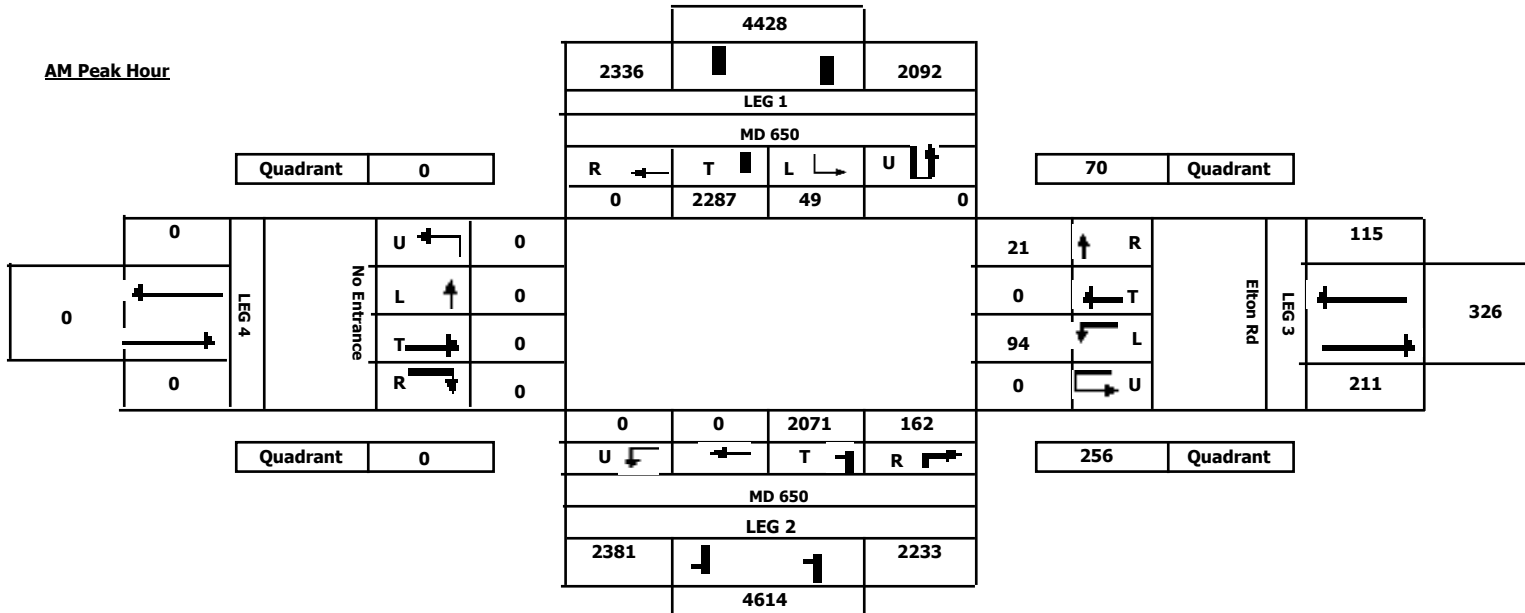
Town: none

Location: MD 650 at ELTON RD

Weather: Sunny

Interval
(dd): 15 min

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start 08:00	End Montg	Volume 4684	LOS A	V/C 0.62	PM PERIOD 12:00PM-19:00P	Start 17:30	End Montg	Volume 4436	LOS B	V/C 0.63
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Turning Movement SummaryAM Peak Hour

Station ID:
Date:
Location:
Interval (dd):

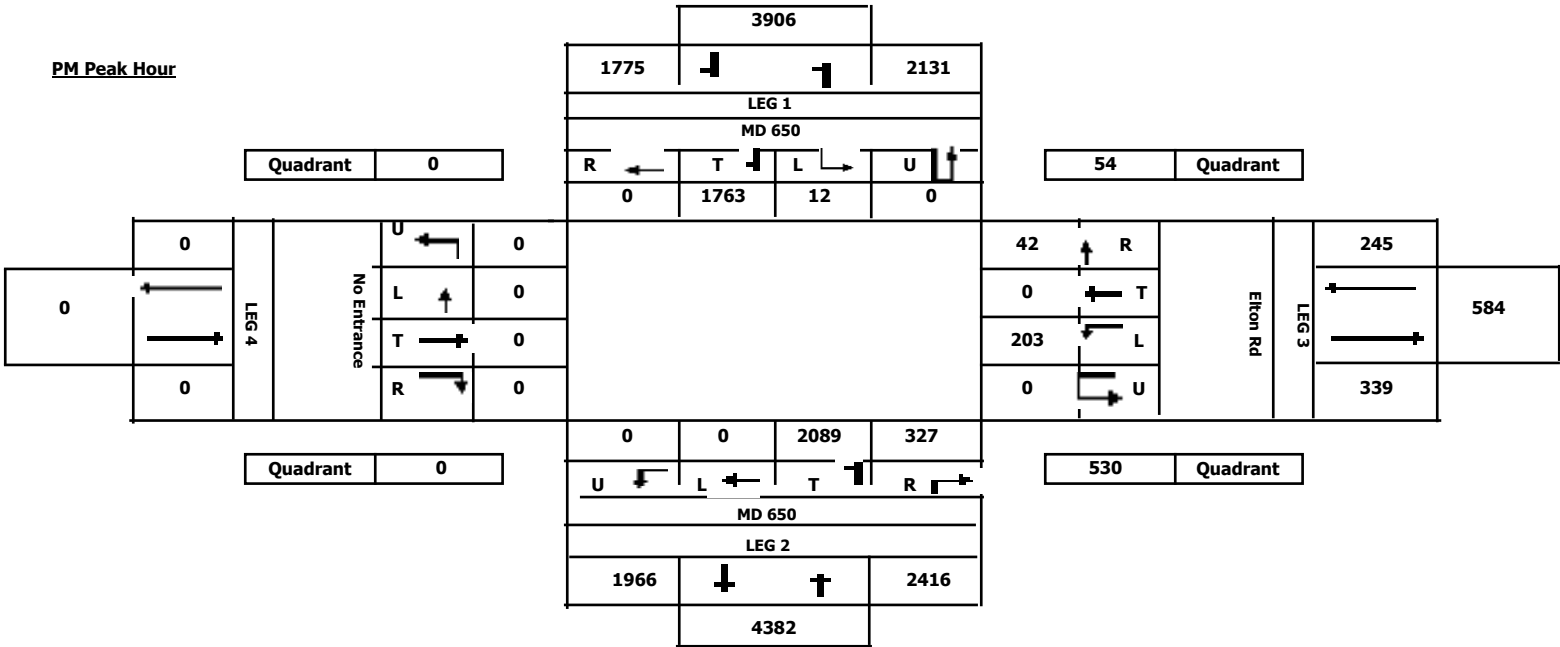
S1999150073
Tuesday 01/13/2015
MD 650 at ELTON RD
15 min

County:
Town:
Weather:

Montgomery
none
Sunny

Comments: LOS AM: A(0.62) PM: B(0.63)

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		08:00	Montg	4684	A	0.62		17:30	Montg	4436	B	0.63



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

Station ID: S1998150181

County: Montgomerly

Comments: LOS AM: D(0.85) PM: D(0.85)

Date: Thursday 01/22/2015

Town: none

Location: MD 650 at Powder Mill Rd

Weather: Sunny

Interval 15 min
(dd):

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		07:30	Montg	5003	D	0.85		17:15	Montg	5155	D	0.85

Hour Ending	MD 650					MD 650					Powder Mill Rd					Powder Mill Rd					Grand Total
	From North					From South					From East					From West					
	U.Tur	Left	Through	Right	TOTAL	U.Turn	Left	Throug	Right	TOTAL	U.Turn	Left	Throug	RIGHT	TOTAL	U.Turn	Left	Through	Right	TOTAL	
6:15	0	24	222	3	249	5	6	189	28	228	0	76	3	12	91	0	2	0	8	10	578
6:30	1	16	281	1	299	7	9	304	24	344	0	108	6	23	137	0	5	0	8	13	793
6:45	0	12	432	3	447	13	5	316	27	361	0	138	12	16	166	0	4	1	9	14	988
7:00	0	19	422	1	442	13	8	364	27	412	0	148	2	34	184	0	2	2	13	17	1055
7:15	2	19	466	2	489	6	11	346	41	404	0	191	4	44	239	0	2	0	11	13	1145
7:30	0	33	521	2	556	7	8	364	37	416	0	207	6	26	239	0	4	4	10	18	1229
7:45	0	25	581	1	607	6	9	427	31	473	0	222	5	26	253	0	3	0	13	16	1349
8:00	2	19	506	3	530	4	14	439	37	494	0	180	3	26	209	0	4	3	8	15	1248
8:15	0	18	471	2	491	9	17	464	42	532	0	124	3	32	159	0	5	1	17	23	1205
8:30	2	13	459	5	479	7	9	463	33	512	1	130	2	43	176	0	1	4	8	13	1180
8:45	0	25	429	0	454	7	8	467	31	513	0	143	5	34	182	0	8	3	12	23	1172
9:00	1	22	403	5	431	3	13	458	29	503	0	121	4	36	161	0	2	0	9	11	1106
9:15	3	28	411	3	445	4	7	420	31	462	0	102	3	29	134	0	1	2	11	14	1055
9:30	1	19	385	4	409	8	10	331	41	390	0	111	0	32	143	0	2	3	10	15	957
9:45	0	25	343	1	369	10	9	307	35	361	0	97	5	25	127	0	6	3	16	25	882
10:00	3	33	309	5	350	5	8	285	28	326	0	69	6	28	103	0	8	0	21	29	808
10:15	0	26	319	1	346	0	11	271	33	315	1	86	1	20	108	0	7	2	18	27	796
10:30	1	17	299	1	318	4	16	267	35	322	0	65	3	22	90	0	10	1	19	30	760
10:45	1	18	263	3	285	9	12	216	28	265	0	73	2	21	96	0	3	9	12	24	670
11:00	0	29	248	3	280	12	12	236	31	291	0	67	2	20	89	0	7	4	18	29	689

Station ID:	S1998150181	County:	Montgomery	Comments:	LOS AM: D(0.85) PM: D(0.85)										
Date:	Thursday 01/22/2015	Town:	none												
Location:	MD 650 at Powder Mill Rd	Weather:	Sunny												
Interval (dd):	15 min														
PEAK HOURS	AM PERIOD 6:00AM-12:00PM					Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P				
						07:30	Montg	5003	D	0.85					
11:15	1	27	229	4	261	10	11	187	31	239	1	61	3	24	89
11:30	3	36	250	1	290	17	10	211	28	266	1	67	5	25	98
11:45	1	30	255	7	293	12	8	218	26	264	0	93	2	23	118
12:00	3	37	228	1	269	11	13	246	35	305	0	69	2	27	98
12:15	0	45	268	2	315	10	9	258	33	310	0	90	1	26	117
12:30	2	41	256	1	300	11	6	264	31	312	0	79	9	24	112
12:45	0	35	270	2	307	16	24	249	34	323	0	79	3	30	112
13:00	0	31	297	3	331	14	11	254	39	318	0	79	5	32	116
13:15	1	36	262	1	300	18	8	285	36	347	1	64	2	45	112
13:30	2	35	238	2	277	21	13	306	35	375	1	81	3	46	131
13:45	1	24	244	1	270	10	12	259	35	316	0	72	2	46	120
14:00	2	29	258	3	292	11	8	280	38	337	0	93	5	36	134
14:15	0	29	280	5	314	17	13	293	37	360	0	83	6	44	133
14:30	1	31	305	2	339	17	11	323	36	387	0	90	3	39	132
14:45	1	30	323	6	360	15	10	326	42	393	0	118	7	34	159
15:00	0	34	329	3	366	7	15	351	43	416	0	95	8	42	145
15:15	2	35	297	1	335	17	12	416	40	485	0	115	3	55	173
15:30	2	43	399	0	444	12	11	401	59	483	1	113	1	61	176
15:45	0	40	414	3	457	0	10	413	62	485	0	110	3	53	166
16:00	5	35	449	4	493	13	9	456	65	543	0	131	2	46	179
16:15	0	42	456	2	500	11	13	437	66	527	0	128	2	51	181
16:30	0	49	462	2	513	8	8	479	57	552	0	124	1	63	188
16:45	3	50	474	3	530	10	5	456	44	515	0	120	3	52	175
17:00	0	41	485	1	527	15	10	477	57	559	0	111	6	58	175
17:15	1	54	490	3	548	11	5	446	44	506	0	99	3	63	165
17:30	2	56	515	4	577	11	9	493	64	577	0	122	5	60	187

Station ID:

S1998150181

Date:

Thursday 01/22/2015

Location:

MD 650 at Powder Mill Rd

County:

Montgomery

Town:

none

Weather:

Sunny

Comments:

LOS AM: D(0.85) PM: D(0.85)

Interval (dd):

15 min

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		07:30	Montg	5003	D	0.85		17:15	Montg	5155	D	0.85

17:45	1	49	486	1	537	20	11	457	49	537	0	109	7	62	178	0	8	6	21	35	1287
18:00	1	55	468	2	526	11	10	491	62	574	0	92	10	75	177	0	7	4	13	24	1301
18:15	0	34	409	2	445	12	14	480	55	561	0	118	4	58	180	0	10	2	9	21	1207
18:30	1	39	385	1	426	13	10	449	53	525	0	111	1	40	152	0	15	4	4	23	1126
18:45	2	26	414	1	443	7	11	431	55	504	0	82	4	59	145	0	9	4	11	24	1116
19:00	1	32	317	1	351	6	7	388	36	437	0	73	0	52	125	0	11	1	12	24	937
TOTAL:	56	1650	18982	124	20812	533	539	18414	2076	21562	7	5529	198	2000	7734	0	380	176	756	1312	51420
AM Peak:	2	95	2079	8	2182	26	48	1694	147	1889	0	733	17	110	860	0	16	8	48	72	5003
PM Peak:	5	214	1959	10	2183	53	35	1887	219	2141	0	422	25	260	707	0	38	16	70	124	5155

Station ID: S1998150181

County: Montqomery

Comments: LOS AM: D(0.85) PM: D(0.85)

Date: Thursday 01/22/2015

Town: none

Location: MD 650 at Powder Mill Rd

Weather: Sunny

Interval
(dd): 15 min

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		07:30	Montg	5003	D	0.85		17:15	Montg	5155	D	0.85

Hour Ending	MD 650 North Leg			MD 650 South Leg			Powder Mill Rd East Leg			Powder Mill Rd West Leg		
	School Children	Pedestrians	Bicycles	School Children	Pedestrians	Bicycles	School Children	Pedestrians	Bicycles	School Children	Pedestrians	Bicycles
6:15	0	0	0	0	4	0	0	0	0	0	0	0
6:30	0	0	0	0	7	0	0	4	0	0	5	0
6:45	0	1	0	0	5	0	0	2	0	0	1	0
7:00	0	0	0	0	5	0	0	2	0	0	1	0
7:15	0	1	0	0	10	0	0	4	0	0	4	0
7:30	0	1	0	0	6	0	0	6	0	0	8	0
7:45	0	1	0	0	7	0	0	3	0	0	5	0
8:00	0	0	0	0	7	0	0	4	0	0	4	0
8:15	0	0	0	0	1	0	0	0	0	0	1	0
8:30	0	1	0	0	3	0	0	3	0	0	7	0
8:45	0	0	0	0	3	0	0	0	0	0	1	0
9:00	0	0	0	0	6	0	0	2	0	0	6	0
9:15	0	1	0	0	12	0	0	6	0	0	5	0
9:30	0	0	0	0	8	0	0	0	0	0	5	0
9:45	0	2	0	0	6	0	0	0	0	0	3	0
10:00	0	4	0	0	14	0	0	0	0	0	12	0
10:15	0	2	0	0	6	0	0	0	0	0	9	0
10:30	0	4	0	0	7	0	0	2	0	0	6	0
10:45	0	1	0	0	3	0	0	3	0	0	13	0
11:00	0	3	0	0	5	0	0	1	0	0	4	0
11:15	0	2	0	0	7	0	0	4	0	0	6	0
11:30	0	2	0	0	7	0	0	0	0	0	7	0
11:45	0	6	0	0	4	0	0	1	0	0	2	0
12:00	0	1	0	0	6	0	0	0	0	0	1	0
12:15	0	3	0	0	4	0	0	0	0	0	3	0
12:30	0	0	0	0	3	0	0	0	0	0	1	0
12:45	0	1	0	0	11	0	0	0	0	0	7	0
13:00	0	1	0	0	9	0	0	0	0	0	5	0

Station ID: S1998150181

County: Montgomery

Comments: LOS AM: D(0.85) PM: D(0.85)

Date: Thursday 01/22/2015

Town: none

Location: MD 650 at Powder Mill Rd

Weather: Sunny

Interval 15 min

(dd):

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		07:30	Montg	5003	D	0.85		17:15	Montg	5155	D	0.85

13:15	0	0	0	0	16	0	0	6	0	0	8	0
13:30	0	1	0	0	10	0	0	2	0	0	0	0
13:45	0	0	0	0	12	0	0	0	0	0	2	0
14:00	0	2	0	0	4	0	0	3	0	0	4	0
14:15	0	0	0	0	23	0	0	11	0	0	6	0
14:30	0	1	0	0	16	0	0	4	0	0	4	0
14:45	0	1	0	0	5	0	0	1	0	0	4	0
15:00	0	1	0	0	11	0	0	3	0	0	1	0
15:15	0	0	0	0	6	0	0	1	0	0	2	0
15:30	0	1	0	0	5	0	0	1	0	0	8	0
15:45	0	5	0	0	4	0	0	1	0	0	3	0
16:00	0	1	0	0	5	0	0	0	0	0	1	0
16:15	0	0	0	0	7	0	0	1	0	0	2	0
16:30	0	1	0	0	12	0	0	0	0	0	1	0
16:45	0	0	0	0	8	0	0	4	0	0	8	0
17:00	0	2	0	0	6	0	0	4	0	0	3	0
17:15	0	3	0	0	7	0	0	1	0	0	2	0
17:30	0	3	0	0	6	0	0	8	0	0	1	0
17:45	0	3	0	0	12	0	0	3	0	0	3	0
18:00	0	2	0	0	8	0	0	1	0	0	2	0
18:15	0	0	0	0	6	0	0	2	0	0	0	0
18:30	0	0	0	0	8	0	0	2	0	0	2	0
18:45	0	0	0	0	4	0	0	1	0	0	1	0
19:00	0	0	0	0	3	0	0	0	0	0	1	0

Total:	0	65	0	0	380	0	0	107	0	0	201	0
AM Pe	0	2	0	0	21	0	0	13	0	0	18	0
PM Pe	0	11	0	0	33	0	0	13	0	0	8	0

Station ID: S1998150181

County: Montqomery

Comments: LOS AM: D(0.85) PM: D(0.85)

Date: Thursday 01/22/2015

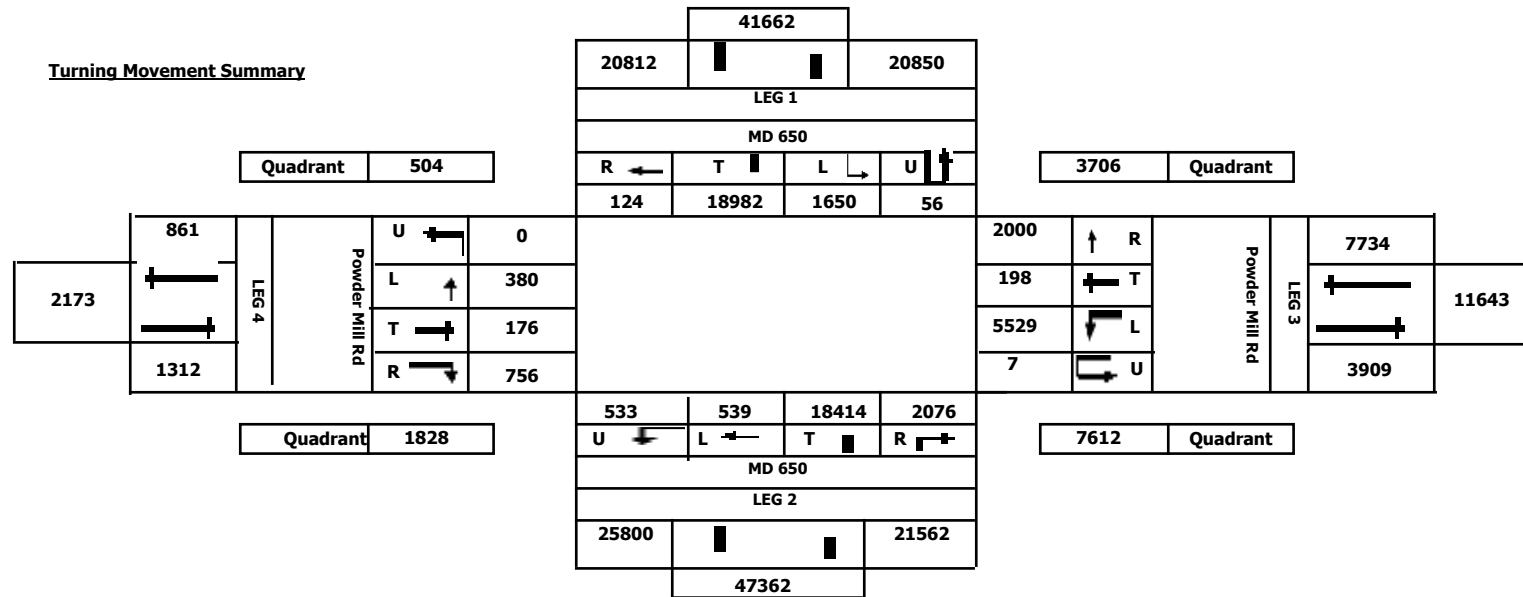
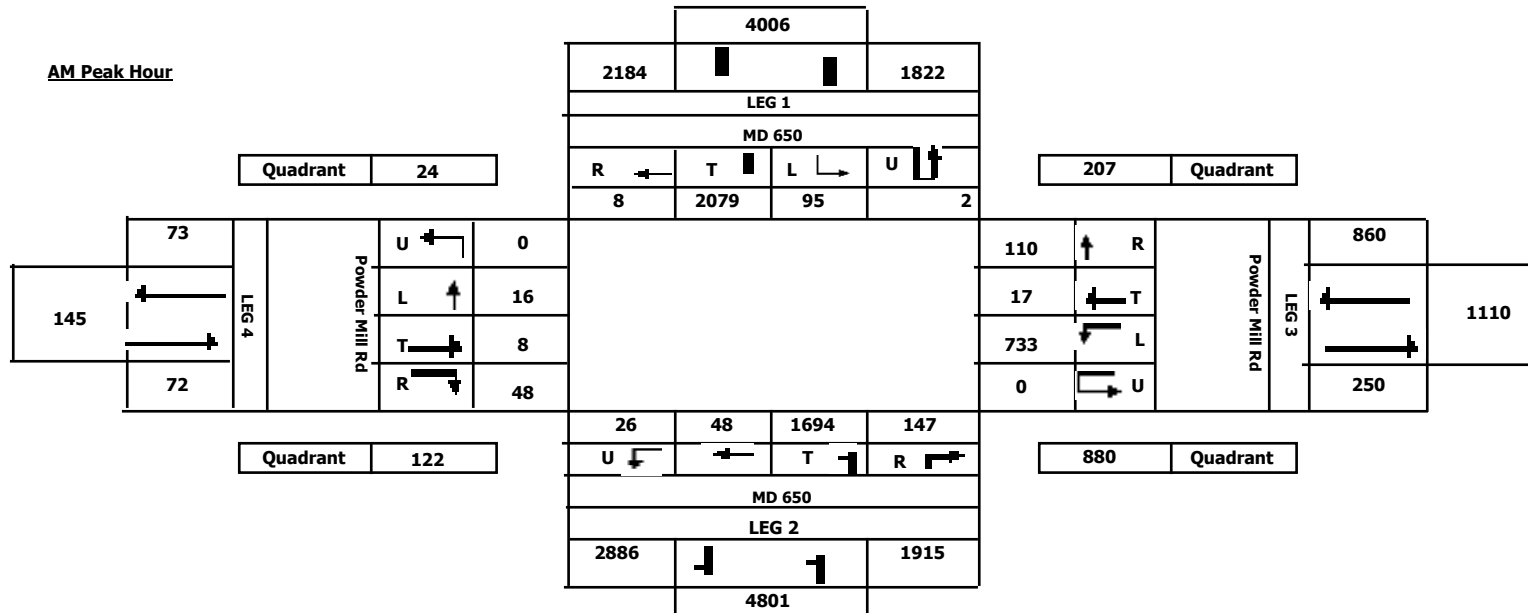
Town: none

Location: MD 650 at Powder Mill Rd

Weather: Sunny

Interval
(dd): 15 min

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		07:30	Montg	5003	D	0.85		17:15	Montg	5155	D	0.85

Turning Movement SummaryAM Peak Hour

Station ID:
Date:
Location:
Interval (dd):

S1998150181
Thursday 01/22/2015
MD 650 at Powder Mill Rd
15 min

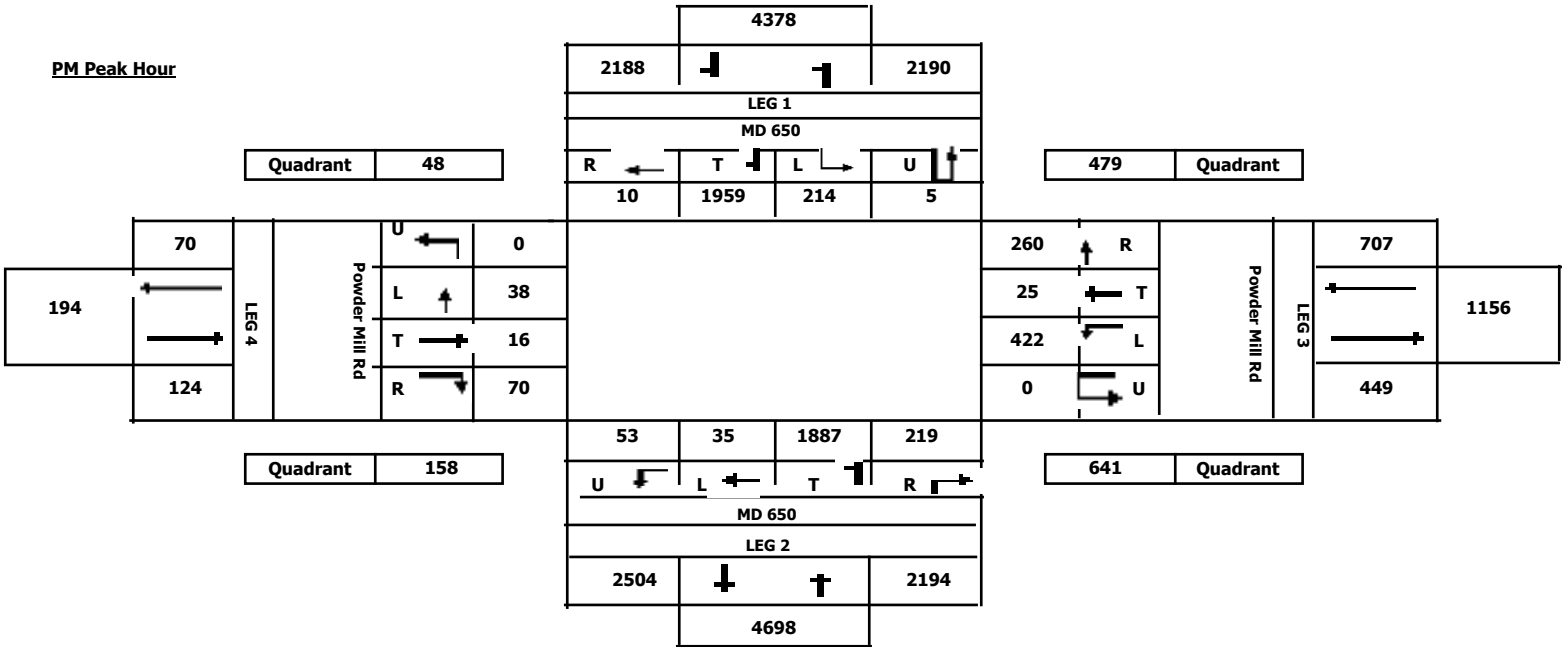
County:
Town:
Weather:

Montgomery
none
Sunny

Comments:

LOS AM: D(0.85) PM: D(0.85)

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-19:00P	Start	End	Volume	LOS	V/C
		07:30	Montg	5003	D	0.85		17:15	Montg	5155	D	0.85

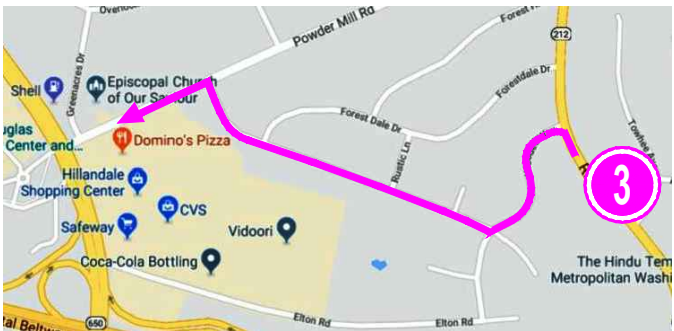
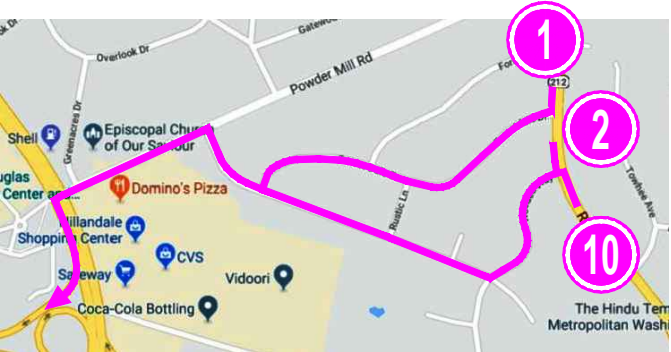
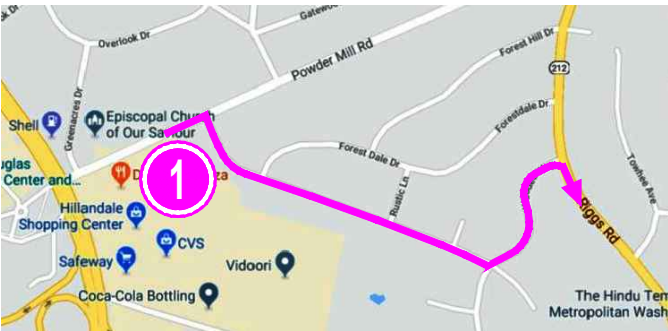
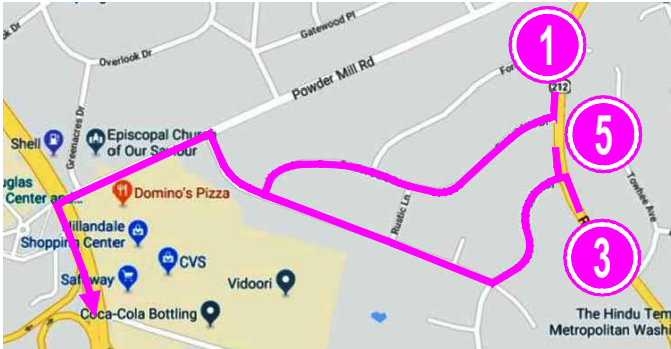
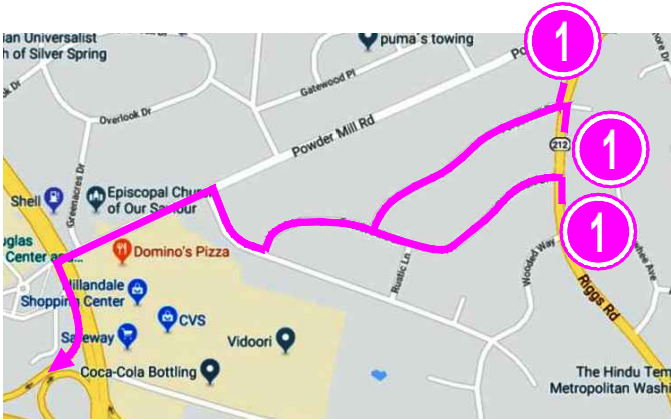
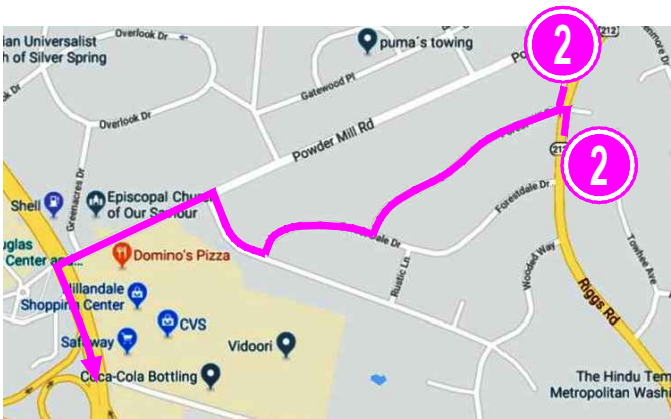
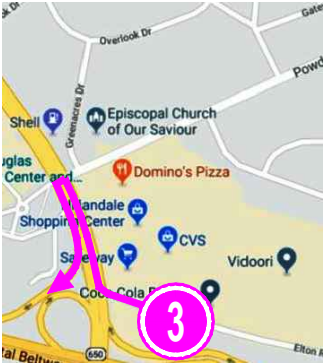




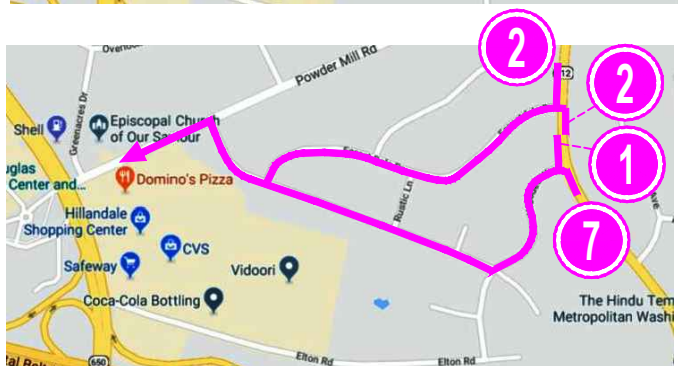
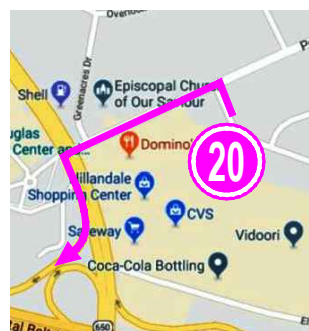
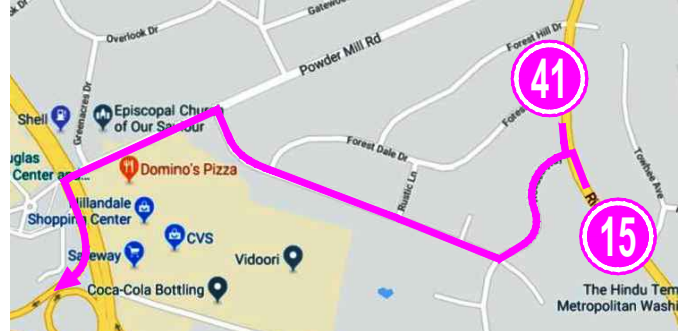
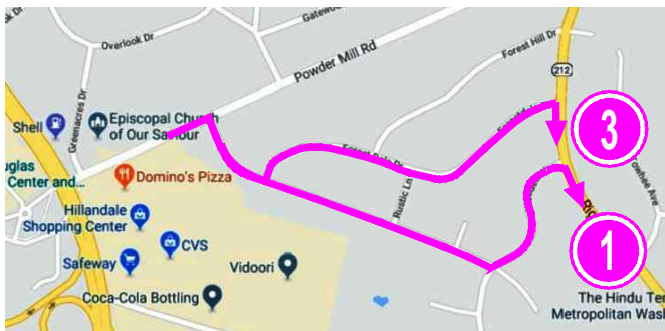
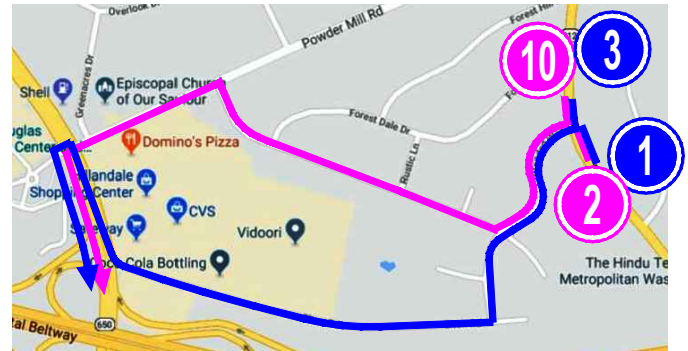
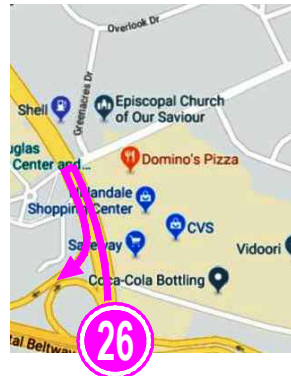
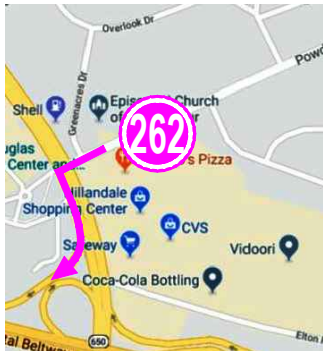
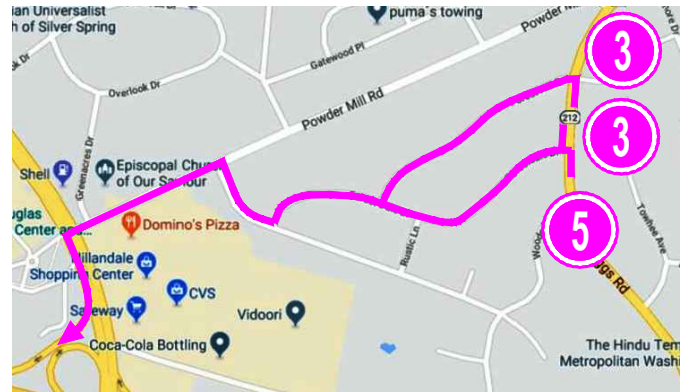
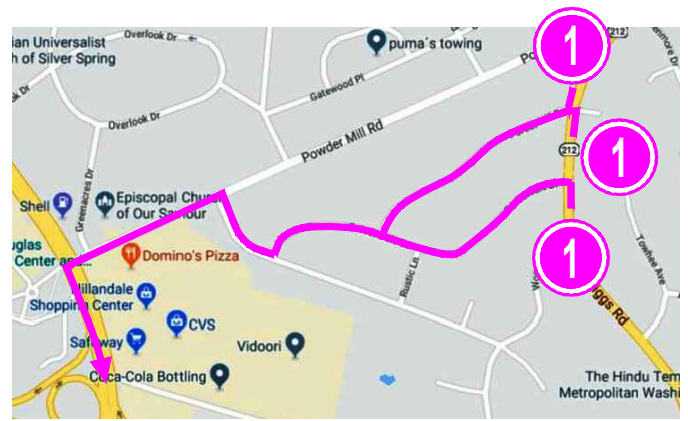
Appendix A-2

O/D Match Survey Data

OD MATCHES IN AM PERIOD (6:00-9:00, 6/11/2019)



OD MATCHES IN PM PERIOD (16:00-19:00, 6/11/2019)





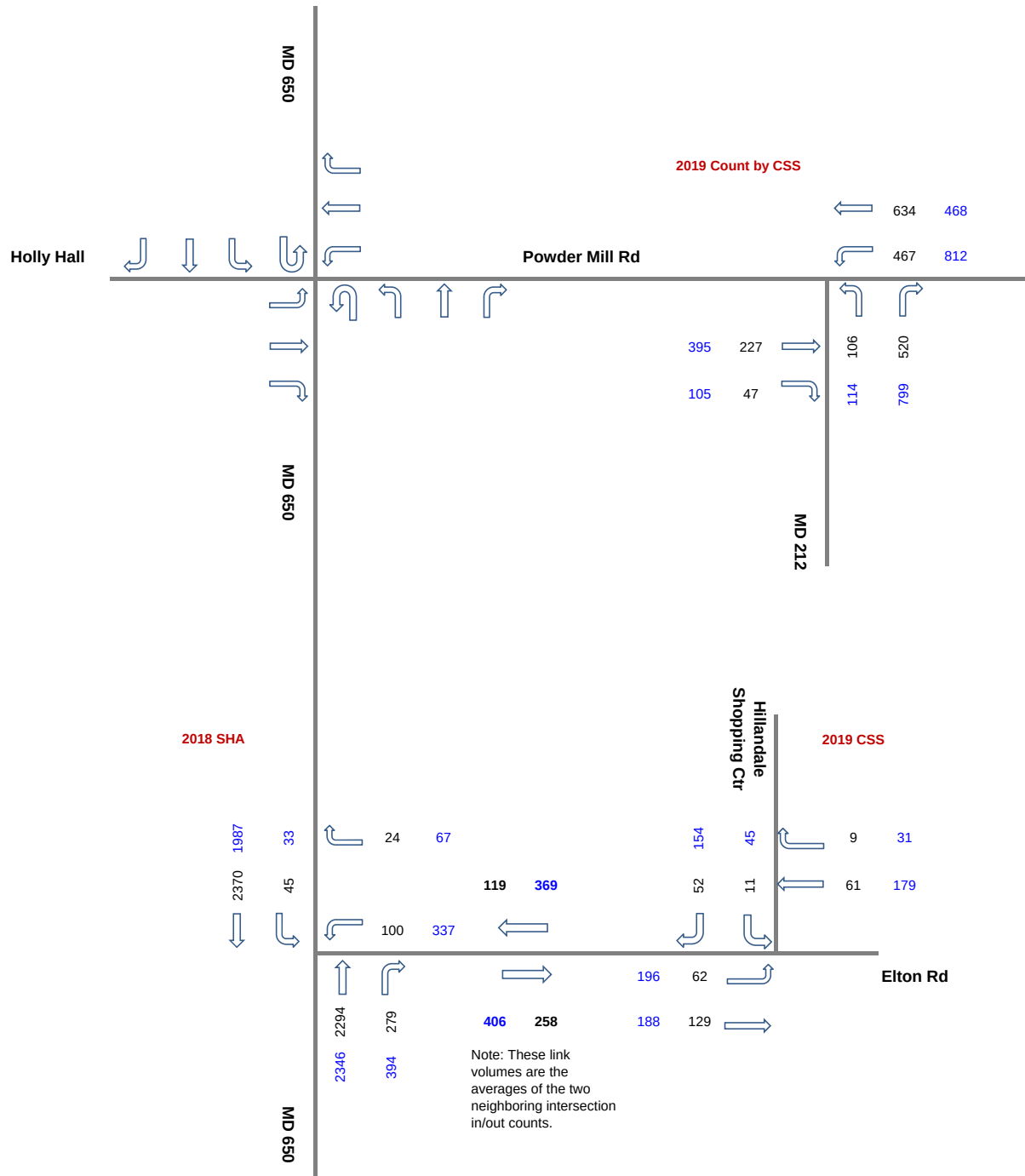
Appendix A-3

Hillandale Volume Forecasting



MD 212/Powder Mill Rd: Synchro Input in White Oak Local Area
Transportation Review Intersection Improvement Cost Evaluation,
9/26/2016

2015 Traffic Volumes



Legend	
XXX :	AM Peak Hour Volume
XXX :	PM Peak Hour Volume

Figure A- 3-2

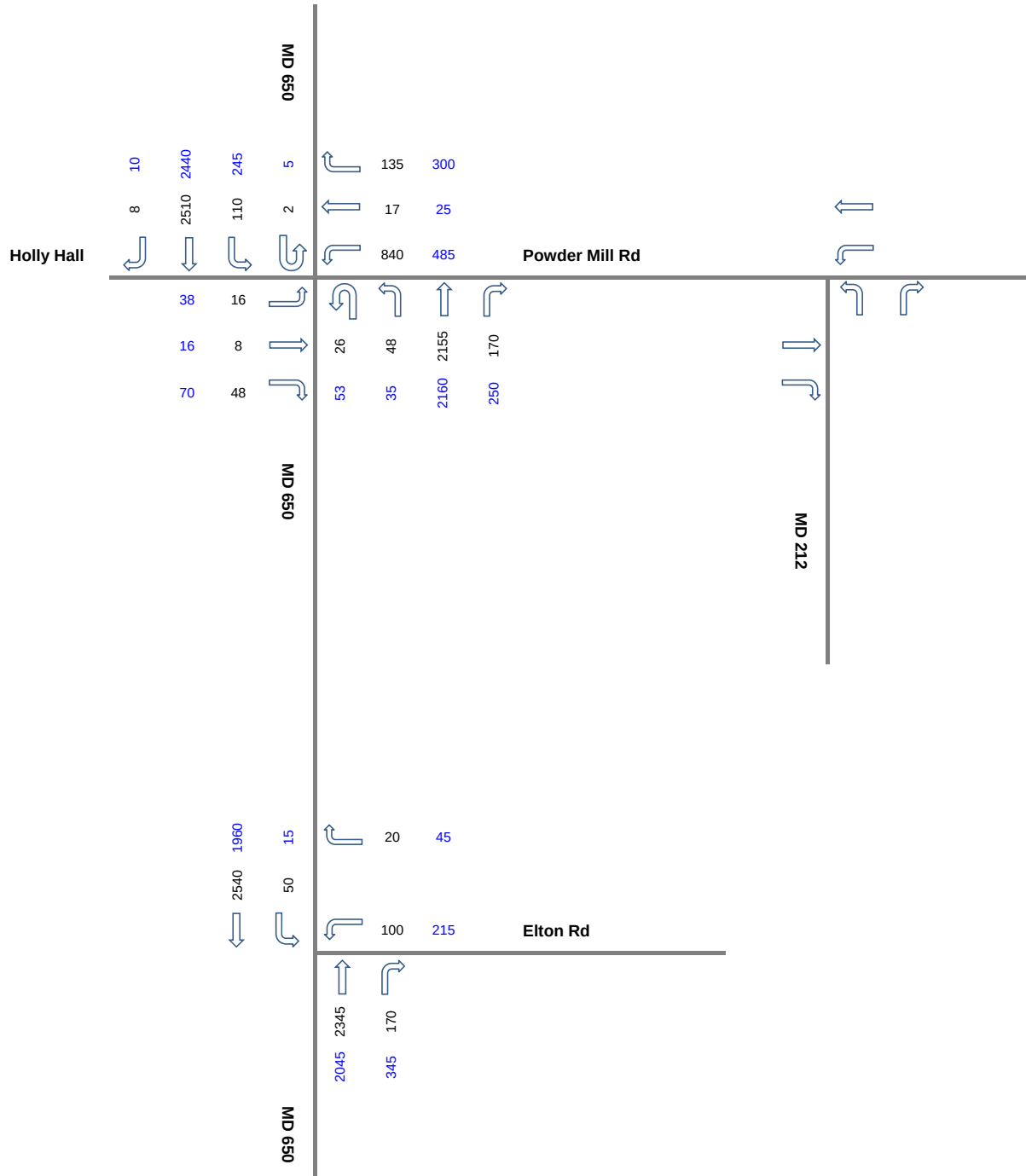
Recent Traffic Counts



Legend	
XXX :	AM Peak Hour Volume
xxx :	PM Peak Hour Volume

Figure A- 3-3

Adjusted Existing Traffic Volumes



Data Source:
MD 650 Intersection Volumes: White Oak LATIP Supplemental
Transportation Analysis, 11/12/2018

Legend	
xxx	AM Peak Hour Volume
xxx	PM Peak Hour Volume

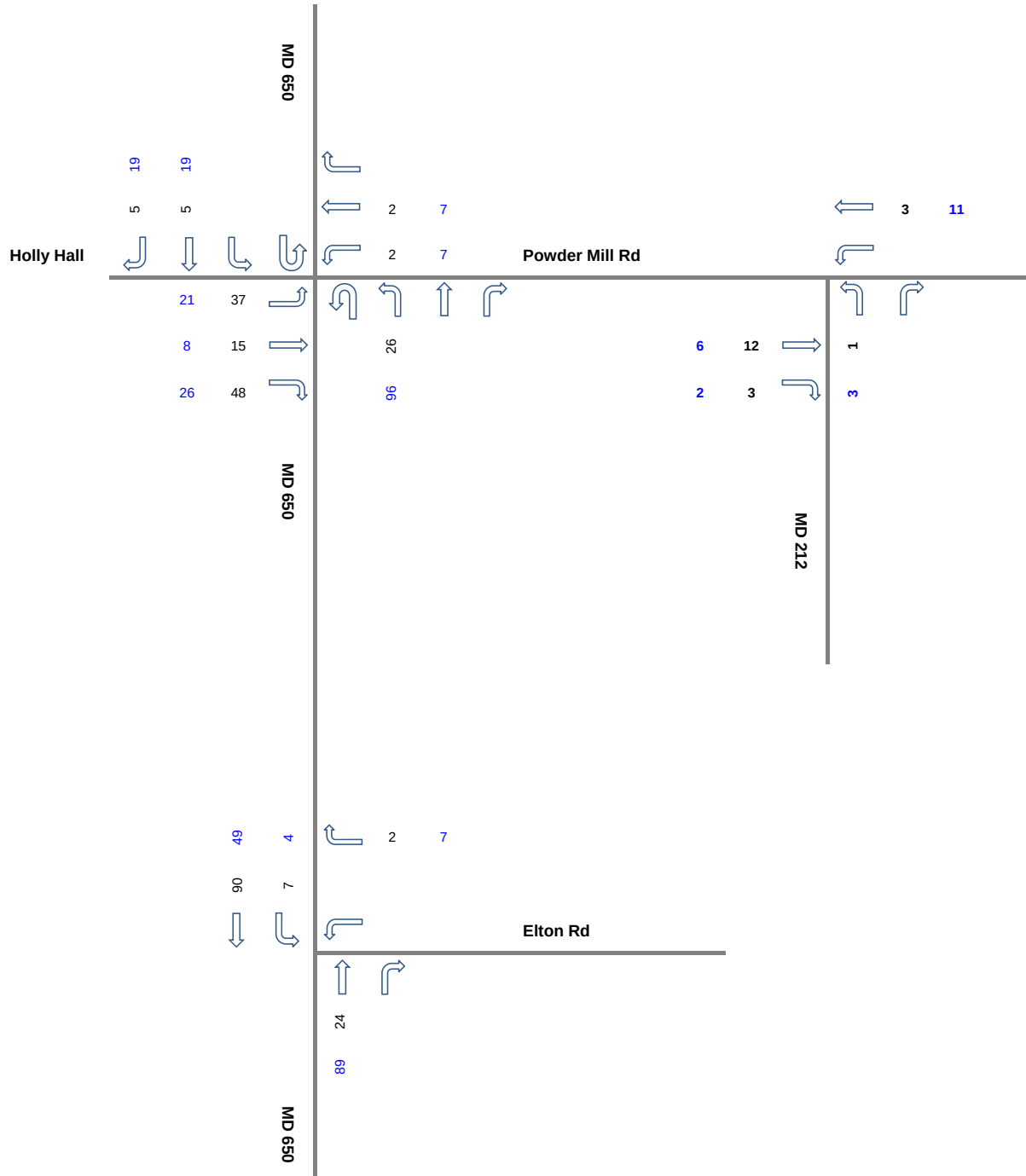
Figure A- 3-4

Background Development Volumes



Legend	
XXX	: AM Peak Hour Volume
XXX	: PM Peak Hour Volume

		Figure A- 3-6	Background Volumes Added - Adjusted	
--	--	---------------	-------------------------------------	--

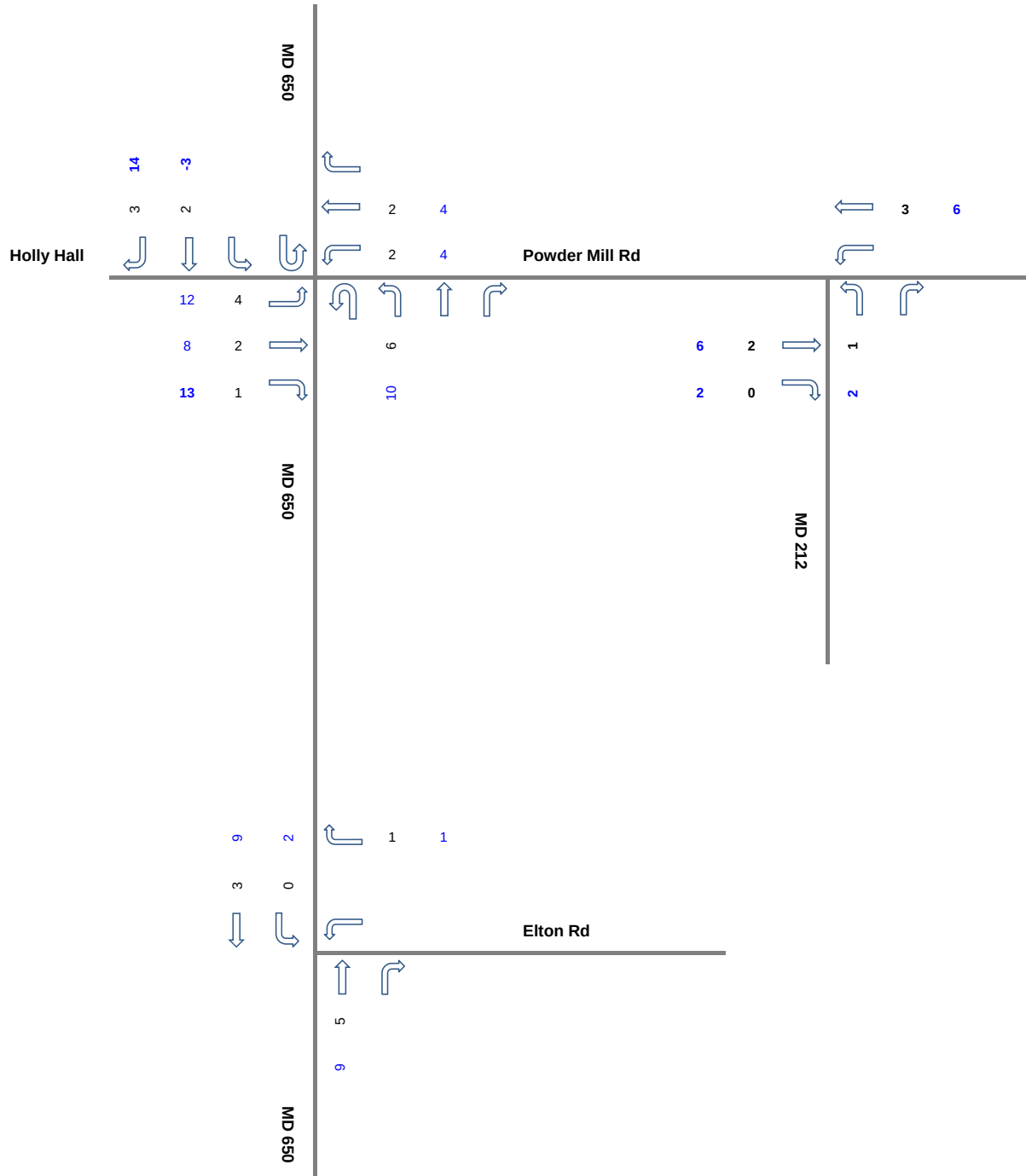


Data Source:
MD 650 Intersection Volumes: White Oak LATIP Supplemental
Transportation Analysis, 11/12/2018

Legend	
XXX :	AM Peak Hour Volume
xxx :	PM Peak Hour Volume

Figure A- 3-7

Hillandale Development Trips -
Residential

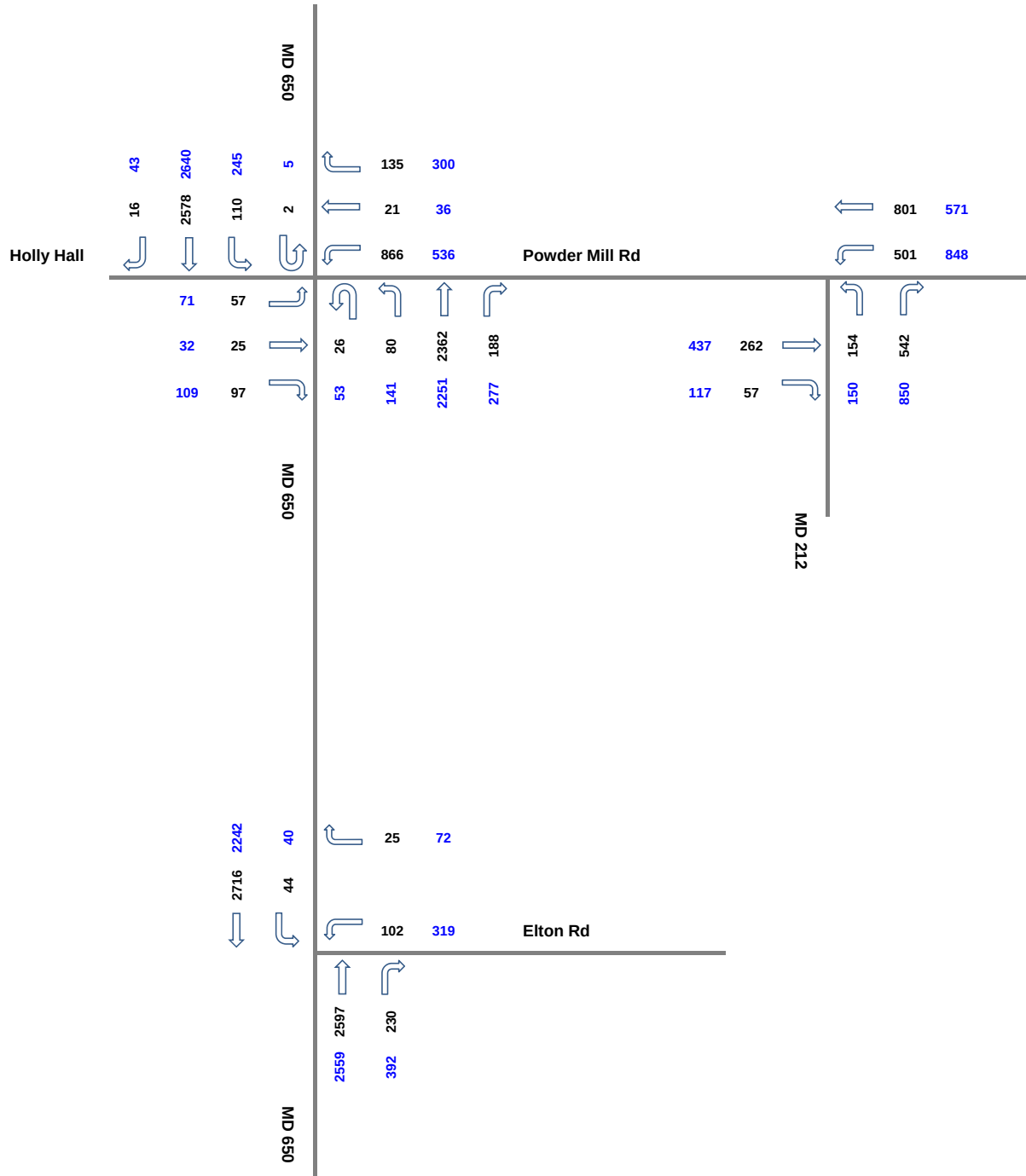


Data Source:
MD 650 Intersection Volumes: White Oak LATIP Supplemental
Transportation Analysis, 11/12/2018

Legend	
XXX :	AM Peak Hour Volume
xxx :	PM Peak Hour Volume

Figure A- 3-8

Hillandale Development Trips -
Shopping with Passby Trips



Note:

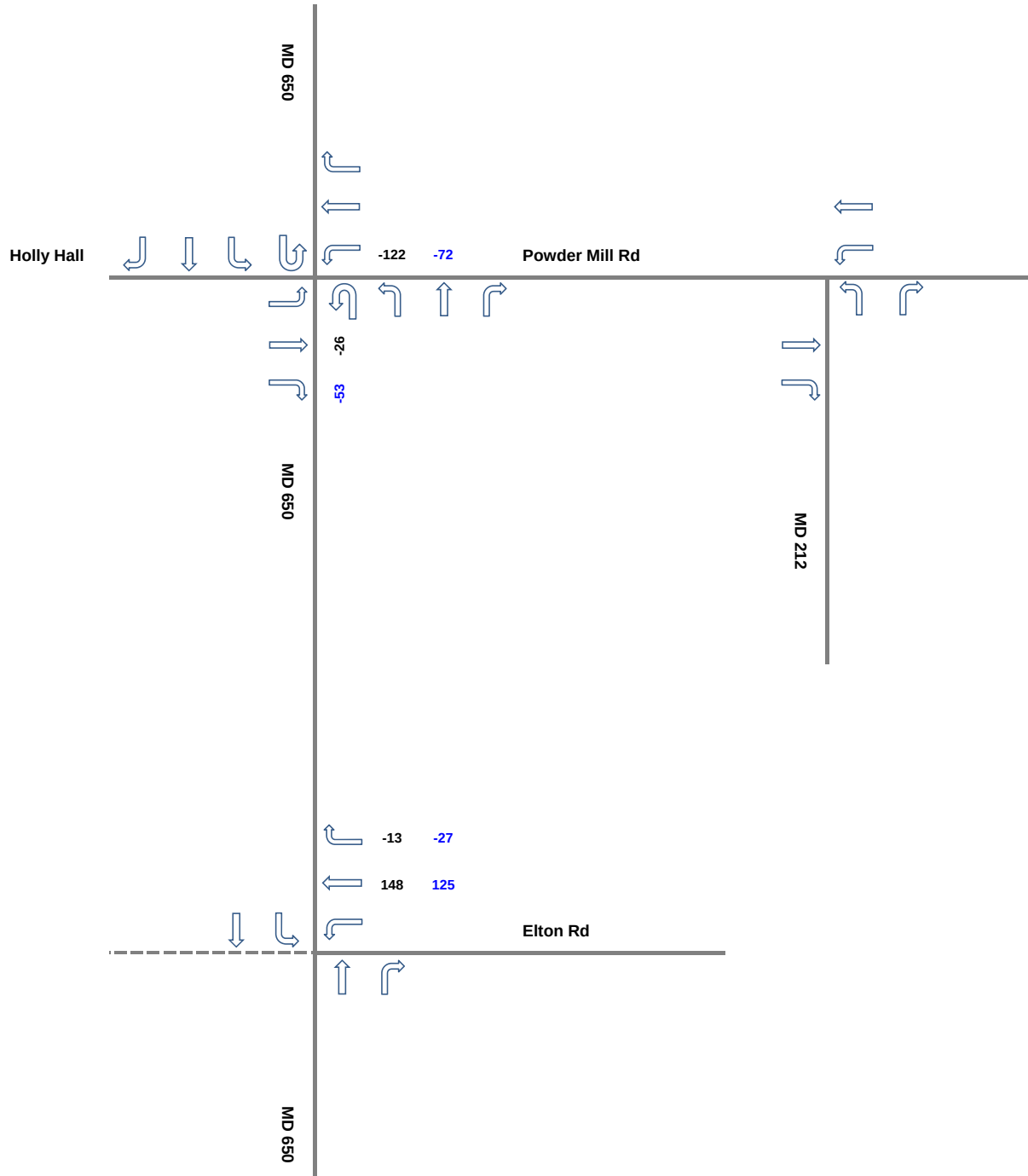
This future volumes is the sum of the adjusted Existing, Background development, and Hillandale development volumes.

Legend

XXX : AM Peak Hour Volume
xxx : PM Peak Hour Volume

Figure A- 3-9

Total Future Traffic Volumes - Adjusted



Source: Exhibit 8a, 8b, White Oak LATIP
Supplemental Transportation Analysis,
11/12/2018

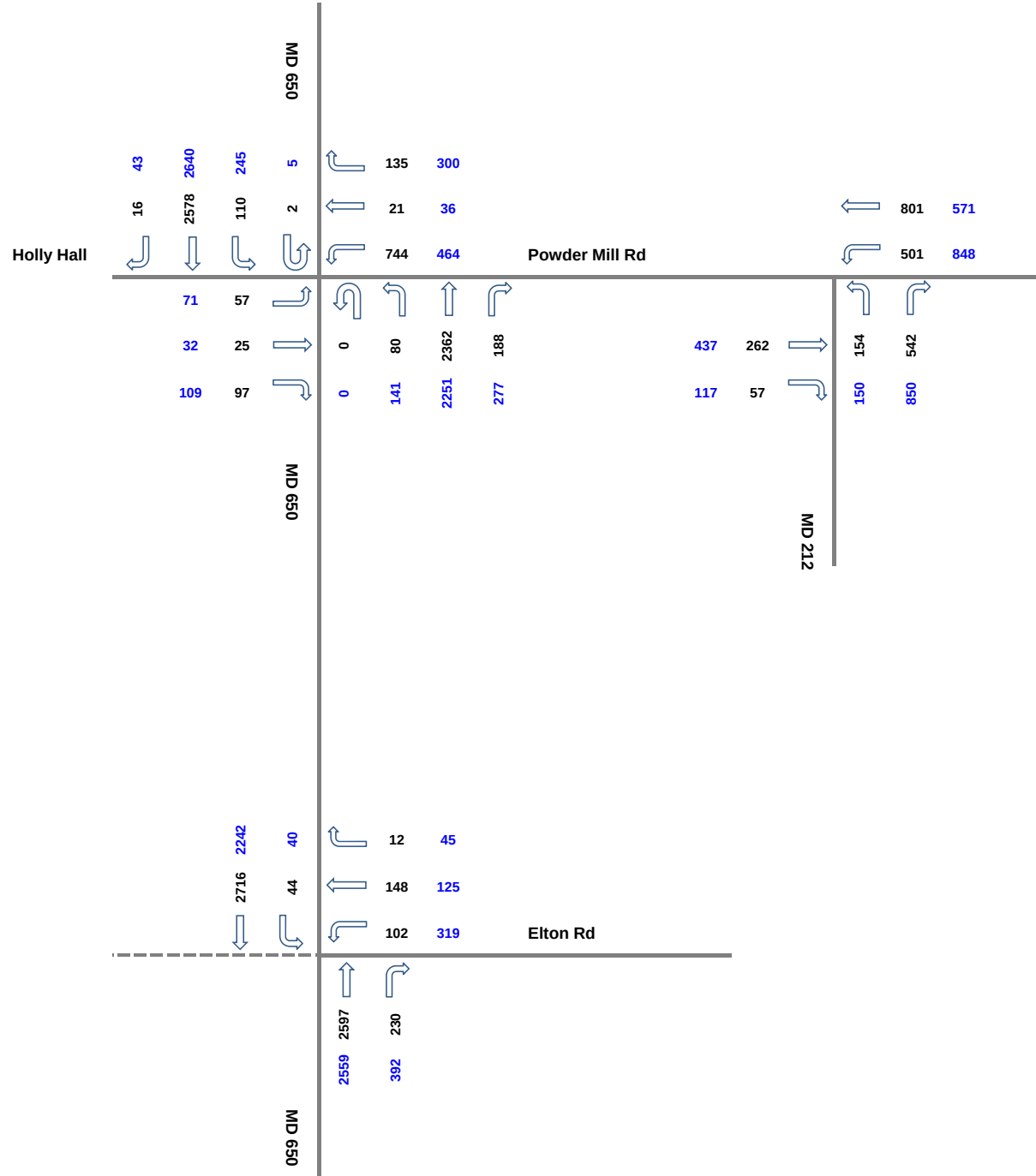
Legend

XXX : AM Peak Hour Volume

XXX : PM Peak Hour Volume

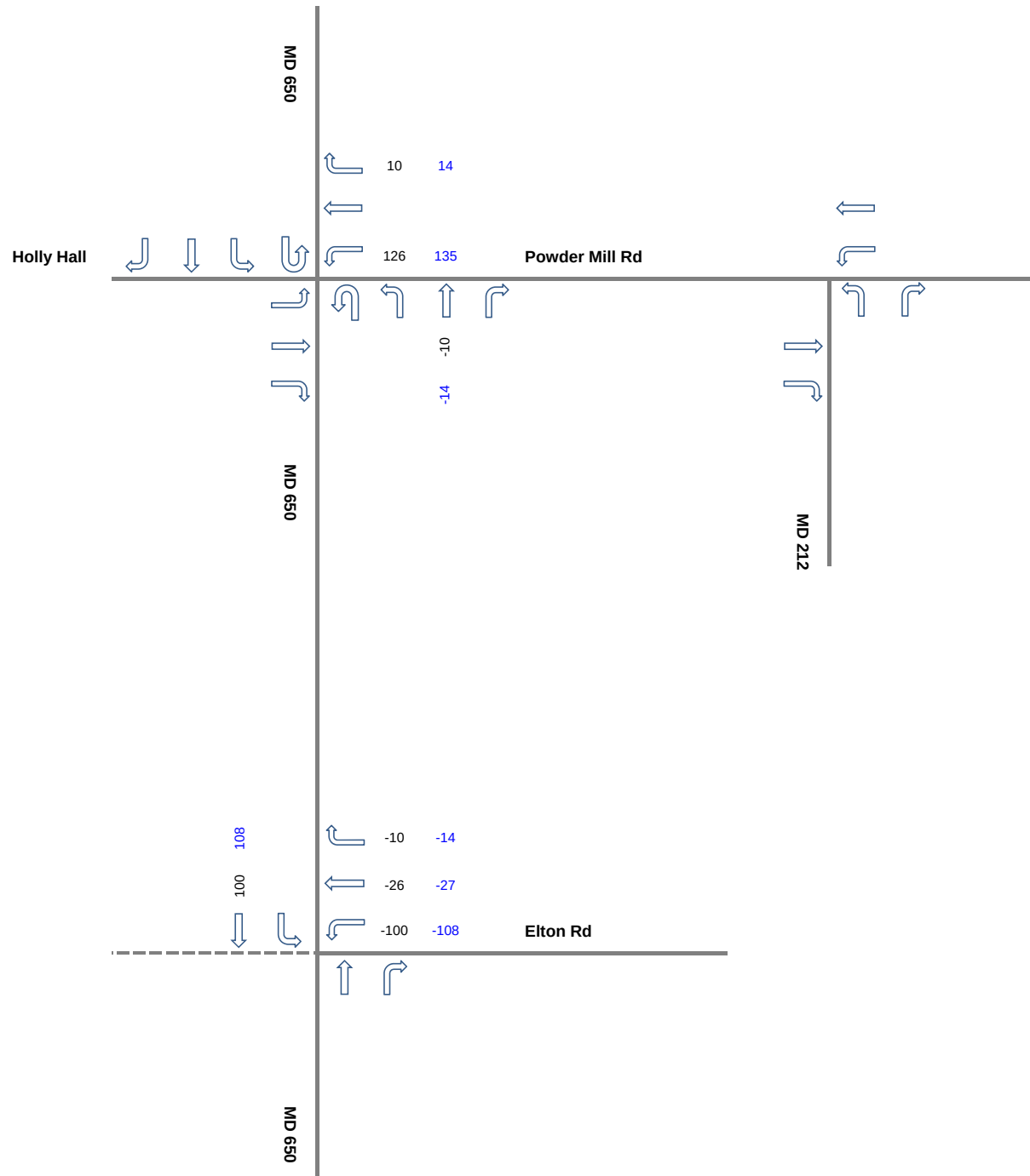
Figure A- 3-10

Potential Diversions with Slip Ramp
onto I-495 WB



Legend	
XXX :	AM Peak Hour Volume
xxx :	PM Peak Hour Volume

		Figure A- 3-11	Total Future Traffic Volumes with Diversions	
--	--	----------------	--	--



Source: Exhibit 3, White Oak LATIP
Supplemental Analysis - Cut-through
Traffic, 11/21/2018

Legend

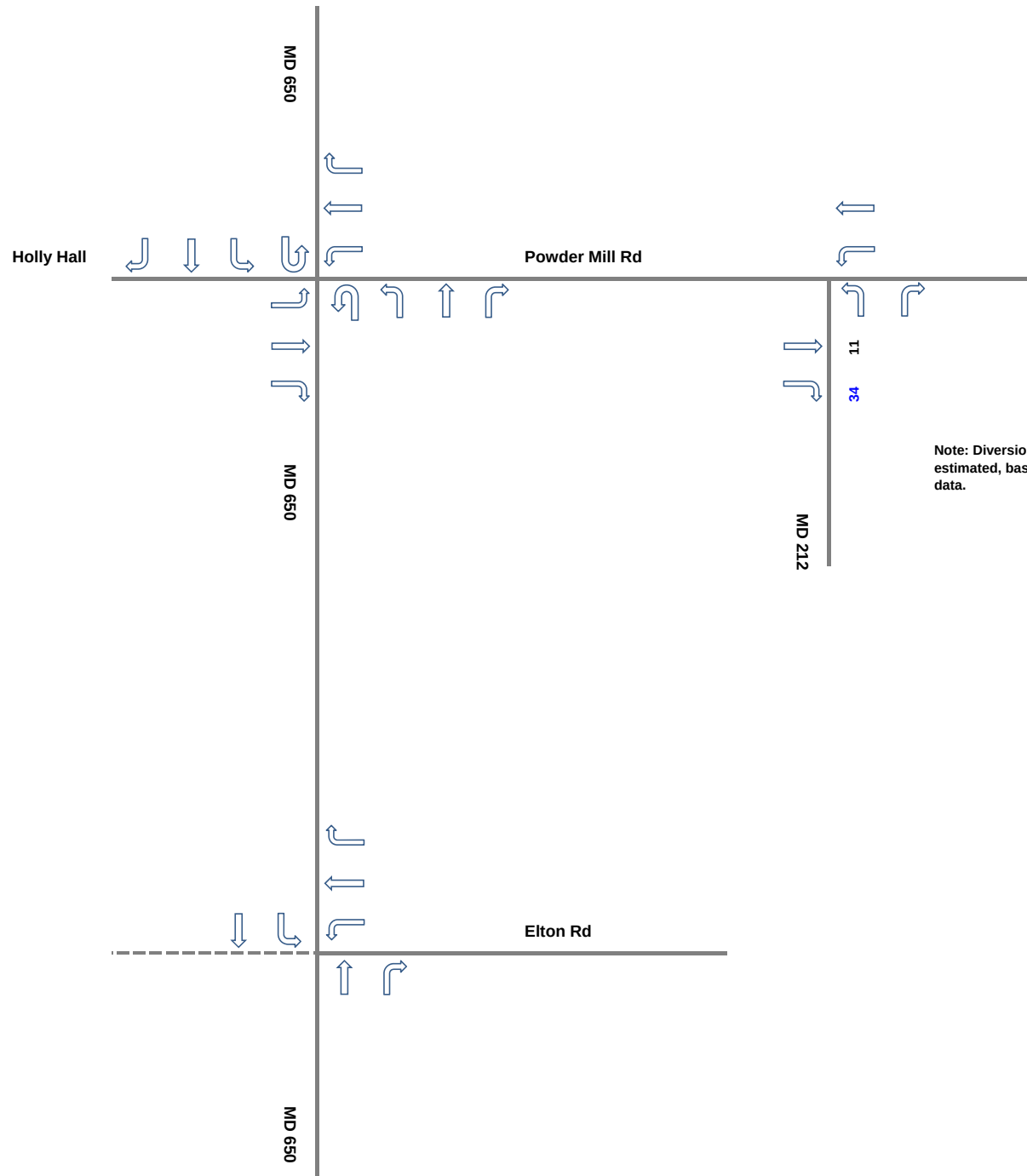
XXX : AM Peak Hour Volume
XXX : PM Peak Hour Volume

Figure A- 3-12

Diversions with WB Restriction

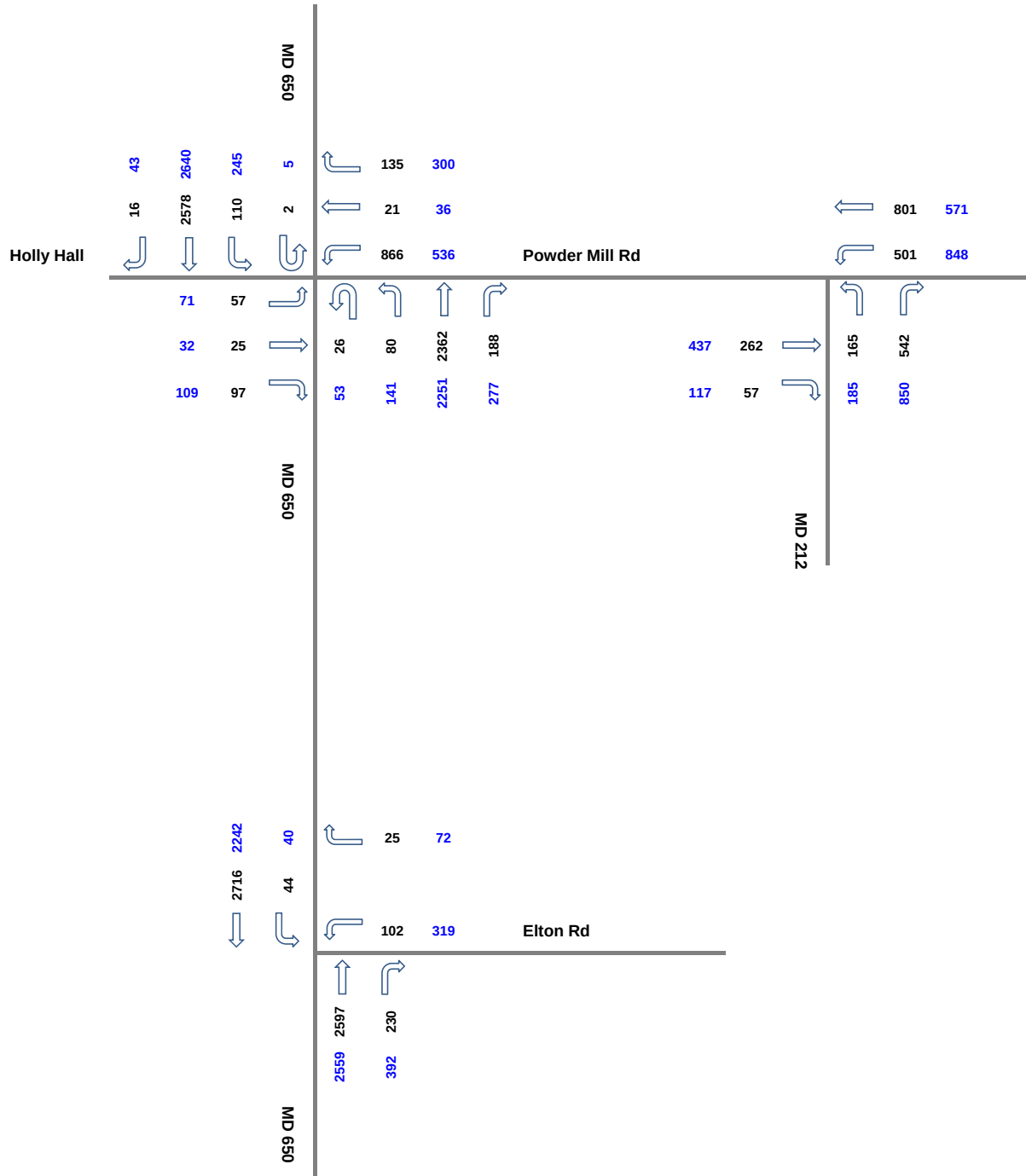


		Figure A- 3-14	Total Future Volume with WB Restricted	
--	--	----------------	--	--



Legend	
XXX	AM Peak Hour Volume
xxx	PM Peak Hour Volume

		Figure A- 3-15	Diversions with MD 212/Powder Mill Rd Improvement	
--	--	----------------	---	--



Legend	
XXX :	AM Peak Hour Volume
xxx :	PM Peak Hour Volume

Figure A- 3-16

Total Future Volume with Intersection Improvement



Legend	
XXX :	AM Peak Hour Volume
xxx :	PM Peak Hour Volume

		Figure A- 3-17	Total Future Volume with Intersection Improvement (with Slip Ramp onto I-495)	
--	--	----------------	---	--

Comparison of Volume Estimation between 2018 and Current Reports

Existing		2018 Study		Current Study		Difference		Adjustment Note for Existing Traffic	
Intersection	Approach	AM	PM	AM	PM	AM	PM	Previous Study	GF Study
MD 650/ Powder Mill Rd	NB	1915	2194	2140	2470	+225	+276	2015 Counts	Adjusted with 2018 SHA Counts for MD 650/Elton Rd
	SB	2184	2188	2245	2372	+61	+184		
	EB	72	124	72	124	0	0		
	WB	860	707	882	747	+22	+40		
	Total	5031	5213	5339	5713	+308	+500		
MD 650/ Elton Rd	NB	2233	2416	2516	2720	+283	+304		
	SB	2336	1775	2406	2018	+70	+243		
	WB	115	245	119	369	+4	+124		
	Total	4684	4436	5040	5107	+356	+671		

2040 No Build with Background Developments									
Intersection	Approach	2018 Study		Current Study		Difference		Adjustment Note for Background Traffic	
		AM	PM	AM	PM	AM	PM	Previous Study	GF Study
MD 650/ Powder Mill Rd	NB	2431	2604	2656	2722	+225	+118	Exhibits 4-6, White Oak LATIP Supplemental Transportation Analysis, 11/12/2018	Basically used the same background development volumes added in the previous study. Since there was much imbalancing for NB PM between two intersections in the previous study background volumes, the average of NB thru background trips at Powder Mill and Elton Rd were used for the PM NB background trip.
	SB	2645	2749	2706	2933	+61	+184		
	EB	179	212	179	212	0	0		
	WB	1000	832	1022	872	+22	+40		
	Total	6255	6397	6563	6739	+308	+342		
MD 650/ Elton Rd	NB	2544	2488	2827	2951	+283	+463		
	SB	2690	2039	2760	2282	+70	+243		
	WB	123	268	127	392	+4	+124		
	Total	5357	4795	5713	5625	+356	+830		

2040 Slip Ramp to I-495									
Intersection	Approach	2018 Study		Current Study		Difference		Adjustment Note for Diversion to Slip Ramp	
		AM	PM	AM	PM	AM	PM	Previous Study	GF Study
MD 650/ Powder Mill Rd	NB	2405	2551	2630	2669	+225	+118	Diversion Volume to Slip Ramp: 14.5% of WB LT at PMR, 100% of NB U- turns at PMR	Used the same diversion volumes to the slip ramp used in the previous study - 14% of WB LT at PMR for GF Study, 100% of NB U-turns at PMR
	SB	2645	2749	2706	2933	+61	+184		
	EB	179	212	179	212	0	0		
	WB	878	760	900	800	+22	+40		
	Total	6107	6272	6415	6614	+308	+342		
MD 650/ Elton Rd	NB	2544	2488	2827	2951	+283	+463		
	SB	2690	2039	2760	2282	+70	+243		
	WB	258	366	262	490	+4	+124		
	Total	5492	4893	5848	5723	+356	+830		

2040 Slip Ramp with WB Restriction on Elton									
Intersection	Approach	2018 Study		Current Study		Difference		Adjustment Note for WB Restriction	
		AM	PM	AM	PM	AM	PM	Previous Study	GF Study
MD 650/ Powder Mill Rd	NB	2395	2537	2628	2655	+233	+118	All of WB turning traffic leaving Elton Rd for AM will divert to PMR, and for PM, 50%.	Considering 2019 traffic count at Elton Road/Hillandale Shopping Center, WB restricted volumes were reduced - 50% of WB traffic leaving Elton Rd for AM will divert to PMR, and for PM, 70%.
	SB	2645	2749	2706	2933	+61	+184		
	EB	179	212	179	212	0	0		
	WB	1014	909	938	922	-76	+13		
	Total	6233	6407	6451	6722	+218	+315		
MD 650/ Elton Rd	NB	2544	2488	2827	2951	+283	+463		
	SB	2790	2147	2781	2378	-9	+231		
	WB	122	217	223	368	+101	+151		
	Total	5456	4852	5831	5696	+375	+844		



Appendix A-4

Synchro HCM Analysis Reports: LOS

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis

Existing - AM

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	WY		AAA	A	A	AAA
Traffic Volume (vph)	96	23	2294	222	36	2370
Future Volume (vph)	96	23	2294	222	36	2370
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		2.5	2.0	2.5	2.5
Lane Util. Factor	0.97		0.91	1.00	1.00	0.91
Frt	0.97		1.00	0.85	1.00	1.00
Flt Protected	0.96		1.00	1.00	0.95	1.00
Satd. Flow (prot)	3261		4916	1531	1711	4916
Flt Permitted	0.96		1.00	1.00	0.05	1.00
Satd. Flow (perm)	3261		4916	1531	93	4916
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	102	24	2440	236	38	2521
RTOR Reduction (vph)	7	0	0	0	0	0
Lane Group Flow (vph)	119	0	2440	236	38	2521
Turn Type	Prot		NA	pm+ov	Perm	NA
Protected Phases	3		2 4 9	3		6 4 9
Permitted Phases	3			2 4 9	6 4 9	
Actuated Green, G (s)	12.9		154.6	167.5	154.6	154.6
Effective Green, g (s)	15.9		158.6	170.5	158.6	158.6
Actuated g/C Ratio	0.09		0.88	0.95	0.88	0.88
Clearance Time (s)	6.0			6.0		
Vehicle Extension (s)	4.0			4.0		
Lane Grp Cap (vph)	288		4331	1467	81	4331
v/s Ratio Prot	c0.04		0.50	0.02		c0.51
v/s Ratio Perm				0.14	0.41	
v/c Ratio	0.41		0.56	0.16	0.47	0.58
Uniform Delay, d1	77.6		2.5	0.3	2.2	2.6
Progression Factor	1.00		1.21	1.00	1.54	1.06
Incremental Delay, d2	1.3		0.2	0.1	3.4	0.1
Delay (s)	78.9		3.2	0.4	6.8	2.9
Level of Service	E		A	A	A	A
Approach Delay (s)	78.9		3.0			3.0
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			4.8		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.59			
Actuated Cycle Length (s)			180.0		Sum of lost time (s)	11.5
Intersection Capacity Utilization			55.9%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

Existing - AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	16	8	48	755	17	110	26	48	1901	165	2	95
Future Volume (vph)	16	8	48	755	17	110	26	48	1901	165	2	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0		3.0	4.0			5.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00		1.00	0.91			1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99			1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (prot)	1711	1801	1531	3113	1566	1531		1711	4601			1711
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (perm)	1711	1801	1531	3113	1566	1531		1711	4601			1711
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97	0.97	1.00	0.97
Adj. Flow (vph)	16	8	49	778	18	113	26	49	1960	170	2	98
RTOR Reduction (vph)	0	0	0	0	0	86	0	0	5	0	0	0
Lane Group Flow (vph)	16	8	49	529	267	27	0	75	2125	0	0	100
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3		4	4		1	1	5		6	6
Permitted Phases			3			4						
Actuated Green, G (s)	9.8	9.8	9.8	41.4	41.4	41.4		13.2	89.3			12.0
Effective Green, g (s)	11.8	11.8	11.8	43.4	43.4	43.4		16.2	92.3			14.0
Actuated g/C Ratio	0.07	0.07	0.07	0.24	0.24	0.24		0.09	0.51			0.08
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0		6.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	0.2			3.0
Lane Grp Cap (vph)	112	118	100	750	377	369		153	2359			133
v/s Ratio Prot	0.01	0.00		0.17	c0.17			0.04	c0.46			0.06
v/s Ratio Perm			c0.03			0.02						
v/c Ratio	0.14	0.07	0.49	0.71	0.71	0.07		0.49	0.90			0.75
Uniform Delay, d1	79.3	78.9	81.2	62.5	62.5	52.8		78.0	39.7			81.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.14	1.06			1.00
Incremental Delay, d2	0.6	0.2	3.7	3.0	6.0	0.1		2.1	5.2			21.0
Delay (s)	79.9	79.2	84.9	65.5	68.5	52.9		91.3	47.4			102.3
Level of Service	E	E	F	E	E	D		F	D			F
Approach Delay (s)		83.2			64.8				48.9			
Approach LOS		F			E				D			
Intersection Summary												
HCM 2000 Control Delay			51.5				HCM 2000 Level of Service		D			
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			180.0				Sum of lost time (s)		18.5			
Intersection Capacity Utilization			80.7%				ICU Level of Service		D			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

Existing - AM



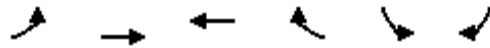
Movement	SBT	SBR
Lane Configurations	↑↑↑	↑
Traffic Volume (vph)	2140	8
Future Volume (vph)	2140	8
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	
Lane Util. Factor	0.91	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4913	
Flt Permitted	1.00	
Satd. Flow (perm)	4913	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	2206	8
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	2214	0
Turn Type	NA	
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	89.1	
Effective Green, g (s)	91.1	
Actuated g/C Ratio	0.51	
Clearance Time (s)	7.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2486	
v/s Ratio Prot	c0.45	
v/s Ratio Perm		
v/c Ratio	0.89	
Uniform Delay, d1	40.0	
Progression Factor	1.00	
Incremental Delay, d2	5.3	
Delay (s)	45.3	
Level of Service	D	
Approach Delay (s)	47.8	
Approach LOS	D	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

Existing - AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	106	520	467	0	227	47
Future Volume (vph)	106	520	467	0	227	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.38	1.00	1.00		0.95	1.00
Satd. Flow (perm)	708	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	115	565	508	0	247	51
RTOR Reduction (vph)	0	0	0	0	0	41
Lane Group Flow (vph)	115	565	508	0	247	10
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	105.2	105.2	91.8		28.6	28.6
Effective Green, g (s)	105.2	105.2	91.8		28.6	28.6
Actuated g/C Ratio	0.72	0.72	0.63		0.19	0.19
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	568	1335	1165		344	308
v/s Ratio Prot	0.01	c0.30	c0.27		c0.14	0.01
v/s Ratio Perm	0.13					
v/c Ratio	0.20	0.42	0.44		0.72	0.03
Uniform Delay, d1	7.8	8.5	14.2		55.3	47.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.2	1.0	1.2		11.2	0.2
Delay (s)	8.0	9.4	15.4		66.5	48.0
Level of Service	A	A	B		E	D
Approach Delay (s)		9.2	15.4		63.4	
Approach LOS		A	B		E	
Intersection Summary						
HCM 2000 Control Delay			22.2		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.51			
Actuated Cycle Length (s)			146.8		Sum of lost time (s)	18.0
Intersection Capacity Utilization			58.0%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
Existing - PM

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W	W	T	T	T	T
Traffic Volume (vph)	307	61	2346	374	31	1987
Future Volume (vph)	307	61	2346	374	31	1987
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0		2.5	2.0	2.5	2.5
Lane Util. Factor	0.97		0.91	1.00	1.00	0.91
Frt	0.98		1.00	0.85	1.00	1.00
Flt Protected	0.96		1.00	1.00	0.95	1.00
Satd. Flow (prot)	3270		4916	1531	1711	4916
Flt Permitted	0.96		1.00	1.00	0.04	1.00
Satd. Flow (perm)	3270		4916	1531	74	4916
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	327	65	2496	398	33	2114
RTOR Reduction (vph)	8	0	0	0	0	0
Lane Group Flow (vph)	384	0	2496	398	33	2114
Turn Type	Prot		NA	pm+ov	Perm	NA
Protected Phases	3		2 4 9	3		6 4 9
Permitted Phases	3			2 4 9	6 4 9	
Actuated Green, G (s)	28.8		138.7	167.5	138.7	138.7
Effective Green, g (s)	31.8		142.7	170.5	142.7	142.7
Actuated g/C Ratio	0.18		0.79	0.95	0.79	0.79
Clearance Time (s)	6.0			6.0		
Vehicle Extension (s)	4.0			4.0		
Lane Grp Cap (vph)	577		3897	1467	58	3897
v/s Ratio Prot	c0.12		c0.51	0.05		0.43
v/s Ratio Perm				0.21	0.45	
v/c Ratio	0.67		0.64	0.27	0.57	0.54
Uniform Delay, d1	69.1		7.9	0.3	7.0	6.8
Progression Factor	1.00		0.83	1.00	1.06	0.61
Incremental Delay, d2	3.2		0.3	0.1	10.4	0.1
Delay (s)	72.3		6.8	0.5	17.9	4.2
Level of Service	E		A	A	B	A
Approach Delay (s)	72.3		6.0			4.5
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			10.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.67			
Actuated Cycle Length (s)			180.0		Sum of lost time (s)	11.5
Intersection Capacity Utilization			62.7%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

Existing - PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	38	16	70	462	25	260	53	35	2136	246	2	95
Future Volume (vph)	38	16	70	462	25	260	53	35	2136	246	2	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0		3.0	4.0			5.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00		1.00	0.91			1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.98			1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (prot)	1711	1801	1531	3113	1572	1531		1711	4585			1711
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (perm)	1711	1801	1531	3113	1572	1531		1711	4585			1711
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97	0.97	1.00	0.97
Adj. Flow (vph)	39	16	72	476	26	268	53	36	2202	254	2	98
RTOR Reduction (vph)	0	0	0	0	0	147	0	0	7	0	0	0
Lane Group Flow (vph)	39	16	72	333	169	121	0	89	2449	0	0	100
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3		4	4		1	1	5		6	6
Permitted Phases			3			4						
Actuated Green, G (s)	13.8	13.8	13.8	25.8	25.8	25.8		14.7	92.9			20.0
Effective Green, g (s)	15.8	15.8	15.8	27.8	27.8	27.8		17.7	95.9			22.0
Actuated g/C Ratio	0.09	0.09	0.09	0.15	0.15	0.15		0.10	0.53			0.12
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0		6.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	0.2			3.0
Lane Grp Cap (vph)	150	158	134	480	242	236		168	2442			209
v/s Ratio Prot	0.02	0.01		0.11	c0.11			0.05	c0.53			0.06
v/s Ratio Perm			c0.05			0.08						
v/c Ratio	0.26	0.10	0.54	0.69	0.70	0.51		0.53	1.00			0.48
Uniform Delay, d1	76.6	75.6	78.6	72.1	72.1	69.9		77.2	42.0			73.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.09	0.50			1.00
Incremental Delay, d2	0.9	0.3	4.1	4.3	8.5	1.9		2.4	17.0			1.7
Delay (s)	77.6	75.8	82.7	76.4	80.6	71.7		86.8	38.1			75.4
Level of Service	E	E	F	E	F	E		F	D			E
Approach Delay (s)		80.3			75.7				39.8			
Approach LOS		F			E				D			
Intersection Summary												
HCM 2000 Control Delay			43.9				HCM 2000 Level of Service		D			
HCM 2000 Volume to Capacity ratio			0.89									
Actuated Cycle Length (s)			180.0				Sum of lost time (s)		18.5			
Intersection Capacity Utilization			90.4%				ICU Level of Service		E			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

Existing - PM



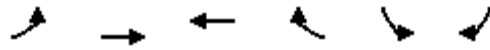
Movement	SBT	SBR
Lane Configurations	↑↑↑	↘
Traffic Volume (vph)	2140	8
Future Volume (vph)	2140	8
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	
Lane Util. Factor	0.91	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4913	
Flt Permitted	1.00	
Satd. Flow (perm)	4913	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	2206	8
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	2214	0
Turn Type	NA	
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	99.2	
Effective Green, g (s)	101.2	
Actuated g/C Ratio	0.56	
Clearance Time (s)	7.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2762	
v/s Ratio Prot	c0.45	
v/s Ratio Perm		
v/c Ratio	0.80	
Uniform Delay, d1	31.4	
Progression Factor	1.00	
Incremental Delay, d2	2.6	
Delay (s)	34.0	
Level of Service	C	
Approach Delay (s)	35.7	
Approach LOS	D	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

Existing - PM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	114	799	812	0	395	105
Future Volume (vph)	114	799	812	0	395	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.13	1.00	1.00		0.95	1.00
Satd. Flow (perm)	237	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	124	868	883	0	429	114
RTOR Reduction (vph)	0	0	0	0	0	69
Lane Group Flow (vph)	124	868	883	0	429	45
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	105.0	105.0	89.8		35.0	35.0
Effective Green, g (s)	105.0	105.0	89.8		35.0	35.0
Actuated g/C Ratio	0.69	0.69	0.59		0.23	0.23
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	264	1278	1093		404	362
v/s Ratio Prot	0.03	c0.47	c0.47		c0.24	0.03
v/s Ratio Perm	0.29					
v/c Ratio	0.47	0.68	0.81		1.06	0.13
Uniform Delay, d1	22.2	14.1	24.8		59.0	46.8
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.3	2.9	6.4		62.1	0.6
Delay (s)	23.5	17.0	31.3		121.1	47.4
Level of Service	C	B	C		F	D
Approach Delay (s)		17.8	31.3		105.6	
Approach LOS		B	C		F	
Intersection Summary						
HCM 2000 Control Delay			42.5		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.88			
Actuated Cycle Length (s)			153.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			85.9%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 AM

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			  			  
Traffic Volume (vph)	102	25	2597	230	44	2716
Future Volume (vph)	102	25	2597	230	44	2716
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	2.5	2.0	2.5	2.5
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1711	1531	4916	1531	1711	4916
Flt Permitted	0.95	1.00	1.00	1.00	0.03	1.00
Satd. Flow (perm)	1711	1531	4916	1531	58	4916
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	109	27	2763	245	47	2889
RTOR Reduction (vph)	0	4	0	0	0	0
Lane Group Flow (vph)	109	23	2763	245	47	2889
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	3		2 4 9	3		6 4 9
Permitted Phases	3	3		2 4 9	6 4 9	
Actuated Green, G (s)	18.0	18.0	149.5	167.5	149.5	149.5
Effective Green, g (s)	21.0	20.0	153.5	170.5	153.5	153.5
Actuated g/C Ratio	0.12	0.11	0.85	0.95	0.85	0.85
Clearance Time (s)	6.0	6.0		6.0		
Vehicle Extension (s)	4.0	4.0		4.0		
Lane Grp Cap (vph)	199	170	4192	1467	49	4192
v/s Ratio Prot	c0.06		0.56	0.02		0.59
v/s Ratio Perm		0.02		0.14	c0.80	
v/c Ratio	0.55	0.14	0.66	0.17	0.96	0.69
Uniform Delay, d1	75.0	72.2	4.5	0.3	10.7	4.7
Progression Factor	1.00	1.00	1.09	1.00	1.22	0.65
Incremental Delay, d2	3.8	0.5	0.3	0.1	62.3	0.2
Delay (s)	78.8	72.7	5.2	0.4	75.4	3.3
Level of Service	E	E	A	A	E	A
Approach Delay (s)	77.6		4.8			4.4
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			6.2		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.93			
Actuated Cycle Length (s)			180.0		Sum of lost time (s)	11.5
Intersection Capacity Utilization			64.8%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	57	25	97	866	21	135	26	80	2360	188	2	110
Future Volume (vph)	57	25	97	866	21	135	26	80	2360	188	2	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0		3.0	4.0			5.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00		1.00	0.91			1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.99			1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (prot)	1711	1801	1531	3113	1566	1531		1711	4605			1711
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (perm)	1711	1801	1531	3113	1566	1531		1711	4605			1711
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97	0.97	1.00	0.97
Adj. Flow (vph)	59	26	100	893	22	139	26	82	2433	194	2	113
RTOR Reduction (vph)	0	0	0	0	0	108	0	0	5	0	0	0
Lane Group Flow (vph)	59	26	100	607	308	31	0	108	2622	0	0	115
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3		4	4		1	1	5		6	6
Permitted Phases			3			4						
Actuated Green, G (s)	17.1	17.1	17.1	38.4	38.4	38.4		9.0	84.0			13.0
Effective Green, g (s)	19.1	19.1	19.1	40.4	40.4	40.4		12.0	87.0			15.0
Actuated g/C Ratio	0.11	0.11	0.11	0.22	0.22	0.22		0.07	0.48			0.08
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0		6.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	0.2			3.0
Lane Grp Cap (vph)	181	191	162	698	351	343		114	2225			142
v/s Ratio Prot	0.03	0.01		0.19	c0.20			0.06	c0.57			0.07
v/s Ratio Perm			c0.07			0.02						
v/c Ratio	0.33	0.14	0.62	0.87	0.88	0.09		0.95	1.18			0.81
Uniform Delay, d1	74.5	73.0	77.0	67.3	67.4	55.3		83.7	46.5			81.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.28	0.55			1.00
Incremental Delay, d2	1.1	0.3	6.8	11.2	21.1	0.1		58.0	84.2			27.7
Delay (s)	75.5	73.3	83.8	78.5	88.5	55.4		165.5	109.8			108.8
Level of Service	E	E	F	E	F	E		F	F			F
Approach Delay (s)		79.7			78.3				112.0			
Approach LOS		E			E				F			
Intersection Summary												
HCM 2000 Control Delay			96.1				HCM 2000 Level of Service		F			
HCM 2000 Volume to Capacity ratio			1.04									
Actuated Cycle Length (s)			180.0				Sum of lost time (s)		18.5			
Intersection Capacity Utilization			93.9%				ICU Level of Service		F			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM



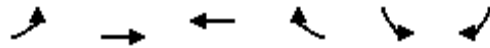
Movement	SBT	SBR
Lane Configurations	↑↑↑	↑
Traffic Volume (vph)	2578	16
Future Volume (vph)	2578	16
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	
Lane Util. Factor	0.91	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4911	
Flt Permitted	1.00	
Satd. Flow (perm)	4911	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	2658	16
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	2674	0
Turn Type	NA	
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	89.0	
Effective Green, g (s)	91.0	
Actuated g/C Ratio	0.51	
Clearance Time (s)	7.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2482	
v/s Ratio Prot	c0.54	
v/s Ratio Perm		
v/c Ratio	1.08	
Uniform Delay, d1	44.5	
Progression Factor	1.00	
Incremental Delay, d2	42.9	
Delay (s)	87.4	
Level of Service	F	
Approach Delay (s)	88.3	
Approach LOS	F	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	154	542	501	0	262	57
Future Volume (vph)	154	542	501	0	262	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.35	1.00	1.00		0.95	1.00
Satd. Flow (perm)	645	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	167	589	545	0	285	62
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	167	589	545	0	285	13
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	105.1	105.1	90.1		30.9	30.9
Effective Green, g (s)	105.1	105.1	90.1		30.9	30.9
Actuated g/C Ratio	0.71	0.71	0.60		0.21	0.21
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	530	1314	1126		367	328
v/s Ratio Prot	0.02	c0.32	c0.29		c0.16	0.01
v/s Ratio Perm	0.20					
v/c Ratio	0.32	0.45	0.48		0.78	0.04
Uniform Delay, d1	9.5	9.5	16.5		55.8	47.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.3	1.1	1.5		13.2	0.2
Delay (s)	9.8	10.6	17.9		69.0	47.4
Level of Service	A	B	B		E	D
Approach Delay (s)		10.4	17.9		65.1	
Approach LOS		B	B		E	
Intersection Summary						
HCM 2000 Control Delay			24.4		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.56			
Actuated Cycle Length (s)			149.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			64.4%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			  			  
Traffic Volume (vph)	319	72	2539	392	40	2242
Future Volume (vph)	319	72	2539	392	40	2242
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	2.5	2.0	2.5	2.5
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1711	1531	4916	1531	1711	4916
Flt Permitted	0.95	1.00	1.00	1.00	0.03	1.00
Satd. Flow (perm)	1711	1531	4916	1531	54	4916
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	339	77	2701	417	43	2385
RTOR Reduction (vph)	0	5	0	0	0	0
Lane Group Flow (vph)	339	72	2701	417	43	2385
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	3		2 4 9	3		6 4 9
Permitted Phases	3	3		2 4 9	6 4 9	
Actuated Green, G (s)	38.4	38.4	129.1	167.5	129.1	129.1
Effective Green, g (s)	41.4	40.4	133.1	170.5	133.1	133.1
Actuated g/C Ratio	0.23	0.22	0.74	0.95	0.74	0.74
Clearance Time (s)	6.0	6.0		6.0		
Vehicle Extension (s)	4.0	4.0		4.0		
Lane Grp Cap (vph)	393	343	3635	1467	39	3635
v/s Ratio Prot	c0.20		0.55	0.07		0.49
v/s Ratio Perm		0.05		0.21	c0.79	
v/c Ratio	0.86	0.21	0.74	0.28	1.10	0.66
Uniform Delay, d1	66.6	56.8	13.6	0.3	23.5	11.9
Progression Factor	1.00	1.00	0.60	1.00	0.74	0.39
Incremental Delay, d2	17.9	0.4	0.6	0.1	114.0	0.2
Delay (s)	84.5	57.2	8.8	0.4	131.2	4.8
Level of Service	F	E	A	A	F	A
Approach Delay (s)	79.4		7.7			7.1
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			12.4		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			1.06			
Actuated Cycle Length (s)			180.0		Sum of lost time (s)	11.5
Intersection Capacity Utilization			73.4%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis
2040 PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	71	32	109	536	36	300	53	141	2251	277	5	245
Future Volume (vph)	71	32	109	536	36	300	53	141	2251	277	5	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0		3.0	4.0			5.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00		1.00	0.91			1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.98			1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (prot)	1711	1801	1531	3113	1575	1531		1711	4580			1711
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (perm)	1711	1801	1531	3113	1575	1531		1711	4580			1711
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97	0.97	1.00	0.97
Adj. Flow (vph)	73	33	112	553	37	309	53	145	2321	286	5	253
RTOR Reduction (vph)	0	0	0	0	0	143	0	0	8	0	0	0
Lane Group Flow (vph)	73	33	112	393	197	166	0	198	2599	0	0	258
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3		4	4		1	1	5		6	6
Permitted Phases			3			4						
Actuated Green, G (s)	18.5	18.5	18.5	28.0	28.0	28.0		15.0	85.0			21.0
Effective Green, g (s)	20.5	20.5	20.5	30.0	30.0	30.0		18.0	88.0			23.0
Actuated g/C Ratio	0.11	0.11	0.11	0.17	0.17	0.17		0.10	0.49			0.13
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0		6.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	0.2			3.0
Lane Grp Cap (vph)	194	205	174	518	262	255		171	2239			218
v/s Ratio Prot	0.04	0.02		c0.13	0.13			0.12	c0.57			c0.15
v/s Ratio Perm			c0.07			0.11						
v/c Ratio	0.38	0.16	0.64	0.76	0.75	0.65		1.16	1.16			1.18
Uniform Delay, d1	73.8	72.0	76.3	71.5	71.5	70.1		81.0	46.0			78.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		0.83	0.48			1.00
Incremental Delay, d2	1.2	0.4	7.9	6.3	11.5	5.6		107.9	76.4			119.4
Delay (s)	75.1	72.4	84.2	77.8	83.0	75.7		175.2	98.6			197.9
Level of Service	E	E	F	E	F	E		F	F			F
Approach Delay (s)		79.3			78.2				104.0			
Approach LOS		E			E				F			
Intersection Summary												
HCM 2000 Control Delay			96.5				HCM 2000 Level of Service		F			
HCM 2000 Volume to Capacity ratio			1.02									
Actuated Cycle Length (s)			180.0				Sum of lost time (s)		18.5			
Intersection Capacity Utilization			104.4%				ICU Level of Service		G			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

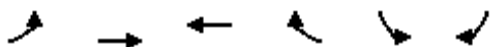
2040 PM

	↓	↙
Movement	SBT	SBR
Lane Configurations	↑↑↑	↔
Traffic Volume (vph)	2640	43
Future Volume (vph)	2640	43
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	
Lane Util. Factor	0.91	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4904	
Flt Permitted	1.00	
Satd. Flow (perm)	4904	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	2722	44
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	2765	0
Turn Type	NA	
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	92.0	
Effective Green, g (s)	94.0	
Actuated g/C Ratio	0.52	
Clearance Time (s)	7.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2560	
v/s Ratio Prot	0.56	
v/s Ratio Perm		
v/c Ratio	1.08	
Uniform Delay, d1	43.0	
Progression Factor	1.00	
Incremental Delay, d2	43.8	
Delay (s)	86.8	
Level of Service	F	
Approach Delay (s)	96.3	
Approach LOS	F	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 PM



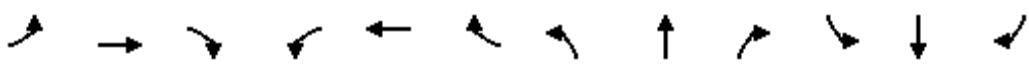
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	150	850	821	0	437	117
Future Volume (vph)	150	850	821	0	437	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.05	1.00	1.00		0.95	1.00
Satd. Flow (perm)	96	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	163	924	892	0	475	127
RTOR Reduction (vph)	0	0	0	0	0	69
Lane Group Flow (vph)	163	924	892	0	475	58
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	97.0	97.0	78.8		43.0	43.0
Effective Green, g (s)	97.0	97.0	78.8		43.0	43.0
Actuated g/C Ratio	0.63	0.63	0.52		0.28	0.28
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	205	1181	959		497	444
v/s Ratio Prot	0.07	c0.50	c0.48		c0.27	0.04
v/s Ratio Perm	0.44					
v/c Ratio	0.80	0.78	0.93		0.96	0.13
Uniform Delay, d1	46.5	20.3	34.5		54.1	41.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	18.8	5.2	16.4		30.6	0.5
Delay (s)	65.4	25.5	51.0		84.6	41.5
Level of Service	E	C	D		F	D
Approach Delay (s)		31.5	51.0		75.5	
Approach LOS		C	D		E	
Intersection Summary						
HCM 2000 Control Delay			48.5		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.94			
Actuated Cycle Length (s)			153.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			90.7%		ICU Level of Service	E
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis

2040 AM - Alt. 1

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	81	133	10	0	2597	230	44	2737	0
Future Volume (vph)	0	0	0	81	133	10	0	2597	230	44	2737	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	6.5			2.5	2.0	2.5	2.5	
Lane Util. Factor				0.95	0.95			0.91	1.00	1.00	0.91	
Frt				1.00	0.99			1.00	0.85	1.00	1.00	
Flt Protected				0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1625	1687			4916	1531	1711	4916	
Flt Permitted				0.95	1.00			1.00	1.00	0.03	1.00	
Satd. Flow (perm)				1625	1687			4916	1531	61	4916	
Peak-hour factor, PHF	1.00	1.00	1.00	0.94	1.00	0.94	1.00	0.94	0.94	0.94	0.94	1.00
Adj. Flow (vph)	0	0	0	86	133	11	0	2763	245	47	2912	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	77	152	0	0	2763	245	47	2912	0
Turn Type				custom	NA			NA	pm+ov	Perm	NA	
Protected Phases				3	8!			2 4 9!	3		6 4 9!	
Permitted Phases				3					2 4 9		6 4 9!	
Actuated Green, G (s)				14.9	64.5			152.6	167.5	152.6	152.6	
Effective Green, g (s)				17.9	64.5			156.6	170.5	156.6	156.6	
Actuated g/C Ratio				0.10	0.36			0.87	0.95	0.87	0.87	
Clearance Time (s)				6.0	6.5				6.0			
Vehicle Extension (s)				4.0	4.0				4.0			
Lane Grp Cap (vph)				161	604			4276	1467	53	4276	
v/s Ratio Prot				c0.05	0.02			0.56	0.02		0.59	
v/s Ratio Perm					0.07				0.14	c0.77		
v/c Ratio				0.48	0.25			0.65	0.17	0.89	0.68	
Uniform Delay, d1				76.6	40.7			3.5	0.3	6.7	3.7	
Progression Factor				1.00	1.00			1.29	1.00	1.54	0.74	
Incremental Delay, d2				3.0	0.3			0.3	0.1	42.9	0.2	
Delay (s)				79.7	41.0			4.8	0.4	53.1	2.9	
Level of Service				E	D			A	A	D	A	
Approach Delay (s)		0.0			54.0			4.4			3.7	
Approach LOS		A			D			A			A	
Intersection Summary												
HCM 2000 Control Delay			5.9			HCM 2000 Level of Service			A			
HCM 2000 Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			180.0			Sum of lost time (s)			11.5			
Intersection Capacity Utilization			68.7%			ICU Level of Service			C			
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 AM - Alt. 1

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	57	25	97	779	21	137	80	2360	188	2	110	2578
Future Volume (vph)	57	25	97	779	21	137	80	2360	188	2	110	2578
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0	3.0	4.0			5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.91			1.00	0.91
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99			1.00	1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1711	1801	1531	3113	1566	1531	1711	4605			1711	4911
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)	1711	1801	1531	3113	1566	1531	1711	4605			1711	4911
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97
Adj. Flow (vph)	59	26	100	803	22	141	82	2433	194	2	113	2658
RTOR Reduction (vph)	0	0	0	0	0	109	0	5	0	0	0	0
Lane Group Flow (vph)	59	26	100	546	279	32	82	2622	0	0	115	2674
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA		Prot	Prot	NA
Protected Phases	3	3		4	4		1	5		6	6	2
Permitted Phases			3			4						
Actuated Green, G (s)	17.1	17.1	17.1	38.4	38.4	38.4	9.0	84.0			13.0	89.0
Effective Green, g (s)	19.1	19.1	19.1	40.4	40.4	40.4	12.0	87.0			15.0	91.0
Actuated g/C Ratio	0.11	0.11	0.11	0.22	0.22	0.22	0.07	0.48			0.08	0.51
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0	6.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.2			3.0	0.2
Lane Grp Cap (vph)	181	191	162	698	351	343	114	2225			142	2482
v/s Ratio Prot	0.03	0.01		0.18	c0.18		0.05	c0.57			0.07	c0.54
v/s Ratio Perm			c0.07			0.02						
v/c Ratio	0.33	0.14	0.62	0.78	0.79	0.09	0.72	1.18			0.81	1.08
Uniform Delay, d1	74.5	73.0	77.0	65.7	65.9	55.3	82.3	46.5			81.1	44.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.29	0.56			1.00	1.00
Incremental Delay, d2	1.1	0.3	6.8	5.7	11.7	0.1	15.7	84.3			27.7	42.9
Delay (s)	75.5	73.3	83.8	71.4	77.6	55.4	121.8	110.1			108.8	87.4
Level of Service	E	E	F	E	E	E	F	F			F	F
Approach Delay (s)		79.7			70.8			110.5				88.3
Approach LOS		E			E			F				F
Intersection Summary												
HCM 2000 Control Delay			94.6									
HCM 2000 Volume to Capacity ratio			1.02									
Actuated Cycle Length (s)			180.0									
Intersection Capacity Utilization			91.9%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 1

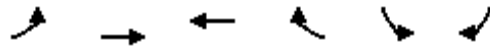
Movement	SBR
Lane Configurations	
Traffic Volume (vph)	16
Future Volume (vph)	16
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Flt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	16
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 1



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	166	542	492	0	262	57
Future Volume (vph)	166	542	492	0	262	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.35	1.00	1.00		0.95	1.00
Satd. Flow (perm)	655	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	180	589	535	0	285	62
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	180	589	535	0	285	13
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	105.1	105.1	89.7		30.9	30.9
Effective Green, g (s)	105.1	105.1	89.7		30.9	30.9
Actuated g/C Ratio	0.71	0.71	0.60		0.21	0.21
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	539	1314	1121		367	328
v/s Ratio Prot	0.02	c0.32	c0.29		c0.16	0.01
v/s Ratio Perm	0.21					
v/c Ratio	0.33	0.45	0.48		0.78	0.04
Uniform Delay, d1	9.5	9.5	16.6		55.8	47.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	1.1	1.5		13.2	0.2
Delay (s)	9.8	10.6	18.0		69.0	47.4
Level of Service	A	B	B		E	D
Approach Delay (s)		10.4	18.0		65.1	
Approach LOS		B	B		E	
Intersection Summary						
HCM 2000 Control Delay			24.4		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.55			
Actuated Cycle Length (s)			149.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			64.6%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM - Alt. 1

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								  			  	
Traffic Volume (vph)	0	0	0	224	113	32	0	2559	392	40	2338	0
Future Volume (vph)	0	0	0	224	113	32	0	2559	392	40	2338	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	6.5			2.5	2.0	2.5	2.5	
Lane Util. Factor				0.95	0.95			0.91	1.00	1.00	0.91	
Frt				1.00	0.97			1.00	0.85	1.00	1.00	
Flt Protected				0.95	0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1625	1646			4916	1531	1711	4916	
Flt Permitted				0.95	0.99			1.00	1.00	0.03	1.00	
Satd. Flow (perm)				1625	1646			4916	1531	54	4916	
Peak-hour factor, PHF	1.00	1.00	1.00	0.94	1.00	0.94	1.00	0.94	0.94	0.94	0.94	1.00
Adj. Flow (vph)	0	0	0	238	113	34	0	2722	417	43	2487	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	193	189	0	0	2722	417	43	2487	0
Turn Type				custom	NA			NA	pm+ov	Perm	NA	
Protected Phases				3	8!			2 4 9!	3		6 4 9!	
Permitted Phases				3					2 4 9	6 4 9!		
Actuated Green, G (s)				28.4	76.5			139.1	167.5	139.1	139.1	
Effective Green, g (s)				31.4	76.5			143.1	170.5	143.1	143.1	
Actuated g/C Ratio				0.17	0.42			0.79	0.95	0.79	0.79	
Clearance Time (s)				6.0	6.5				6.0			
Vehicle Extension (s)				4.0	4.0				4.0			
Lane Grp Cap (vph)				283	699			3908	1467	42	3908	
v/s Ratio Prot				c0.12	0.04			0.55	0.05		0.51	
v/s Ratio Perm					0.07				0.22	c0.80		
v/c Ratio				0.68	0.27			0.70	0.28	1.02	0.64	
Uniform Delay, d1				69.6	33.6			8.5	0.3	18.5	7.7	
Progression Factor				1.00	1.00			0.70	1.00	1.04	0.47	
Incremental Delay, d2				7.2	0.3			0.4	0.1	84.9	0.1	
Delay (s)				76.8	33.9			6.3	0.4	104.1	3.7	
Level of Service				E	C			A	A	F	A	
Approach Delay (s)		0.0			55.4			5.5			5.4	
Approach LOS		A			E			A			A	
Intersection Summary												
HCM 2000 Control Delay			8.7			HCM 2000 Level of Service			A			
HCM 2000 Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			180.0			Sum of lost time (s)			11.5			
Intersection Capacity Utilization			68.3%			ICU Level of Service			C			
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 1

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	71	32	109	572	36	314	141	2237	277	5	245	2640
Future Volume (vph)	71	32	109	572	36	314	141	2237	277	5	245	2640
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0	3.0	4.0			5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00	1.00	0.91			1.00	0.91
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98			1.00	1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1711	1801	1531	3113	1574	1531	1711	4580			1711	4904
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)	1711	1801	1531	3113	1574	1531	1711	4580			1711	4904
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97
Adj. Flow (vph)	73	33	112	590	37	324	145	2306	286	5	253	2722
RTOR Reduction (vph)	0	0	0	0	0	141	0	8	0	0	0	1
Lane Group Flow (vph)	73	33	112	419	208	183	145	2584	0	0	258	2765
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA		Prot	Prot	NA
Protected Phases	3	3		4	4		1	5		6	6	2
Permitted Phases			3			4						
Actuated Green, G (s)	18.5	18.5	18.5	29.2	29.2	29.2	15.0	83.8			21.0	90.8
Effective Green, g (s)	20.5	20.5	20.5	31.2	31.2	31.2	18.0	86.8			23.0	92.8
Actuated g/C Ratio	0.11	0.11	0.11	0.17	0.17	0.17	0.10	0.48			0.13	0.52
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0	6.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.2			3.0	0.2
Lane Grp Cap (vph)	194	205	174	539	272	265	171	2208			218	2528
v/s Ratio Prot	0.04	0.02		c0.13	0.13		0.08	c0.56			c0.15	0.56
v/s Ratio Perm			c0.07			0.12						
v/c Ratio	0.38	0.16	0.64	0.78	0.76	0.69	0.85	1.17			1.18	1.09
Uniform Delay, d1	73.8	72.0	76.3	71.1	70.9	69.8	79.7	46.6			78.5	43.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.49			1.00	1.00
Incremental Delay, d2	1.2	0.4	7.9	7.0	12.0	7.3	24.2	80.7			119.4	49.3
Delay (s)	75.1	72.4	84.2	78.0	83.0	77.1	92.7	103.7			197.9	92.9
Level of Service	E	E	F	E	F	E	F	F			F	F
Approach Delay (s)		79.3			78.8			103.1				101.9
Approach LOS		E			E			F				F
Intersection Summary												
HCM 2000 Control Delay			98.5									
HCM 2000 Volume to Capacity ratio			1.03									
Actuated Cycle Length (s)			180.0									
Intersection Capacity Utilization			105.0%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

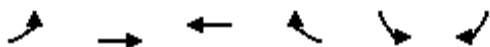
2040 PM - Alt. 1

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	43
Future Volume (vph)	43
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Flt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	44
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 PM - Alt. 1



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	188	850	821	0	437	117
Future Volume (vph)	188	850	821	0	437	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.05	1.00	1.00		0.95	1.00
Satd. Flow (perm)	91	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	924	892	0	475	127
RTOR Reduction (vph)	0	0	0	0	0	69
Lane Group Flow (vph)	204	924	892	0	475	58
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	97.0	97.0	77.3		43.0	43.0
Effective Green, g (s)	97.0	97.0	77.3		43.0	43.0
Actuated g/C Ratio	0.63	0.63	0.51		0.28	0.28
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	219	1181	941		497	444
v/s Ratio Prot	c0.09	0.50	0.48		c0.27	0.04
v/s Ratio Perm	c0.50					
v/c Ratio	0.93	0.78	0.95		0.96	0.13
Uniform Delay, d1	52.4	20.3	35.9		54.1	41.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	42.0	5.2	19.2		30.6	0.5
Delay (s)	94.4	25.5	55.1		84.6	41.5
Level of Service	F	C	E		F	D
Approach Delay (s)		38.0	55.1		75.5	
Approach LOS		D	E		E	
Intersection Summary						
HCM 2000 Control Delay			52.4		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.96			
Actuated Cycle Length (s)			153.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			92.8%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 AM - Alt. 2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	81	133	10	0	2597	230	44	2737	0
Future Volume (vph)	0	0	0	81	133	10	0	2597	230	44	2737	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	6.5			2.5	2.0	2.5	2.5	
Lane Util. Factor				0.95	0.95			0.91	1.00	1.00	0.91	
Frt				1.00	0.99			1.00	0.85	1.00	1.00	
Flt Protected				0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1625	1687			4916	1531	1711	4916	
Flt Permitted				0.95	1.00			1.00	1.00	0.03	1.00	
Satd. Flow (perm)				1625	1687			4916	1531	61	4916	
Peak-hour factor, PHF	1.00	1.00	1.00	0.94	1.00	0.94	1.00	0.94	0.94	0.94	0.94	1.00
Adj. Flow (vph)	0	0	0	86	133	11	0	2763	245	47	2912	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	77	152	0	0	2763	245	47	2912	0
Turn Type				custom	NA			NA	pm+ov	Perm	NA	
Protected Phases				3	8!			2 4 9!	3		6 4 9!	
Permitted Phases				3					2 4 9		6 4 9!	
Actuated Green, G (s)				14.9	64.5			152.6	167.5	152.6	152.6	
Effective Green, g (s)				17.9	64.5			156.6	170.5	156.6	156.6	
Actuated g/C Ratio				0.10	0.36			0.87	0.95	0.87	0.87	
Clearance Time (s)				6.0	6.5				6.0			
Vehicle Extension (s)				4.0	4.0				4.0			
Lane Grp Cap (vph)				161	604			4276	1467	53	4276	
v/s Ratio Prot				c0.05	0.02			0.56	0.02		0.59	
v/s Ratio Perm					0.07				0.14	c0.77		
v/c Ratio				0.48	0.25			0.65	0.17	0.89	0.68	
Uniform Delay, d1				76.6	40.7			3.5	0.3	6.7	3.7	
Progression Factor				1.00	1.00			1.29	1.00	1.61	0.76	
Incremental Delay, d2				3.0	0.3			0.3	0.1	45.7	0.2	
Delay (s)				79.7	41.0			4.8	0.4	56.4	3.0	
Level of Service				E	D			A	A	E	A	
Approach Delay (s)		0.0			54.0			4.4			3.9	
Approach LOS		A			D			A			A	
Intersection Summary												
HCM 2000 Control Delay			6.0									
HCM 2000 Level of Service										A		
HCM 2000 Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			180.0							11.5		
Intersection Capacity Utilization			68.7%									
ICU Level of Service										C		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 AM - Alt. 2

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	57	25	97	779	21	137	80	2360	188	2	110	2578
Future Volume (vph)	57	25	97	779	21	137	80	2360	188	2	110	2578
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0	3.0	4.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	0.95	0.91	0.91	1.00	1.00	0.91	1.00		1.00	0.91
Frt	1.00	0.91	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1711	1557	1454	3113	1566	1531	1711	4657	1531		1711	4911
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1711	1557	1454	3113	1566	1531	1711	4657	1531		1711	4911
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97
Adj. Flow (vph)	59	26	100	803	22	141	82	2433	194	2	113	2658
RTOR Reduction (vph)	0	0	0	0	0	106	0	0	55	0	0	0
Lane Group Flow (vph)	59	65	61	546	279	35	82	2433	139	0	115	2674
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA	Perm	Prot	Prot	NA
Protected Phases	3	3		4	4		1	5		6	6	2
Permitted Phases			3			4			5			
Actuated Green, G (s)	12.9	12.9	12.9	42.6	42.6	42.6	9.0	84.0	84.0		13.0	89.0
Effective Green, g (s)	14.9	14.9	14.9	44.6	44.6	44.6	12.0	87.0	86.0		15.0	91.0
Actuated g/C Ratio	0.08	0.08	0.08	0.25	0.25	0.25	0.07	0.48	0.48		0.08	0.51
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0	6.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.2	0.2		3.0	0.2
Lane Grp Cap (vph)	141	128	120	771	388	379	114	2250	731		142	2482
v/s Ratio Prot	0.03	0.04		0.18	c0.18		0.05	c0.52			0.07	c0.54
v/s Ratio Perm			c0.04			0.02			0.09			
v/c Ratio	0.42	0.51	0.51	0.71	0.72	0.09	0.72	1.08	0.19		0.81	1.08
Uniform Delay, d1	78.4	79.0	79.0	61.8	62.0	52.1	82.3	46.5	27.0		81.1	44.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.29	0.55	0.48		1.00	1.00
Incremental Delay, d2	2.0	3.1	3.4	3.0	6.3	0.1	15.7	43.6	0.5		27.7	42.9
Delay (s)	80.4	82.2	82.4	64.8	68.2	52.2	121.8	69.4	13.5		108.8	87.4
Level of Service	F	F	F	E	E	D	F	E	B		F	F
Approach Delay (s)		81.7			63.9			67.0				88.3
Approach LOS		F			E			E				F
Intersection Summary												
HCM 2000 Control Delay			75.9									
HCM 2000 Volume to Capacity ratio			0.94									
Actuated Cycle Length (s)			180.0									
Intersection Capacity Utilization			89.0%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 2

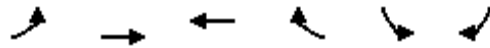
Movement	SBR
Lane Configurations	
Traffic Volume (vph)	16
Future Volume (vph)	16
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Flt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	16
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 2



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	166	542	492	0	262	57
Future Volume (vph)	166	542	492	0	262	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.35	1.00	1.00		0.95	1.00
Satd. Flow (perm)	655	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	180	589	535	0	285	62
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	180	589	535	0	285	13
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	105.1	105.1	89.7		30.9	30.9
Effective Green, g (s)	105.1	105.1	89.7		30.9	30.9
Actuated g/C Ratio	0.71	0.71	0.60		0.21	0.21
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	539	1314	1121		367	328
v/s Ratio Prot	0.02	c0.32	c0.29		c0.16	0.01
v/s Ratio Perm	0.21					
v/c Ratio	0.33	0.45	0.48		0.78	0.04
Uniform Delay, d1	9.5	9.5	16.6		55.8	47.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	1.1	1.5		13.2	0.2
Delay (s)	9.8	10.6	18.0		69.0	47.4
Level of Service	A	B	B		E	D
Approach Delay (s)		10.4	18.0		65.1	
Approach LOS		B	B		E	
Intersection Summary						
HCM 2000 Control Delay			24.4		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.55			
Actuated Cycle Length (s)			149.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			64.6%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM - Alt. 2

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	224	113	32	0	2559	392	40	2338	0
Future Volume (vph)	0	0	0	224	113	32	0	2559	392	40	2338	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	6.5			2.5	2.0	2.5	2.5	
Lane Util. Factor				0.95	0.95			0.91	1.00	1.00	0.91	
Frt				1.00	0.97			1.00	0.85	1.00	1.00	
Flt Protected				0.95	0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1625	1646			4916	1531	1711	4916	
Flt Permitted				0.95	0.99			1.00	1.00	0.03	1.00	
Satd. Flow (perm)				1625	1646			4916	1531	54	4916	
Peak-hour factor, PHF	1.00	1.00	1.00	0.94	1.00	0.94	1.00	0.94	0.94	0.94	0.94	1.00
Adj. Flow (vph)	0	0	0	238	113	34	0	2722	417	43	2487	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	193	189	0	0	2722	417	43	2487	0
Turn Type				custom	NA			NA	pm+ov	Perm	NA	
Protected Phases				3	8!			2 4 9!	3		6 4 9!	
Permitted Phases				3					2 4 9		6 4 9!	
Actuated Green, G (s)				28.4	76.5			139.1	167.5	139.1	139.1	
Effective Green, g (s)				31.4	76.5			143.1	170.5	143.1	143.1	
Actuated g/C Ratio				0.17	0.42			0.79	0.95	0.79	0.79	
Clearance Time (s)				6.0	6.5				6.0			
Vehicle Extension (s)				4.0	4.0				4.0			
Lane Grp Cap (vph)				283	699			3908	1467	42	3908	
v/s Ratio Prot				c0.12	0.04			0.55	0.05		0.51	
v/s Ratio Perm					0.07				0.22	c0.80		
v/c Ratio				0.68	0.27			0.70	0.28	1.02	0.64	
Uniform Delay, d1				69.6	33.6			8.5	0.3	18.5	7.7	
Progression Factor				1.00	1.00			0.70	1.00	0.94	0.44	
Incremental Delay, d2				7.2	0.3			0.4	0.1	92.7	0.1	
Delay (s)				76.8	33.9			6.3	0.4	110.1	3.5	
Level of Service				E	C			A	A	F	A	
Approach Delay (s)		0.0			55.4			5.5			5.3	
Approach LOS		A			E			A			A	
Intersection Summary												
HCM 2000 Control Delay			8.6			HCM 2000 Level of Service			A			
HCM 2000 Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			180.0			Sum of lost time (s)			11.5			
Intersection Capacity Utilization			68.3%			ICU Level of Service			C			
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 2

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	71	32	109	572	36	314	141	2237	277	5	245	2640
Future Volume (vph)	71	32	109	572	36	314	141	2237	277	5	245	2640
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0	3.0	4.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.95	0.95	0.91	0.91	1.00	1.00	0.91	1.00		1.00	0.91
Frt	1.00	0.92	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1711	1568	1454	3113	1574	1531	1711	4657	1531		1711	4904
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1711	1568	1454	3113	1574	1531	1711	4657	1531		1711	4904
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97
Adj. Flow (vph)	73	33	112	590	37	324	145	2306	286	5	253	2722
RTOR Reduction (vph)	0	0	0	0	0	225	0	0	54	0	0	1
Lane Group Flow (vph)	73	74	71	419	208	99	145	2306	232	0	258	2765
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA	Perm	Prot	Prot	NA
Protected Phases	3	3		4	4		1	5		6	6	2
Permitted Phases			3			4			5			
Actuated Green, G (s)	14.1	14.1	14.1	30.5	30.5	30.5	15.0	86.9	86.9		21.0	93.9
Effective Green, g (s)	16.1	16.1	16.1	32.5	32.5	32.5	18.0	89.9	88.9		23.0	95.9
Actuated g/C Ratio	0.09	0.09	0.09	0.18	0.18	0.18	0.10	0.50	0.49		0.13	0.53
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0	6.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.2	0.2		3.0	0.2
Lane Grp Cap (vph)	153	140	130	562	284	276	171	2325	756		218	2612
v/s Ratio Prot	0.04	0.05		c0.13	0.13		0.08	0.50			c0.15	c0.56
v/s Ratio Perm			c0.05			0.06			0.15			
v/c Ratio	0.48	0.53	0.55	0.75	0.73	0.36	0.85	0.99	0.31		1.18	1.06
Uniform Delay, d1	77.9	78.3	78.5	69.8	69.6	64.6	79.7	44.7	27.2		78.5	42.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.48	0.37		1.00	1.00
Incremental Delay, d2	2.3	3.6	4.6	5.3	9.4	0.8	24.2	14.4	0.8		119.4	35.6
Delay (s)	80.3	81.9	83.1	75.2	79.0	65.4	92.7	36.0	10.9		197.9	77.6
Level of Service	F	F	F	E	E	E	F	D	B		F	E
Approach Delay (s)		81.7			72.7			36.4				87.9
Approach LOS		F			E			D				F
Intersection Summary												
HCM 2000 Control Delay			65.3									
HCM 2000 Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			180.0									
Intersection Capacity Utilization			98.5%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis
2040 PM - Alt. 2

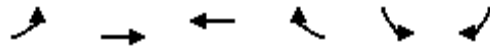
Movement	SBR
Lane Configurations	
Traffic Volume (vph)	43
Future Volume (vph)	43
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Flt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	44
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 2



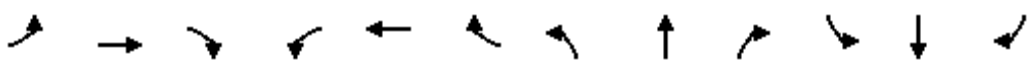
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	188	850	821	0	437	117
Future Volume (vph)	188	850	821	0	437	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.05	1.00	1.00		0.95	1.00
Satd. Flow (perm)	91	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	924	892	0	475	127
RTOR Reduction (vph)	0	0	0	0	0	69
Lane Group Flow (vph)	204	924	892	0	475	58
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	97.0	97.0	77.3		43.0	43.0
Effective Green, g (s)	97.0	97.0	77.3		43.0	43.0
Actuated g/C Ratio	0.63	0.63	0.51		0.28	0.28
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	219	1181	941		497	444
v/s Ratio Prot	c0.09	0.50	0.48		c0.27	0.04
v/s Ratio Perm	c0.50					
v/c Ratio	0.93	0.78	0.95		0.96	0.13
Uniform Delay, d1	52.4	20.3	35.9		54.1	41.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	42.0	5.2	19.2		30.6	0.5
Delay (s)	94.4	25.5	55.1		84.6	41.5
Level of Service	F	C	E		F	D
Approach Delay (s)		38.0	55.1		75.5	
Approach LOS		D	E		E	
Intersection Summary						
HCM 2000 Control Delay			52.4		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.96			
Actuated Cycle Length (s)			153.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			92.8%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis

2040 AM - Alt. 3

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	81	133	10	0	2597	230	44	2737	0
Future Volume (vph)	0	0	0	81	133	10	0	2597	230	44	2737	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	6.5			2.5	2.0	2.5	2.5	
Lane Util. Factor				0.95	0.95			0.91	1.00	1.00	0.91	
Frt				1.00	0.99			1.00	0.85	1.00	1.00	
Flt Protected				0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1625	1687			4916	1531	1711	4916	
Flt Permitted				0.95	1.00			1.00	1.00	0.03	1.00	
Satd. Flow (perm)				1625	1687			4916	1531	61	4916	
Peak-hour factor, PHF	1.00	1.00	1.00	0.94	1.00	0.94	1.00	0.94	0.94	0.94	0.94	1.00
Adj. Flow (vph)	0	0	0	86	133	11	0	2763	245	47	2912	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	77	152	0	0	2763	245	47	2912	0
Turn Type				custom	NA			NA	pm+ov	Perm	NA	
Protected Phases				3	8!			2 4 9!	3		6 4 9!	
Permitted Phases				3					2 4 9		6 4 9!	
Actuated Green, G (s)				14.9	64.5			152.6	167.5	152.6	152.6	
Effective Green, g (s)				17.9	64.5			156.6	170.5	156.6	156.6	
Actuated g/C Ratio				0.10	0.36			0.87	0.95	0.87	0.87	
Clearance Time (s)				6.0	6.5				6.0			
Vehicle Extension (s)				4.0	4.0				4.0			
Lane Grp Cap (vph)				161	604			4276	1467	53	4276	
v/s Ratio Prot				c0.05	0.02			0.56	0.02		0.59	
v/s Ratio Perm					0.07				0.14	c0.77		
v/c Ratio				0.48	0.25			0.65	0.17	0.89	0.68	
Uniform Delay, d1				76.6	40.7			3.5	0.3	6.7	3.7	
Progression Factor				1.00	1.00			1.29	1.00	1.64	0.77	
Incremental Delay, d2				3.0	0.3			0.3	0.1	46.3	0.2	
Delay (s)				79.7	41.0			4.8	0.4	57.2	3.1	
Level of Service				E	D			A	A	E	A	
Approach Delay (s)		0.0			54.0			4.4			3.9	
Approach LOS		A			D			A			A	
Intersection Summary												
HCM 2000 Control Delay			6.0			HCM 2000 Level of Service				A		
HCM 2000 Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			180.0			Sum of lost time (s)				11.5		
Intersection Capacity Utilization			68.7%			ICU Level of Service				C		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 AM - Alt. 3

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	57	25	97	779	21	137	80	2360	188	2	110	2578
Future Volume (vph)	57	25	97	779	21	137	80	2360	188	2	110	2578
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0	3.0	4.0			5.0	5.0
Lane Util. Factor	0.91	0.86	0.91	0.91	0.91	1.00	1.00	0.91			1.00	0.91
Frt	1.00	0.91	0.85	1.00	1.00	0.85	1.00	0.99			1.00	1.00
Flt Protected	0.95	0.99	1.00	0.95	0.96	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1557	2814	1393	3113	1566	1531	1711	4605			1711	4911
Flt Permitted	0.95	0.99	1.00	0.95	0.96	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)	1557	2814	1393	3113	1566	1531	1711	4605			1711	4911
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97
Adj. Flow (vph)	59	26	100	803	22	141	82	2433	194	2	113	2658
RTOR Reduction (vph)	0	0	0	0	0	105	0	5	0	0	0	0
Lane Group Flow (vph)	47	88	50	546	279	36	82	2622	0	0	115	2674
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA		Prot	Prot	NA
Protected Phases	3	3		4	4		1	5		6	6	2
Permitted Phases			3			4						
Actuated Green, G (s)	12.0	12.0	12.0	43.5	43.5	43.5	9.0	84.0			13.0	89.0
Effective Green, g (s)	14.0	14.0	14.0	45.5	45.5	45.5	12.0	87.0			15.0	91.0
Actuated g/C Ratio	0.08	0.08	0.08	0.25	0.25	0.25	0.07	0.48			0.08	0.51
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0	6.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.2			3.0	0.2
Lane Grp Cap (vph)	121	218	108	786	395	387	114	2225			142	2482
v/s Ratio Prot	0.03	0.03		0.18	c0.18		0.05	c0.57			0.07	c0.54
v/s Ratio Perm			c0.04			0.02						
v/c Ratio	0.39	0.40	0.46	0.69	0.71	0.09	0.72	1.18			0.81	1.08
Uniform Delay, d1	78.9	79.0	79.4	61.0	61.2	51.4	82.3	46.5			81.1	44.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.29	0.56			1.00	1.00
Incremental Delay, d2	2.1	1.2	3.1	2.7	5.7	0.1	15.7	84.3			27.7	42.9
Delay (s)	81.0	80.2	82.5	63.6	66.8	51.6	121.8	110.1			108.8	87.4
Level of Service	F	F	F	E	E	D	F	F			F	F
Approach Delay (s)		81.1			62.8			110.5				88.3
Approach LOS		F			E			F				F
Intersection Summary												
HCM 2000 Control Delay			93.4									
HCM 2000 Volume to Capacity ratio			0.99									
Actuated Cycle Length (s)			180.0									
Intersection Capacity Utilization			91.9%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 3

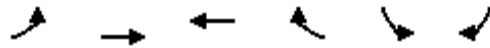
Movement	SBR
Left Lane Configurations	
Traffic Volume (vph)	16
Future Volume (vph)	16
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Flt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	16
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 3



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	166	542	492	0	262	57
Future Volume (vph)	166	542	492	0	262	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.35	1.00	1.00		0.95	1.00
Satd. Flow (perm)	655	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	180	589	535	0	285	62
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	180	589	535	0	285	13
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	105.1	105.1	89.7		30.9	30.9
Effective Green, g (s)	105.1	105.1	89.7		30.9	30.9
Actuated g/C Ratio	0.71	0.71	0.60		0.21	0.21
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	539	1314	1121		367	328
v/s Ratio Prot	0.02	c0.32	c0.29		c0.16	0.01
v/s Ratio Perm	0.21					
v/c Ratio	0.33	0.45	0.48		0.78	0.04
Uniform Delay, d1	9.5	9.5	16.6		55.8	47.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	1.1	1.5		13.2	0.2
Delay (s)	9.8	10.6	18.0		69.0	47.4
Level of Service	A	B	B		E	D
Approach Delay (s)		10.4	18.0		65.1	
Approach LOS		B	B		E	
Intersection Summary						
HCM 2000 Control Delay			24.4		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.55			
Actuated Cycle Length (s)			149.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			64.6%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM - Alt. 3

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	224	113	32	0	2559	392	40	2338	0
Future Volume (vph)	0	0	0	224	113	32	0	2559	392	40	2338	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	6.5			2.5	2.0	2.5	2.5	
Lane Util. Factor				0.95	0.95			0.91	1.00	1.00	0.91	
Frt				1.00	0.97			1.00	0.85	1.00	1.00	
Flt Protected				0.95	0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1625	1646			4916	1531	1711	4916	
Flt Permitted				0.95	0.99			1.00	1.00	0.03	1.00	
Satd. Flow (perm)				1625	1646			4916	1531	54	4916	
Peak-hour factor, PHF	1.00	1.00	1.00	0.94	1.00	0.94	1.00	0.94	0.94	0.94	0.94	1.00
Adj. Flow (vph)	0	0	0	238	113	34	0	2722	417	43	2487	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	193	189	0	0	2722	417	43	2487	0
Turn Type				custom	NA			NA	pm+ov	Perm	NA	
Protected Phases				3	8!			2 4 9!	3		6 4 9!	
Permitted Phases				3					2 4 9	6 4 9!		
Actuated Green, G (s)				28.4	76.5			139.1	167.5	139.1	139.1	
Effective Green, g (s)				31.4	76.5			143.1	170.5	143.1	143.1	
Actuated g/C Ratio				0.17	0.42			0.79	0.95	0.79	0.79	
Clearance Time (s)				6.0	6.5				6.0			
Vehicle Extension (s)				4.0	4.0				4.0			
Lane Grp Cap (vph)				283	699			3908	1467	42	3908	
v/s Ratio Prot				c0.12	0.04			0.55	0.05		0.51	
v/s Ratio Perm					0.07				0.22	c0.80		
v/c Ratio				0.68	0.27			0.70	0.28	1.02	0.64	
Uniform Delay, d1				69.6	33.6			8.5	0.3	18.5	7.7	
Progression Factor				1.00	1.00			0.70	1.00	0.94	0.43	
Incremental Delay, d2				7.2	0.3			0.4	0.1	94.6	0.2	
Delay (s)				76.8	33.9			6.3	0.4	111.9	3.5	
Level of Service				E	C			A	A	F	A	
Approach Delay (s)		0.0			55.4			5.5			5.3	
Approach LOS		A			E			A			A	
Intersection Summary												
HCM 2000 Control Delay			8.6									
HCM 2000 Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			180.0									
Intersection Capacity Utilization			68.3%									
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis
2040 PM - Alt. 3

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	71	32	109	572	36	314	141	2237	277	5	245	2640
Future Volume (vph)	71	32	109	572	36	314	141	2237	277	5	245	2640
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0	3.0	4.0			5.0	5.0
Lane Util. Factor	0.91	0.86	0.91	0.91	0.91	1.00	1.00	0.91			1.00	0.91
Frt	1.00	0.92	0.85	1.00	1.00	0.85	1.00	0.98			1.00	1.00
Flt Protected	0.95	0.99	1.00	0.95	0.96	1.00	0.95	1.00			0.95	1.00
Satd. Flow (prot)	1557	2830	1393	3113	1574	1531	1711	4580			1711	4904
Flt Permitted	0.95	0.99	1.00	0.95	0.96	1.00	0.95	1.00			0.95	1.00
Satd. Flow (perm)	1557	2830	1393	3113	1574	1531	1711	4580			1711	4904
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97
Adj. Flow (vph)	73	33	112	590	37	324	145	2306	286	5	253	2722
RTOR Reduction (vph)	0	0	0	0	0	140	0	7	0	0	0	1
Lane Group Flow (vph)	55	107	56	419	208	184	145	2585	0	0	258	2765
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA		Prot	Prot	NA
Protected Phases	3	3		4	4		1	5		6	6	2
Permitted Phases			3			4						
Actuated Green, G (s)	13.0	13.0	13.0	30.9	30.9	30.9	15.0	87.6			21.0	94.6
Effective Green, g (s)	15.0	15.0	15.0	32.9	32.9	32.9	18.0	90.6			23.0	96.6
Actuated g/C Ratio	0.08	0.08	0.08	0.18	0.18	0.18	0.10	0.50			0.13	0.54
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0	6.0	7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.2			3.0	0.2
Lane Grp Cap (vph)	129	235	116	568	287	279	171	2305			218	2631
v/s Ratio Prot	0.04	0.04		c0.13	0.13		0.08	c0.56			c0.15	0.56
v/s Ratio Perm			c0.04			0.12						
v/c Ratio	0.43	0.46	0.48	0.74	0.72	0.66	0.85	1.12			1.18	1.05
Uniform Delay, d1	78.4	78.6	78.8	69.5	69.3	68.4	79.7	44.7			78.5	41.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.47			1.00	1.00
Incremental Delay, d2	2.3	1.4	3.1	5.0	8.8	5.8	24.2	59.5			119.4	32.8
Delay (s)	80.7	80.0	81.9	74.5	78.0	74.1	92.7	80.8			197.9	74.5
Level of Service	F	F	F	E	E	E	F	F			F	E
Approach Delay (s)		80.7			75.1			81.4				85.0
Approach LOS		F			E			F				F
Intersection Summary												
HCM 2000 Control Delay			82.1									
HCM 2000 Volume to Capacity ratio			0.99									
Actuated Cycle Length (s)			180.0									
Intersection Capacity Utilization			105.0%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

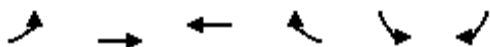
2040 PM - Alt. 3

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	43
Future Volume (vph)	43
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Flt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	44
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 PM - Alt. 3



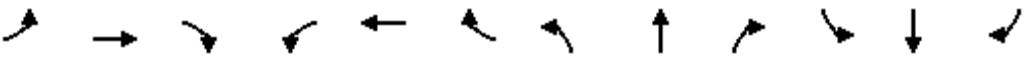
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	188	850	821	0	437	117
Future Volume (vph)	188	850	821	0	437	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.05	1.00	1.00		0.95	1.00
Satd. Flow (perm)	91	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	924	892	0	475	127
RTOR Reduction (vph)	0	0	0	0	0	69
Lane Group Flow (vph)	204	924	892	0	475	58
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	97.0	97.0	77.3		43.0	43.0
Effective Green, g (s)	97.0	97.0	77.3		43.0	43.0
Actuated g/C Ratio	0.63	0.63	0.51		0.28	0.28
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	219	1181	941		497	444
v/s Ratio Prot	c0.09	0.50	0.48		c0.27	0.04
v/s Ratio Perm	c0.50					
v/c Ratio	0.93	0.78	0.95		0.96	0.13
Uniform Delay, d1	52.4	20.3	35.9		54.1	41.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	42.0	5.2	19.2		30.6	0.5
Delay (s)	94.4	25.5	55.1		84.6	41.5
Level of Service	F	C	E		F	D
Approach Delay (s)		38.0	55.1		75.5	
Approach LOS		D	E		E	
Intersection Summary						
HCM 2000 Control Delay			52.4		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.96			
Actuated Cycle Length (s)			153.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			92.8%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis

2040 AM - Alt. 4

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	81	133	10	0	2597	230	44	2737	0
Future Volume (vph)	0	0	0	81	133	10	0	2597	230	44	2737	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	6.5			2.5	2.0	2.5	2.5	
Lane Util. Factor				0.95	0.95			0.91	1.00	1.00	0.91	
Frt				1.00	0.99			1.00	0.85	1.00	1.00	
Flt Protected				0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1625	1687			4916	1531	1711	4916	
Flt Permitted				0.95	1.00			1.00	1.00	0.03	1.00	
Satd. Flow (perm)				1625	1687			4916	1531	61	4916	
Peak-hour factor, PHF	1.00	1.00	1.00	0.94	1.00	0.94	1.00	0.94	0.94	0.94	0.94	1.00
Adj. Flow (vph)	0	0	0	86	133	11	0	2763	245	47	2912	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	77	152	0	0	2763	245	47	2912	0
Turn Type				custom	NA			NA	pm+ov	Perm	NA	
Protected Phases				3	8!			2 4 9!	3		6 4 9!	
Permitted Phases				3					2 4 9		6 4 9!	
Actuated Green, G (s)				14.9	64.5			152.6	167.5	152.6	152.6	
Effective Green, g (s)				17.9	64.5			156.6	170.5	156.6	156.6	
Actuated g/C Ratio				0.10	0.36			0.87	0.95	0.87	0.87	
Clearance Time (s)				6.0	6.5				6.0			
Vehicle Extension (s)				4.0	4.0				4.0			
Lane Grp Cap (vph)				161	604			4276	1467	53	4276	
v/s Ratio Prot				c0.05	0.02			0.56	0.02		0.59	
v/s Ratio Perm					0.07				0.14	c0.77		
v/c Ratio				0.48	0.25			0.65	0.17	0.89	0.68	
Uniform Delay, d1				76.6	40.7			3.5	0.3	6.7	3.7	
Progression Factor				1.00	1.00			1.29	1.00	1.64	0.77	
Incremental Delay, d2				3.0	0.3			0.3	0.1	46.3	0.2	
Delay (s)				79.7	41.0			4.8	0.4	57.2	3.1	
Level of Service				E	D			A	A	E	A	
Approach Delay (s)		0.0			54.0			4.4			3.9	
Approach LOS		A			D			A			A	
Intersection Summary												
HCM 2000 Control Delay			6.0									
HCM 2000 Level of Service										A		
HCM 2000 Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			180.0							11.5		
Intersection Capacity Utilization			68.7%									
ICU Level of Service										C		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 AM - Alt. 4

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	57	25	97	779	21	137	80	2360	188	2	110	2578
Future Volume (vph)	57	25	97	779	21	137	80	2360	188	2	110	2578
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0	3.0	4.0	5.0		5.0	5.0
Lane Util. Factor	0.91	0.86	0.91	0.91	0.91	1.00	1.00	0.91	1.00		1.00	0.91
Frt	1.00	0.91	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	1.00
Flt Protected	0.95	0.99	1.00	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1557	2814	1393	3113	1566	1531	1711	4657	1531		1711	4911
Flt Permitted	0.95	0.99	1.00	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1557	2814	1393	3113	1566	1531	1711	4657	1531		1711	4911
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97
Adj. Flow (vph)	59	26	100	803	22	141	82	2433	194	2	113	2658
RTOR Reduction (vph)	0	0	0	0	0	105	0	0	55	0	0	0
Lane Group Flow (vph)	47	88	50	546	279	36	82	2433	139	0	115	2674
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA	Perm	Prot	Prot	NA
Protected Phases	3	3		4	4		1	5		6	6	2
Permitted Phases			3			4			5			
Actuated Green, G (s)	12.0	12.0	12.0	43.5	43.5	43.5	9.0	84.0	84.0		13.0	89.0
Effective Green, g (s)	14.0	14.0	14.0	45.5	45.5	45.5	12.0	87.0	86.0		15.0	91.0
Actuated g/C Ratio	0.08	0.08	0.08	0.25	0.25	0.25	0.07	0.48	0.48		0.08	0.51
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0	6.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.2	0.2		3.0	0.2
Lane Grp Cap (vph)	121	218	108	786	395	387	114	2250	731		142	2482
v/s Ratio Prot	0.03	0.03		0.18	c0.18		0.05	c0.52			0.07	c0.54
v/s Ratio Perm			c0.04			0.02			0.09			
v/c Ratio	0.39	0.40	0.46	0.69	0.71	0.09	0.72	1.08	0.19		0.81	1.08
Uniform Delay, d1	78.9	79.0	79.4	61.0	61.2	51.4	82.3	46.5	27.0		81.1	44.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.29	0.55	0.48		1.00	1.00
Incremental Delay, d2	2.1	1.2	3.1	2.7	5.7	0.1	15.7	43.6	0.5		27.7	42.9
Delay (s)	81.0	80.2	82.5	63.6	66.8	51.6	121.8	69.4	13.5		108.8	87.4
Level of Service	F	F	F	E	E	D	F	E	B		F	F
Approach Delay (s)		81.1			62.8			67.0				88.3
Approach LOS		F			E			E				F
Intersection Summary												
HCM 2000 Control Delay			75.7									
HCM 2000 Level of Service												E
HCM 2000 Volume to Capacity ratio			0.94									
Actuated Cycle Length (s)			180.0									
Sum of lost time (s)											18.5	
Intersection Capacity Utilization			89.0%									
ICU Level of Service												E
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis
2040 AM - Alt. 4

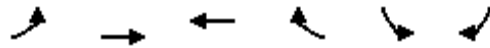
Movement	SBR
Lane Configurations	
Traffic Volume (vph)	16
Future Volume (vph)	16
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Flt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	16
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 4



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	166	542	492	0	262	57
Future Volume (vph)	166	542	492	0	262	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.35	1.00	1.00		0.95	1.00
Satd. Flow (perm)	655	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	180	589	535	0	285	62
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	180	589	535	0	285	13
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	105.1	105.1	89.7		30.9	30.9
Effective Green, g (s)	105.1	105.1	89.7		30.9	30.9
Actuated g/C Ratio	0.71	0.71	0.60		0.21	0.21
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	539	1314	1121		367	328
v/s Ratio Prot	0.02	c0.32	c0.29		c0.16	0.01
v/s Ratio Perm	0.21					
v/c Ratio	0.33	0.45	0.48		0.78	0.04
Uniform Delay, d1	9.5	9.5	16.6		55.8	47.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	1.1	1.5		13.2	0.2
Delay (s)	9.8	10.6	18.0		69.0	47.4
Level of Service	A	B	B		E	D
Approach Delay (s)		10.4	18.0		65.1	
Approach LOS		B	B		E	
Intersection Summary						
HCM 2000 Control Delay			24.4		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.55			
Actuated Cycle Length (s)			149.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			64.6%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM - Alt. 4

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	224	113	32	0	2559	392	40	2338	0
Future Volume (vph)	0	0	0	224	113	32	0	2559	392	40	2338	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				3.0	6.5			2.5	2.0	2.5	2.5	
Lane Util. Factor				0.95	0.95			0.91	1.00	1.00	0.91	
Frt				1.00	0.97			1.00	0.85	1.00	1.00	
Flt Protected				0.95	0.99			1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1625	1646			4916	1531	1711	4916	
Flt Permitted				0.95	0.99			1.00	1.00	0.03	1.00	
Satd. Flow (perm)				1625	1646			4916	1531	54	4916	
Peak-hour factor, PHF	1.00	1.00	1.00	0.94	1.00	0.94	1.00	0.94	0.94	0.94	0.94	1.00
Adj. Flow (vph)	0	0	0	238	113	34	0	2722	417	43	2487	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	193	189	0	0	2722	417	43	2487	0
Turn Type				custom	NA			NA	pm+ov	Perm	NA	
Protected Phases				3	8!			2 4 9!	3		6 4 9!	
Permitted Phases				3					2 4 9	6 4 9!		
Actuated Green, G (s)				28.4	76.5			139.1	167.5	139.1	139.1	
Effective Green, g (s)				31.4	76.5			143.1	170.5	143.1	143.1	
Actuated g/C Ratio				0.17	0.42			0.79	0.95	0.79	0.79	
Clearance Time (s)				6.0	6.5				6.0			
Vehicle Extension (s)				4.0	4.0				4.0			
Lane Grp Cap (vph)				283	699			3908	1467	42	3908	
v/s Ratio Prot				c0.12	0.04			0.55	0.05		0.51	
v/s Ratio Perm					0.07				0.22	c0.80		
v/c Ratio				0.68	0.27			0.70	0.28	1.02	0.64	
Uniform Delay, d1				69.6	33.6			8.5	0.3	18.5	7.7	
Progression Factor				1.00	1.00			0.70	1.00	0.94	0.43	
Incremental Delay, d2				7.2	0.3			0.4	0.1	94.6	0.2	
Delay (s)				76.8	33.9			6.3	0.4	111.9	3.5	
Level of Service				E	C			A	A	F	A	
Approach Delay (s)		0.0			55.4			5.5			5.3	
Approach LOS		A			E			A			A	
Intersection Summary												
HCM 2000 Control Delay			8.6									
HCM 2000 Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			180.0									
Intersection Capacity Utilization			68.3%									
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 4

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBU	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	71	32	109	572	36	314	141	2237	277	5	245	2640
Future Volume (vph)	71	32	109	572	36	314	141	2237	277	5	245	2640
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0	3.0	4.0	5.0		5.0	5.0
Lane Util. Factor	0.91	0.86	0.91	0.91	0.91	1.00	1.00	0.91	1.00		1.00	0.91
Frt	1.00	0.92	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	1.00
Flt Protected	0.95	0.99	1.00	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1557	2830	1393	3113	1574	1531	1711	4657	1531		1711	4904
Flt Permitted	0.95	0.99	1.00	0.95	0.96	1.00	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1557	2830	1393	3113	1574	1531	1711	4657	1531		1711	4904
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97
Adj. Flow (vph)	73	33	112	590	37	324	145	2306	286	5	253	2722
RTOR Reduction (vph)	0	0	0	0	0	224	0	0	53	0	0	1
Lane Group Flow (vph)	55	107	56	419	208	100	145	2306	233	0	258	2765
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	NA	Perm	Prot	Prot	NA
Protected Phases	3	3		4	4		1	5		6	6	2
Permitted Phases			3			4			5			
Actuated Green, G (s)	13.0	13.0	13.0	30.9	30.9	30.9	15.0	87.6	87.6		21.0	94.6
Effective Green, g (s)	15.0	15.0	15.0	32.9	32.9	32.9	18.0	90.6	89.6		23.0	96.6
Actuated g/C Ratio	0.08	0.08	0.08	0.18	0.18	0.18	0.10	0.50	0.50		0.13	0.54
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0	6.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.2	0.2		3.0	0.2
Lane Grp Cap (vph)	129	235	116	568	287	279	171	2344	762		218	2631
v/s Ratio Prot	0.04	0.04		c0.13	0.13		0.08	0.50			c0.15	c0.56
v/s Ratio Perm			c0.04			0.07			0.15			
v/c Ratio	0.43	0.46	0.48	0.74	0.72	0.36	0.85	0.98	0.31		1.18	1.05
Uniform Delay, d1	78.4	78.6	78.8	69.5	69.3	64.3	79.7	44.0	26.8		78.5	41.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.86	0.48	0.37		1.00	1.00
Incremental Delay, d2	2.3	1.4	3.1	5.0	8.8	0.8	24.2	12.7	0.8		119.4	32.8
Delay (s)	80.7	80.0	81.9	74.5	78.0	65.1	92.7	33.8	10.7		197.9	74.5
Level of Service	F	F	F	E	E	E	F	C	B		F	E
Approach Delay (s)		80.7			72.1			34.5				85.0
Approach LOS		F			E			C				F
Intersection Summary												
HCM 2000 Control Delay			63.2									
HCM 2000 Volume to Capacity ratio			0.96									
Actuated Cycle Length (s)			180.0									
Intersection Capacity Utilization			98.5%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis
2040 PM - Alt. 4

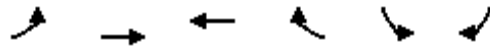
Movement	SBR
Lane Configurations	
Traffic Volume (vph)	43
Future Volume (vph)	43
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Flt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.97
Adj. Flow (vph)	44
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 4



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	188	850	821	0	437	117
Future Volume (vph)	188	850	821	0	437	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.05	1.00	1.00		0.95	1.00
Satd. Flow (perm)	91	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	924	892	0	475	127
RTOR Reduction (vph)	0	0	0	0	0	69
Lane Group Flow (vph)	204	924	892	0	475	58
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	97.0	97.0	77.3		43.0	43.0
Effective Green, g (s)	97.0	97.0	77.3		43.0	43.0
Actuated g/C Ratio	0.63	0.63	0.51		0.28	0.28
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	219	1181	941		497	444
v/s Ratio Prot	c0.09	0.50	0.48		c0.27	0.04
v/s Ratio Perm	c0.50					
v/c Ratio	0.93	0.78	0.95		0.96	0.13
Uniform Delay, d1	52.4	20.3	35.9		54.1	41.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	42.0	5.2	19.2		30.6	0.5
Delay (s)	94.4	25.5	55.1		84.6	41.5
Level of Service	F	C	E		F	D
Approach Delay (s)		38.0	55.1		75.5	
Approach LOS		D	E		E	
Intersection Summary						
HCM 2000 Control Delay			52.4		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.96			
Actuated Cycle Length (s)			153.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			92.8%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 AM - Alt. 5

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	102	25	2597	230	44	2716
Future Volume (vph)	102	25	2597	230	44	2716
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	2.5	2.0	2.5	2.5
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1711	1531	4916	1531	1711	4916
Flt Permitted	0.95	1.00	1.00	1.00	0.03	1.00
Satd. Flow (perm)	1711	1531	4916	1531	58	4916
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	109	27	2763	245	47	2889
RTOR Reduction (vph)	0	4	0	0	0	0
Lane Group Flow (vph)	109	23	2763	245	47	2889
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	3		2 4 9	3		6 4 9
Permitted Phases	3	3		2 4 9	6 4 9	
Actuated Green, G (s)	18.0	18.0	149.5	167.5	149.5	149.5
Effective Green, g (s)	21.0	20.0	153.5	170.5	153.5	153.5
Actuated g/C Ratio	0.12	0.11	0.85	0.95	0.85	0.85
Clearance Time (s)	6.0	6.0		6.0		
Vehicle Extension (s)	4.0	4.0		4.0		
Lane Grp Cap (vph)	199	170	4192	1467	49	4192
v/s Ratio Prot	c0.06		0.56	0.02		0.59
v/s Ratio Perm		0.02		0.14	c0.80	
v/c Ratio	0.55	0.14	0.66	0.17	0.96	0.69
Uniform Delay, d1	75.0	72.2	4.5	0.3	10.7	4.7
Progression Factor	1.00	1.00	1.09	1.00	1.31	0.72
Incremental Delay, d2	3.8	0.5	0.3	0.1	67.2	0.2
Delay (s)	78.8	72.7	5.2	0.4	81.2	3.6
Level of Service	E	E	A	A	F	A
Approach Delay (s)	77.6		4.8			4.8
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			6.4		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.93			
Actuated Cycle Length (s)			180.0		Sum of lost time (s)	11.5
Intersection Capacity Utilization			64.8%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 AM - Alt. 5

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	57	25	97	866	21	135	26	80	2360	188	2	110
Future Volume (vph)	57	25	97	866	21	135	26	80	2360	188	2	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0		3.0	4.0			5.0
Lane Util. Factor	0.91	0.86	0.91	0.91	0.91	1.00		1.00	0.91			1.00
Frt	1.00	0.91	0.85	1.00	1.00	0.85		1.00	0.99			1.00
Flt Protected	0.95	0.99	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (prot)	1557	2814	1393	3113	1566	1531		1711	4605			1711
Flt Permitted	0.95	0.99	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (perm)	1557	2814	1393	3113	1566	1531		1711	4605			1711
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97	0.97	1.00	0.97
Adj. Flow (vph)	59	26	100	893	22	139	26	82	2433	194	2	113
RTOR Reduction (vph)	0	0	0	0	0	104	0	0	5	0	0	0
Lane Group Flow (vph)	47	88	50	607	308	35	0	108	2622	0	0	115
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3		4	4		1	1	5		6	6
Permitted Phases			3			4						
Actuated Green, G (s)	12.0	12.0	12.0	43.5	43.5	43.5		9.0	84.0			13.0
Effective Green, g (s)	14.0	14.0	14.0	45.5	45.5	45.5		12.0	87.0			15.0
Actuated g/C Ratio	0.08	0.08	0.08	0.25	0.25	0.25		0.07	0.48			0.08
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0		6.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	0.2			3.0
Lane Grp Cap (vph)	121	218	108	786	395	387		114	2225			142
v/s Ratio Prot	0.03	0.03		0.19	c0.20			0.06	c0.57			0.07
v/s Ratio Perm			c0.04			0.02						
v/c Ratio	0.39	0.40	0.46	0.77	0.78	0.09		0.95	1.18			0.81
Uniform Delay, d1	78.9	79.0	79.4	62.4	62.6	51.4		83.7	46.5			81.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.28	0.55			1.00
Incremental Delay, d2	2.1	1.2	3.1	4.7	9.4	0.1		58.0	84.2			27.7
Delay (s)	81.0	80.2	82.5	67.2	72.0	51.5		165.5	109.8			108.8
Level of Service	F	F	F	E	E	D		F	F			F
Approach Delay (s)		81.1			66.5				112.0			
Approach LOS		F			E				F			
Intersection Summary												
HCM 2000 Control Delay			94.3			HCM 2000 Level of Service			F			
HCM 2000 Volume to Capacity ratio			1.01									
Actuated Cycle Length (s)			180.0			Sum of lost time (s)			18.5			
Intersection Capacity Utilization			93.6%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 5

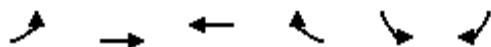


Movement	SBT	SBR
Lane Configurations	↑↑↑	↑
Traffic Volume (vph)	2578	16
Future Volume (vph)	2578	16
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	
Lane Util. Factor	0.91	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4911	
Flt Permitted	1.00	
Satd. Flow (perm)	4911	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	2658	16
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	2674	0
Turn Type	NA	
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	89.0	
Effective Green, g (s)	91.0	
Actuated g/C Ratio	0.51	
Clearance Time (s)	7.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2482	
v/s Ratio Prot	c0.54	
v/s Ratio Perm		
v/c Ratio	1.08	
Uniform Delay, d1	44.5	
Progression Factor	1.00	
Incremental Delay, d2	42.9	
Delay (s)	87.4	
Level of Service	F	
Approach Delay (s)	88.3	
Approach LOS	F	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 AM - Alt. 5



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	165	542	501	0	262	57
Future Volume (vph)	165	542	501	0	262	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.35	1.00	1.00		0.95	1.00
Satd. Flow (perm)	643	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	179	589	545	0	285	62
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	179	589	545	0	285	13
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	105.1	105.1	89.8		30.9	30.9
Effective Green, g (s)	105.1	105.1	89.8		30.9	30.9
Actuated g/C Ratio	0.71	0.71	0.60		0.21	0.21
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	531	1314	1122		367	328
v/s Ratio Prot	0.02	c0.32	c0.29		c0.16	0.01
v/s Ratio Perm	0.21					
v/c Ratio	0.34	0.45	0.49		0.78	0.04
Uniform Delay, d1	9.6	9.5	16.6		55.8	47.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	1.1	1.5		13.2	0.2
Delay (s)	10.0	10.6	18.1		69.0	47.4
Level of Service	A	B	B		E	D
Approach Delay (s)		10.4	18.1		65.1	
Approach LOS		B	B		E	
Intersection Summary						
HCM 2000 Control Delay			24.4		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.56			
Actuated Cycle Length (s)			149.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			65.0%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM - Alt. 5

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			  			  
Traffic Volume (vph)	319	72	2539	392	40	2242
Future Volume (vph)	319	72	2539	392	40	2242
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	2.5	2.0	2.5	2.5
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1711	1531	4916	1531	1711	4916
Flt Permitted	0.95	1.00	1.00	1.00	0.03	1.00
Satd. Flow (perm)	1711	1531	4916	1531	54	4916
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	339	77	2701	417	43	2385
RTOR Reduction (vph)	0	5	0	0	0	0
Lane Group Flow (vph)	339	72	2701	417	43	2385
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	3		2 4 9	3		6 4 9
Permitted Phases	3	3		2 4 9	6 4 9	
Actuated Green, G (s)	38.4	38.4	129.1	167.5	129.1	129.1
Effective Green, g (s)	41.4	40.4	133.1	170.5	133.1	133.1
Actuated g/C Ratio	0.23	0.22	0.74	0.95	0.74	0.74
Clearance Time (s)	6.0	6.0		6.0		
Vehicle Extension (s)	4.0	4.0		4.0		
Lane Grp Cap (vph)	393	343	3635	1467	39	3635
v/s Ratio Prot	c0.20		0.55	0.07		0.49
v/s Ratio Perm		0.05		0.21	c0.79	
v/c Ratio	0.86	0.21	0.74	0.28	1.10	0.66
Uniform Delay, d1	66.6	56.8	13.6	0.3	23.5	11.9
Progression Factor	1.00	1.00	0.60	1.00	0.62	0.38
Incremental Delay, d2	17.9	0.4	0.6	0.1	123.6	0.2
Delay (s)	84.5	57.2	8.8	0.4	138.1	4.7
Level of Service	F	E	A	A	F	A
Approach Delay (s)	79.4		7.7			7.1
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			12.4		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			1.06			
Actuated Cycle Length (s)			180.0		Sum of lost time (s)	11.5
Intersection Capacity Utilization			73.4%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 PM - Alt. 5

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	71	32	109	536	36	300	53	141	2251	277	5	245
Future Volume (vph)	71	32	109	536	36	300	53	141	2251	277	5	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0		3.0	4.0			5.0
Lane Util. Factor	0.91	0.86	0.91	0.91	0.91	1.00		1.00	0.91			1.00
Frt	1.00	0.92	0.85	1.00	1.00	0.85		1.00	0.98			1.00
Flt Protected	0.95	0.99	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (prot)	1557	2830	1393	3113	1575	1531		1711	4580			1711
Flt Permitted	0.95	0.99	1.00	0.95	0.96	1.00		0.95	1.00			0.95
Satd. Flow (perm)	1557	2830	1393	3113	1575	1531		1711	4580			1711
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97	0.97	1.00	0.97
Adj. Flow (vph)	73	33	112	553	37	309	53	145	2321	286	5	253
RTOR Reduction (vph)	0	0	0	0	0	142	0	0	7	0	0	0
Lane Group Flow (vph)	55	107	56	393	197	167	0	198	2600	0	0	258
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA		Prot	Prot
Protected Phases	3	3		4	4		1	1	5		6	6
Permitted Phases			3			4						
Actuated Green, G (s)	13.0	13.0	13.0	29.5	29.5	29.5		15.0	89.0			21.0
Effective Green, g (s)	15.0	15.0	15.0	31.5	31.5	31.5		18.0	92.0			23.0
Actuated g/C Ratio	0.08	0.08	0.08	0.18	0.18	0.18		0.10	0.51			0.13
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0		6.0	7.0			7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	0.2			3.0
Lane Grp Cap (vph)	129	235	116	544	275	267		171	2340			218
v/s Ratio Prot	0.04	0.04		c0.13	0.13			0.12	c0.57			c0.15
v/s Ratio Perm			c0.04			0.11						
v/c Ratio	0.43	0.46	0.48	0.72	0.72	0.63		1.16	1.11			1.18
Uniform Delay, d1	78.4	78.6	78.8	70.1	70.0	68.8		81.0	44.0			78.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		0.83	0.46			1.00
Incremental Delay, d2	2.3	1.4	3.1	4.7	8.6	4.5		107.9	55.0			119.4
Delay (s)	80.7	80.0	81.9	74.8	78.6	73.3		175.2	75.3			197.9
Level of Service	F	F	F	E	E	E		F	E			F
Approach Delay (s)		80.7			75.1				82.3			
Approach LOS		F			E				F			
Intersection Summary												
HCM 2000 Control Delay			80.2				HCM 2000 Level of Service		F			
HCM 2000 Volume to Capacity ratio			0.99									
Actuated Cycle Length (s)			180.0				Sum of lost time (s)		18.5			
Intersection Capacity Utilization			104.4%				ICU Level of Service		G			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 5



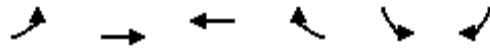
Movement	SBT	SBR
Lane Configurations	↑↑↑	↘
Traffic Volume (vph)	2640	43
Future Volume (vph)	2640	43
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	
Lane Util. Factor	0.91	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4904	
Flt Permitted	1.00	
Satd. Flow (perm)	4904	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	2722	44
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	2765	0
Turn Type	NA	
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	96.0	
Effective Green, g (s)	98.0	
Actuated g/C Ratio	0.54	
Clearance Time (s)	7.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2669	
v/s Ratio Prot	0.56	
v/s Ratio Perm		
v/c Ratio	1.04	
Uniform Delay, d1	41.0	
Progression Factor	1.00	
Incremental Delay, d2	27.6	
Delay (s)	68.6	
Level of Service	E	
Approach Delay (s)	79.6	
Approach LOS	E	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 5



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	188	850	821	0	437	117
Future Volume (vph)	188	850	821	0	437	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.05	1.00	1.00		0.95	1.00
Satd. Flow (perm)	91	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	924	892	0	475	127
RTOR Reduction (vph)	0	0	0	0	0	69
Lane Group Flow (vph)	204	924	892	0	475	58
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	97.0	97.0	77.3		43.0	43.0
Effective Green, g (s)	97.0	97.0	77.3		43.0	43.0
Actuated g/C Ratio	0.63	0.63	0.51		0.28	0.28
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	219	1181	941		497	444
v/s Ratio Prot	c0.09	0.50	0.48		c0.27	0.04
v/s Ratio Perm	c0.50					
v/c Ratio	0.93	0.78	0.95		0.96	0.13
Uniform Delay, d1	52.4	20.3	35.9		54.1	41.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	42.0	5.2	19.2		30.6	0.5
Delay (s)	94.4	25.5	55.1		84.6	41.5
Level of Service	F	C	E		F	D
Approach Delay (s)		38.0	55.1		75.5	
Approach LOS		D	E		E	
Intersection Summary						
HCM 2000 Control Delay			52.4		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.96			
Actuated Cycle Length (s)			153.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			92.8%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 AM - Alt. 6

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	102	25	2597	230	44	2716
Future Volume (vph)	102	25	2597	230	44	2716
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	2.5	2.0	2.5	2.5
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1711	1531	4916	1531	1711	4916
Flt Permitted	0.95	1.00	1.00	1.00	0.03	1.00
Satd. Flow (perm)	1711	1531	4916	1531	58	4916
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	109	27	2763	245	47	2889
RTOR Reduction (vph)	0	4	0	0	0	0
Lane Group Flow (vph)	109	23	2763	245	47	2889
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	3		2 4 9	3		6 4 9
Permitted Phases	3	3		2 4 9	6 4 9	
Actuated Green, G (s)	18.0	18.0	149.5	167.5	149.5	149.5
Effective Green, g (s)	21.0	20.0	153.5	170.5	153.5	153.5
Actuated g/C Ratio	0.12	0.11	0.85	0.95	0.85	0.85
Clearance Time (s)	6.0	6.0		6.0		
Vehicle Extension (s)	4.0	4.0		4.0		
Lane Grp Cap (vph)	199	170	4192	1467	49	4192
v/s Ratio Prot	c0.06		0.56	0.02		0.59
v/s Ratio Perm		0.02		0.14	c0.80	
v/c Ratio	0.55	0.14	0.66	0.17	0.96	0.69
Uniform Delay, d1	75.0	72.2	4.5	0.3	10.7	4.7
Progression Factor	1.00	1.00	1.09	1.00	1.31	0.72
Incremental Delay, d2	3.8	0.5	0.3	0.1	67.2	0.2
Delay (s)	78.8	72.7	5.2	0.4	81.2	3.6
Level of Service	E	E	A	A	F	A
Approach Delay (s)	77.6		4.8			4.8
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			6.4		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.93			
Actuated Cycle Length (s)			180.0		Sum of lost time (s)	11.5
Intersection Capacity Utilization			64.8%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 AM - Alt. 6

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	57	25	97	866	21	135	26	80	2362	188	2	110
Future Volume (vph)	57	25	97	866	21	135	26	80	2362	188	2	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0		3.0	4.0	5.0		5.0
Lane Util. Factor	0.91	0.86	0.91	0.91	0.91	1.00		1.00	0.91	1.00		1.00
Frt	1.00	0.91	0.85	1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	0.99	1.00	0.95	0.96	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	1557	2814	1393	3113	1566	1531		1711	4657	1531		1711
Flt Permitted	0.95	0.99	1.00	0.95	0.96	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	1557	2814	1393	3113	1566	1531		1711	4657	1531		1711
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97	0.97	1.00	0.97
Adj. Flow (vph)	59	26	100	893	22	139	26	82	2435	194	2	113
RTOR Reduction (vph)	0	0	0	0	0	104	0	0	0	55	0	0
Lane Group Flow (vph)	47	88	50	607	308	35	0	108	2435	139	0	115
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA	Perm	Prot	Prot
Protected Phases	3	3		4	4		1	1	5		6	6
Permitted Phases			3			4				5		
Actuated Green, G (s)	12.0	12.0	12.0	43.5	43.5	43.5		9.0	84.0	84.0		13.0
Effective Green, g (s)	14.0	14.0	14.0	45.5	45.5	45.5		12.0	87.0	86.0		15.0
Actuated g/C Ratio	0.08	0.08	0.08	0.25	0.25	0.25		0.07	0.48	0.48		0.08
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0		6.0	7.0	7.0		7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	0.2	0.2		3.0
Lane Grp Cap (vph)	121	218	108	786	395	387		114	2250	731		142
v/s Ratio Prot	0.03	0.03		0.19	c0.20			0.06	c0.52			0.07
v/s Ratio Perm			c0.04			0.02				0.09		
v/c Ratio	0.39	0.40	0.46	0.77	0.78	0.09		0.95	1.08	0.19		0.81
Uniform Delay, d1	78.9	79.0	79.4	62.4	62.6	51.4		83.7	46.5	27.0		81.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.28	0.55	0.46		1.00
Incremental Delay, d2	2.1	1.2	3.1	4.7	9.4	0.1		58.0	43.9	0.4		27.7
Delay (s)	81.0	80.2	82.5	67.2	72.0	51.5		165.2	69.4	12.9		108.8
Level of Service	F	F	F	E	E	D		F	E	B		F
Approach Delay (s)		81.1			66.5				69.2			
Approach LOS		F			E				E			
Intersection Summary												
HCM 2000 Control Delay			77.0			HCM 2000 Level of Service			E			
HCM 2000 Volume to Capacity ratio			0.96									
Actuated Cycle Length (s)			180.0			Sum of lost time (s)			18.5			
Intersection Capacity Utilization			92.1%			ICU Level of Service			F			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 6



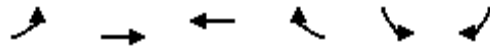
Movement	SBT	SBR
Lane Configurations	↑↑↑	↑
Traffic Volume (vph)	2578	16
Future Volume (vph)	2578	16
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	
Lane Util. Factor	0.91	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4911	
Flt Permitted	1.00	
Satd. Flow (perm)	4911	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	2658	16
RTOR Reduction (vph)	0	0
Lane Group Flow (vph)	2674	0
Turn Type	NA	
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	89.0	
Effective Green, g (s)	91.0	
Actuated g/C Ratio	0.51	
Clearance Time (s)	7.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2482	
v/s Ratio Prot	c0.54	
v/s Ratio Perm		
v/c Ratio	1.08	
Uniform Delay, d1	44.5	
Progression Factor	1.00	
Incremental Delay, d2	42.9	
Delay (s)	87.4	
Level of Service	F	
Approach Delay (s)	88.3	
Approach LOS	F	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 6



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	165	542	501	0	262	57
Future Volume (vph)	165	542	501	0	262	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.35	1.00	1.00		0.95	1.00
Satd. Flow (perm)	643	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	179	589	545	0	285	62
RTOR Reduction (vph)	0	0	0	0	0	49
Lane Group Flow (vph)	179	589	545	0	285	13
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	105.1	105.1	89.8		30.9	30.9
Effective Green, g (s)	105.1	105.1	89.8		30.9	30.9
Actuated g/C Ratio	0.71	0.71	0.60		0.21	0.21
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	531	1314	1122		367	328
v/s Ratio Prot	0.02	c0.32	c0.29		c0.16	0.01
v/s Ratio Perm	0.21					
v/c Ratio	0.34	0.45	0.49		0.78	0.04
Uniform Delay, d1	9.6	9.5	16.6		55.8	47.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.4	1.1	1.5		13.2	0.2
Delay (s)	10.0	10.6	18.1		69.0	47.4
Level of Service	A	B	B		E	D
Approach Delay (s)		10.4	18.1		65.1	
Approach LOS		B	B		E	
Intersection Summary						
HCM 2000 Control Delay			24.4		HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.56			
Actuated Cycle Length (s)			149.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			65.0%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

3: MD 650 & Elton Rd

Hillandale Traffic Analysis

2040 PM - Alt. 6

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			  			  
Traffic Volume (vph)	319	72	2539	392	40	2242
Future Volume (vph)	319	72	2539	392	40	2242
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	2.5	2.0	2.5	2.5
Lane Util. Factor	1.00	1.00	0.91	1.00	1.00	0.91
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1711	1531	4916	1531	1711	4916
Flt Permitted	0.95	1.00	1.00	1.00	0.03	1.00
Satd. Flow (perm)	1711	1531	4916	1531	54	4916
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	339	77	2701	417	43	2385
RTOR Reduction (vph)	0	5	0	0	0	0
Lane Group Flow (vph)	339	72	2701	417	43	2385
Turn Type	Prot	Perm	NA	pm+ov	Perm	NA
Protected Phases	3		2 4 9	3		6 4 9
Permitted Phases	3	3		2 4 9	6 4 9	
Actuated Green, G (s)	38.4	38.4	129.1	167.5	129.1	129.1
Effective Green, g (s)	41.4	40.4	133.1	170.5	133.1	133.1
Actuated g/C Ratio	0.23	0.22	0.74	0.95	0.74	0.74
Clearance Time (s)	6.0	6.0		6.0		
Vehicle Extension (s)	4.0	4.0		4.0		
Lane Grp Cap (vph)	393	343	3635	1467	39	3635
v/s Ratio Prot	c0.20		0.55	0.07		0.49
v/s Ratio Perm		0.05		0.21	c0.79	
v/c Ratio	0.86	0.21	0.74	0.28	1.10	0.66
Uniform Delay, d1	66.6	56.8	13.6	0.3	23.5	11.9
Progression Factor	1.00	1.00	0.60	1.00	0.62	0.38
Incremental Delay, d2	17.9	0.4	0.6	0.1	123.6	0.2
Delay (s)	84.5	57.2	8.8	0.4	138.1	4.7
Level of Service	F	E	A	A	F	A
Approach Delay (s)	79.4		7.7			7.1
Approach LOS	E		A			A
Intersection Summary						
HCM 2000 Control Delay			12.4		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			1.06			
Actuated Cycle Length (s)			180.0		Sum of lost time (s)	11.5
Intersection Capacity Utilization			73.4%		ICU Level of Service	D
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 PM - Alt. 6

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL
Lane Configurations												
Traffic Volume (vph)	71	32	109	536	36	300	53	141	2251	277	5	245
Future Volume (vph)	71	32	109	536	36	300	53	141	2251	277	5	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1800	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	5.0	5.0	5.0		3.0	4.0	5.0		5.0
Lane Util. Factor	0.91	0.86	0.91	0.91	0.91	1.00		1.00	0.91	1.00		1.00
Frt	1.00	0.92	0.85	1.00	1.00	0.85		1.00	1.00	0.85		1.00
Flt Protected	0.95	0.99	1.00	0.95	0.96	1.00		0.95	1.00	1.00		0.95
Satd. Flow (prot)	1557	2830	1393	3113	1575	1531		1711	4657	1531		1711
Flt Permitted	0.95	0.99	1.00	0.95	0.96	1.00		0.95	1.00	1.00		0.95
Satd. Flow (perm)	1557	2830	1393	3113	1575	1531		1711	4657	1531		1711
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	1.00	0.97	0.97	0.97	1.00	0.97
Adj. Flow (vph)	73	33	112	553	37	309	53	145	2321	286	5	253
RTOR Reduction (vph)	0	0	0	0	0	226	0	0	0	52	0	0
Lane Group Flow (vph)	55	107	56	393	197	83	0	198	2321	234	0	258
Turn Type	Split	NA	Perm	Split	NA	Perm	Prot	Prot	NA	Perm	Prot	Prot
Protected Phases	3	3		4	4		1	1	5		6	6
Permitted Phases			3			4				5		
Actuated Green, G (s)	13.0	13.0	13.0	29.5	29.5	29.5		15.0	89.0	89.0		21.0
Effective Green, g (s)	15.0	15.0	15.0	31.5	31.5	31.5		18.0	92.0	91.0		23.0
Actuated g/C Ratio	0.08	0.08	0.08	0.18	0.18	0.18		0.10	0.51	0.51		0.13
Clearance Time (s)	6.5	6.5	6.5	7.0	7.0	7.0		6.0	7.0	7.0		7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	0.2	0.2		3.0
Lane Grp Cap (vph)	129	235	116	544	275	267		171	2380	774		218
v/s Ratio Prot	0.04	0.04		c0.13	0.13			0.12	0.50			c0.15
v/s Ratio Perm			c0.04			0.05				0.15		
v/c Ratio	0.43	0.46	0.48	0.72	0.72	0.31		1.16	0.98	0.30		1.18
Uniform Delay, d1	78.4	78.6	78.8	70.1	70.0	64.8		81.0	42.9	26.0		78.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		0.83	0.47	0.35		1.00
Incremental Delay, d2	2.3	1.4	3.1	4.7	8.6	0.7		107.9	10.9	0.7		119.4
Delay (s)	80.7	80.0	81.9	74.8	78.6	65.4		175.2	31.0	9.9		197.9
Level of Service	F	F	F	E	E	E		F	C	A		F
Approach Delay (s)		80.7			72.4				39.1			
Approach LOS		F			E				D			
Intersection Summary												
HCM 2000 Control Delay			62.3				HCM 2000 Level of Service		E			
HCM 2000 Volume to Capacity ratio			0.95									
Actuated Cycle Length (s)			180.0				Sum of lost time (s)		18.5			
Intersection Capacity Utilization			97.9%				ICU Level of Service		F			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 6



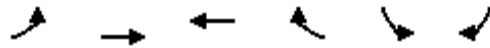
Movement	SBT	SBR
Lane Configurations	↑↑↑	↘
Traffic Volume (vph)	2640	43
Future Volume (vph)	2640	43
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	5.0	
Lane Util. Factor	0.91	
Frt	1.00	
Flt Protected	1.00	
Satd. Flow (prot)	4904	
Flt Permitted	1.00	
Satd. Flow (perm)	4904	
Peak-hour factor, PHF	0.97	0.97
Adj. Flow (vph)	2722	44
RTOR Reduction (vph)	1	0
Lane Group Flow (vph)	2765	0
Turn Type	NA	
Protected Phases	2	
Permitted Phases		
Actuated Green, G (s)	96.0	
Effective Green, g (s)	98.0	
Actuated g/C Ratio	0.54	
Clearance Time (s)	7.0	
Vehicle Extension (s)	0.2	
Lane Grp Cap (vph)	2669	
v/s Ratio Prot	c0.56	
v/s Ratio Perm		
v/c Ratio	1.04	
Uniform Delay, d1	41.0	
Progression Factor	1.00	
Incremental Delay, d2	27.6	
Delay (s)	68.6	
Level of Service	E	
Approach Delay (s)	79.6	
Approach LOS	E	
Intersection Summary		

HCM Signalized Intersection Capacity Analysis

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 6



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	185	850	848	0	437	117
Future Volume (vph)	185	850	848	0	437	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12
Total Lost time (s)	5.0	7.0	7.0		6.0	6.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	1.00		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1863	1863		1770	1583
Flt Permitted	0.05	1.00	1.00		0.95	1.00
Satd. Flow (perm)	90	1863	1863		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	924	922	0	475	127
RTOR Reduction (vph)	0	0	0	0	0	69
Lane Group Flow (vph)	201	924	922	0	475	58
Turn Type	pm+pt	NA	NA		Prot	Prot
Protected Phases	1	6	2		4	4
Permitted Phases	6					
Actuated Green, G (s)	97.0	97.0	77.4		43.0	43.0
Effective Green, g (s)	97.0	97.0	77.4		43.0	43.0
Actuated g/C Ratio	0.63	0.63	0.51		0.28	0.28
Clearance Time (s)	5.0	7.0	7.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0		7.0	7.0
Lane Grp Cap (vph)	217	1181	942		497	444
v/s Ratio Prot	c0.09	0.50	c0.49		c0.27	0.04
v/s Ratio Perm	0.50					
v/c Ratio	0.93	0.78	0.98		0.96	0.13
Uniform Delay, d1	52.7	20.3	37.0		54.1	41.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	40.8	5.2	24.6		30.6	0.5
Delay (s)	93.5	25.5	61.6		84.6	41.5
Level of Service	F	C	E		F	D
Approach Delay (s)		37.7	61.6		75.5	
Approach LOS		D	E		E	
Intersection Summary						
HCM 2000 Control Delay			54.6		HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio			0.97			
Actuated Cycle Length (s)			153.0		Sum of lost time (s)	18.0
Intersection Capacity Utilization			94.1%		ICU Level of Service	F
Analysis Period (min)			15			
c Critical Lane Group						



Appendix A-5

Synchro HCM Analysis Reports: Queue

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
Existing - AM

					
Lane Group	WBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	126	2440	236	38	2521
v/c Ratio	0.43	0.56	0.15	0.46	0.58
Control Delay	76.7	3.7	0.2	17.6	3.3
Queue Delay	0.0	0.2	0.0	0.0	0.3
Total Delay	76.7	3.9	0.2	17.6	3.6
Queue Length 50th (ft)	69	135	0	8	201
Queue Length 95th (ft)	105	135	0	m13	268
Internal Link Dist (ft)	407	112			229
Turn Bay Length (ft)				210	
Base Capacity (vph)	911	4331	1531	82	4331
Starvation Cap Reductn	0	835	0	0	981
Spillback Cap Reductn	0	315	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.14	0.70	0.15	0.46	0.75
Intersection Summary					
m Volume for 95th percentile queue is metered by upstream signal.					

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

Existing - AM

										
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	16	8	49	529	267	113	75	2130	100	2214
v/c Ratio	0.13	0.06	0.44	0.71	0.71	0.24	0.49	0.89	0.75	0.88
Control Delay	78.4	76.4	91.1	68.2	73.8	4.2	97.3	46.6	112.5	44.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0
Total Delay	78.4	76.4	91.1	68.2	73.8	4.2	97.3	47.0	112.5	44.9
Queue Length 50th (ft)	18	9	57	317	320	0	89	694	118	864
Queue Length 95th (ft)	46	29	104	391	445	28	138	#778	#221	#1090
Internal Link Dist (ft)		243			858			342		4843
Turn Bay Length (ft)	200		200	500		90	225		150	
Base Capacity (vph)	299	315	267	750	377	476	209	2396	133	2519
Starvation Cap Reductn	0	0	0	0	0	0	0	50	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.03	0.18	0.71	0.71	0.24	0.36	0.91	0.75	0.88

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Queues
52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
Existing - AM



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	115	565	508	247	51
v/c Ratio	0.20	0.42	0.44	0.72	0.15
Control Delay	7.2	10.2	16.6	67.4	12.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	7.2	10.2	16.6	67.4	12.4
Queue Length 50th (ft)	29	203	239	223	0
Queue Length 95th (ft)	56	312	372	321	37
Internal Link Dist (ft)		820	199	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	661	1334	1165	422	416
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.17	0.42	0.44	0.59	0.12
Intersection Summary					

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis

Existing - PM

					
Lane Group	WBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	392	2496	398	33	2114
v/c Ratio	0.67	0.64	0.26	0.57	0.54
Control Delay	72.8	7.7	0.3	42.1	4.8
Queue Delay	0.0	0.4	0.0	0.0	0.2
Total Delay	72.8	8.1	0.3	42.1	4.9
Queue Length 50th (ft)	220	270	0	4	104
Queue Length 95th (ft)	269	301	0	m23	280
Internal Link Dist (ft)	407	112			229
Turn Bay Length (ft)				210	
Base Capacity (vph)	788	3896	1531	58	3896
Starvation Cap Reductn	0	750	0	0	701
Spillback Cap Reductn	0	254	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.50	0.79	0.26	0.57	0.66
Intersection Summary					
m Volume for 95th percentile queue is metered by upstream signal.					

Queues
4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

Existing - PM

										
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	39	16	72	333	169	268	89	2456	100	2214
v/c Ratio	0.26	0.10	0.54	0.69	0.70	0.70	0.53	1.00	0.48	0.80
Control Delay	79.2	74.6	92.4	79.3	86.7	34.1	92.8	39.6	82.0	35.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	79.2	74.6	92.4	79.3	86.7	34.1	92.8	39.6	82.0	35.9
Queue Length 50th (ft)	44	18	83	208	212	107	96	511	112	742
Queue Length 95th (ft)	85	44	139	254	295	207	m164	#1324	183	#1071
Internal Link Dist (ft)		243			858			342		4843
Turn Bay Length (ft)	200		200	500		90	225		150	
Base Capacity (vph)	289	305	259	533	269	406	408	2447	209	2759
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.05	0.28	0.62	0.63	0.66	0.22	1.00	0.48	0.80

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
Existing - PM



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	124	868	883	429	114
v/c Ratio	0.46	0.68	0.81	1.06	0.27
Control Delay	13.2	17.5	32.6	117.0	15.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.2	17.5	32.6	117.0	15.6
Queue Length 50th (ft)	37	475	653	~469	20
Queue Length 95th (ft)	60	620	951	#688	75
Internal Link Dist (ft)		820	199	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	366	1278	1094	404	430
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.34	0.68	0.81	1.06	0.27

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
3: MD 650 & Elton Rd

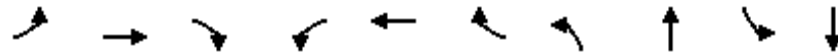
Hillandale Traffic Analysis
2040 AM

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	109	27	2763	245	47	2889
v/c Ratio	0.55	0.16	0.66	0.16	0.96	0.69
Control Delay	84.5	63.6	6.0	0.2	89.2	3.8
Queue Delay	0.0	0.0	0.4	0.0	0.0	1.0
Total Delay	84.5	63.6	6.4	0.2	89.2	4.8
Queue Length 50th (ft)	124	25	177	0	28	199
Queue Length 95th (ft)	188	58	194	0	m#34	m194
Internal Link Dist (ft)	407		112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	475	419	4192	1531	49	4192
Starvation Cap Reductn	0	0	758	0	0	941
Spillback Cap Reductn	0	0	536	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.06	0.80	0.16	0.96	0.89
Intersection Summary						
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues
4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	59	26	100	607	308	139	108	2627	115	2674
v/c Ratio	0.33	0.14	0.62	0.87	0.88	0.31	0.95	1.18	0.81	1.08
Control Delay	77.8	72.2	92.6	80.4	91.5	9.6	162.2	109.9	117.5	84.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	77.8	72.2	92.6	80.4	91.5	9.6	162.2	109.9	117.5	84.9
Queue Length 50th (ft)	66	28	115	384	391	0	133	~1336	136	~1284
Queue Length 95th (ft)	114	62	180	#559	#660	62	m#266	#1410	#254	#1352
Internal Link Dist (ft)		294			889			341		3121
Turn Bay Length (ft)	200		200	500		90	225		275	
Base Capacity (vph)	289	305	259	699	351	453	114	2231	142	2483
Starvation Cap Reductn	0	0	0	0	0	0	0	3	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.09	0.39	0.87	0.88	0.31	0.95	1.18	0.81	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 AM



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	167	589	545	285	62
v/c Ratio	0.31	0.45	0.48	0.78	0.16
Control Delay	8.6	11.3	19.2	70.9	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	8.6	11.3	19.2	70.9	11.4
Queue Length 50th (ft)	49	243	298	264	0
Queue Length 95th (ft)	78	331	423	374	41
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	614	1313	1126	415	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.27	0.45	0.48	0.69	0.15
Intersection Summary					

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	339	77	2701	417	43	2385
v/c Ratio	0.86	0.22	0.74	0.27	1.10	0.66
Control Delay	87.6	52.8	9.4	0.3	136.4	5.1
Queue Delay	0.0	0.0	1.4	0.0	0.0	0.5
Total Delay	87.6	52.8	10.8	0.3	136.4	5.6
Queue Length 50th (ft)	385	67	268	0	~58	156
Queue Length 95th (ft)	#544	121	276	0	m#69	m154
Internal Link Dist (ft)	407		112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	408	362	3634	1528	39	3634
Starvation Cap Reductn	0	0	672	0	0	666
Spillback Cap Reductn	0	0	615	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.21	0.91	0.27	1.10	0.80

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Queues
4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM

										
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	73	33	112	393	197	309	198	2607	258	2766
v/c Ratio	0.38	0.16	0.64	0.76	0.75	0.78	1.16	1.16	1.18	1.08
Control Delay	78.0	71.4	92.4	81.2	89.1	44.8	164.5	99.8	182.4	83.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.0	71.4	92.4	81.2	89.1	44.8	164.5	99.8	182.4	83.8
Queue Length 50th (ft)	81	36	129	245	246	161	~280	~1322	~364	~1345
Queue Length 95th (ft)	134	72	196	311	352	285	m#450	#1489	#559	#1508
Internal Link Dist (ft)		294			889			341		3121
Turn Bay Length (ft)	200		200	500		90	225		275	
Base Capacity (vph)	289	305	259	541	274	408	171	2247	218	2562
Starvation Cap Reductn	0	0	0	0	0	0	0	12	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.11	0.43	0.73	0.72	0.76	1.16	1.17	1.18	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

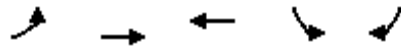
m Volume for 95th percentile queue is metered by upstream signal.

Queues

Hillandale Traffic Analysis

52: Riggs Rd/Powder Mill Rd

2040 PM



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	163	924	892	475	127
v/c Ratio	0.80	0.78	0.93	0.96	0.25
Control Delay	61.8	26.3	51.6	84.4	13.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	61.8	26.3	51.6	84.4	13.9
Queue Length 50th (ft)	104	637	832	469	23
Queue Length 95th (ft)	#206	837	#1135	#694	77
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	225	1181	959	497	513
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.72	0.78	0.93	0.96	0.25

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis

2040 AM - Alt. 1

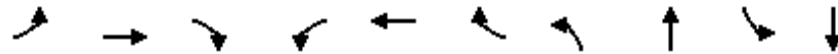
						
Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	77	153	2763	245	47	2912
v/c Ratio	0.48	0.25	0.65	0.16	0.89	0.68
Control Delay	85.6	41.6	5.5	0.2	73.1	3.4
Queue Delay	0.0	0.0	0.4	0.0	0.0	0.8
Total Delay	85.6	41.6	5.9	0.2	73.1	4.2
Queue Length 50th (ft)	92	132	162	0	26	203
Queue Length 95th (ft)	152	201	164	0	m31	m196
Internal Link Dist (ft)		407	112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	451	605	4276	1531	53	4276
Starvation Cap Reductn	0	0	805	0	0	941
Spillback Cap Reductn	0	0	530	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.25	0.80	0.16	0.89	0.87
Intersection Summary						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 1



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	59	26	100	546	279	141	82	2627	115	2674
v/c Ratio	0.33	0.14	0.62	0.78	0.79	0.31	0.72	1.18	0.81	1.08
Control Delay	77.8	72.2	92.6	74.3	82.7	9.9	130.6	110.1	117.5	84.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	77.8	72.2	92.6	74.3	82.7	9.9	130.6	110.1	117.5	84.9
Queue Length 50th (ft)	66	28	115	337	346	0	101	~1336	136	~1284
Queue Length 95th (ft)	114	62	180	#475	#578	64	m#176	#1409	#254	#1352
Internal Link Dist (ft)		294			889			341		3121
Turn Bay Length (ft)	200		200	500		90	225		275	
Base Capacity (vph)	289	305	259	699	351	453	114	2231	142	2483
Starvation Cap Reductn	0	0	0	0	0	0	0	1	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.09	0.39	0.78	0.79	0.31	0.72	1.18	0.81	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 AM - Alt. 1



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	180	589	535	285	62
v/c Ratio	0.33	0.45	0.48	0.78	0.16
Control Delay	8.7	11.3	19.3	70.9	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	8.7	11.3	19.3	70.9	11.4
Queue Length 50th (ft)	54	243	293	264	0
Queue Length 95th (ft)	84	331	417	374	41
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	621	1313	1121	415	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.29	0.45	0.48	0.69	0.15
Intersection Summary					

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis

2040 PM - Alt. 1



Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	193	192	2722	417	43	2487
v/c Ratio	0.68	0.27	0.70	0.27	1.02	0.64
Control Delay	81.3	33.9	7.2	0.3	111.7	4.2
Queue Delay	0.0	0.0	0.8	0.0	0.0	0.4
Total Delay	81.3	33.9	8.1	0.3	111.7	4.6
Queue Length 50th (ft)	228	149	246	0	~24	138
Queue Length 95th (ft)	309	220	275	0	m#65	m156
Internal Link Dist (ft)		407	112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	388	702	3908	1531	42	3908
Starvation Cap Reductn	0	0	785	0	0	757
Spillback Cap Reductn	0	0	627	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.27	0.87	0.27	1.02	0.79

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

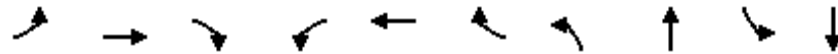
m Volume for 95th percentile queue is metered by upstream signal.

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 1



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	73	33	112	419	208	324	145	2592	258	2766
v/c Ratio	0.38	0.16	0.64	0.78	0.76	0.80	0.85	1.17	1.18	1.09
Control Delay	78.0	71.4	92.4	81.6	88.9	47.9	98.5	104.7	182.4	89.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	78.0	71.4	92.4	81.6	88.9	47.9	98.5	104.7	182.4	89.4
Queue Length 50th (ft)	81	36	129	260	258	181	181	~1333	~364	~1364
Queue Length 95th (ft)	134	72	196	332	#379	312	m#305	#1473	#559	#1508
Internal Link Dist (ft)		294			889			341		3121
Turn Bay Length (ft)	200		200	500		90	225		275	
Base Capacity (vph)	289	305	259	552	279	412	171	2216	218	2531
Starvation Cap Reductn	0	0	0	0	0	0	0	7	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.11	0.43	0.76	0.75	0.79	0.85	1.17	1.18	1.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

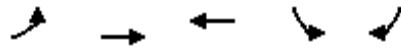
m Volume for 95th percentile queue is metered by upstream signal.

Queues

Hillandale Traffic Analysis

52: Riggs Rd/Powder Mill Rd

2040 PM - Alt. 1



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	204	924	892	475	127
v/c Ratio	0.93	0.78	0.95	0.96	0.25
Control Delay	86.6	26.3	55.6	84.4	13.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	86.6	26.3	55.6	84.4	13.9
Queue Length 50th (ft)	151	637	832	469	23
Queue Length 95th (ft)	#309	837	#1135	#694	77
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	223	1181	940	497	513
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.91	0.78	0.95	0.96	0.25

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 AM - Alt. 2

						
Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	77	153	2763	245	47	2912
v/c Ratio	0.48	0.25	0.65	0.16	0.89	0.68
Control Delay	85.6	41.6	5.5	0.2	76.8	3.5
Queue Delay	0.0	0.0	0.4	0.0	0.0	0.8
Total Delay	85.6	41.6	5.9	0.2	76.8	4.3
Queue Length 50th (ft)	92	132	162	0	26	204
Queue Length 95th (ft)	152	201	164	0	m#33	m197
Internal Link Dist (ft)		407	112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	451	605	4276	1531	53	4276
Starvation Cap Reductn	0	0	805	0	0	941
Spillback Cap Reductn	0	0	385	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.25	0.80	0.16	0.89	0.87
Intersection Summary						
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.					
m	Volume for 95th percentile queue is metered by upstream signal.					

Queues

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 AM - Alt. 2



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	59	65	61	546	279	141	82	2433	194	115	2674
v/c Ratio	0.42	0.50	0.51	0.71	0.72	0.29	0.72	1.08	0.25	0.81	1.08
Control Delay	86.1	91.5	92.6	68.4	74.1	9.1	130.6	69.9	6.5	117.5	84.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0
Total Delay	86.1	91.5	92.6	68.4	74.1	9.1	130.6	77.9	6.5	117.5	84.9
Queue Length 50th (ft)	68	78	73	326	335	0	101	~1156	16	136	~1284
Queue Length 95th (ft)	118	135	128	419	#515	62	m#176	#1233	58	#254	#1352
Internal Link Dist (ft)		294			889			341			3121
Turn Bay Length (ft)	200		200	500		300	225		125	275	
Base Capacity (vph)	289	263	246	770	387	486	114	2250	786	142	2483
Starvation Cap Reductn	0	0	0	0	0	0	0	58	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.25	0.25	0.71	0.72	0.29	0.72	1.11	0.25	0.81	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 AM - Alt. 2



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	180	589	535	285	62
v/c Ratio	0.33	0.45	0.48	0.78	0.16
Control Delay	8.7	11.3	19.3	70.9	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	8.7	11.3	19.3	70.9	11.4
Queue Length 50th (ft)	54	243	293	264	0
Queue Length 95th (ft)	84	331	417	374	41
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	621	1313	1121	415	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.29	0.45	0.48	0.69	0.15
Intersection Summary					

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM - Alt. 2



Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	193	192	2722	417	43	2487
v/c Ratio	0.68	0.27	0.70	0.27	1.02	0.64
Control Delay	81.3	33.9	7.2	0.3	118.4	4.0
Queue Delay	0.0	0.0	0.8	0.0	0.0	0.4
Total Delay	81.3	33.9	8.1	0.3	118.4	4.4
Queue Length 50th (ft)	228	149	246	0	~23	138
Queue Length 95th (ft)	309	220	275	0	m#68	m168
Internal Link Dist (ft)		407	112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	388	702	3908	1531	42	3908
Starvation Cap Reductn	0	0	785	0	0	722
Spillback Cap Reductn	0	0	322	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.27	0.87	0.27	1.02	0.78

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 2

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	73	74	71	419	208	324	145	2306	286	258	2766
v/c Ratio	0.48	0.53	0.55	0.75	0.73	0.65	0.85	0.99	0.35	1.18	1.06
Control Delay	87.2	90.8	93.0	78.2	84.7	18.1	98.5	37.7	7.8	182.4	75.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.3	0.0	0.0	0.0
Total Delay	87.2	90.8	93.0	78.2	84.7	18.1	98.5	48.9	7.8	182.4	75.2
Queue Length 50th (ft)	84	89	86	260	258	51	181	608	55	~364	~1309
Queue Length 95th (ft)	139	148	145	319	359	160	m#305	#1218	112	#559	#1508
Internal Link Dist (ft)		294			889			341			3121
Turn Bay Length (ft)	200		200	500		300	225		125	275	
Base Capacity (vph)	289	265	246	574	290	506	171	2325	809	218	2614
Starvation Cap Reductn	0	0	0	0	0	0	0	89	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.28	0.29	0.73	0.72	0.64	0.85	1.03	0.35	1.18	1.06

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 PM - Alt. 2



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	204	924	892	475	127
v/c Ratio	0.93	0.78	0.95	0.96	0.25
Control Delay	86.6	26.3	55.6	84.4	13.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	86.6	26.3	55.6	84.4	13.9
Queue Length 50th (ft)	151	637	832	469	23
Queue Length 95th (ft)	#309	837	#1135	#694	77
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	223	1181	940	497	513
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.91	0.78	0.95	0.96	0.25

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 AM - Alt. 3

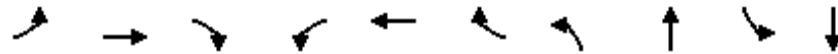
						
Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	77	153	2763	245	47	2912
v/c Ratio	0.48	0.25	0.65	0.16	0.89	0.68
Control Delay	85.6	41.6	5.5	0.2	77.7	3.5
Queue Delay	0.0	0.0	0.4	0.0	0.0	0.8
Total Delay	85.6	41.6	5.9	0.2	77.7	4.4
Queue Length 50th (ft)	92	132	162	0	26	204
Queue Length 95th (ft)	152	201	164	0	m#36	m197
Internal Link Dist (ft)		407	112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	451	605	4276	1531	53	4276
Starvation Cap Reductn	0	0	805	0	0	941
Spillback Cap Reductn	0	0	530	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.25	0.80	0.16	0.89	0.87
Intersection Summary						
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 3



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	47	88	50	546	279	141	82	2627	115	2674
v/c Ratio	0.39	0.40	0.46	0.69	0.71	0.29	0.72	1.18	0.81	1.08
Control Delay	87.0	83.5	92.1	67.1	72.6	8.9	130.6	110.1	117.5	84.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.0	83.5	92.1	67.1	72.6	8.9	130.6	110.1	117.5	84.9
Queue Length 50th (ft)	59	58	63	324	332	0	101	~1336	136	~1284
Queue Length 95th (ft)	108	93	116	415	#500	61	m#176	#1409	#254	#1352
Internal Link Dist (ft)		294			889			341		3121
Turn Bay Length (ft)	200		200	500		90	225		275	
Base Capacity (vph)	263	476	236	786	395	492	114	2231	142	2483
Starvation Cap Reductn	0	0	0	0	0	0	0	1	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.18	0.21	0.69	0.71	0.29	0.72	1.18	0.81	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

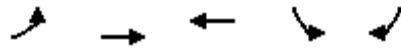
m Volume for 95th percentile queue is metered by upstream signal.

Queues

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 3



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	180	589	535	285	62
v/c Ratio	0.33	0.45	0.48	0.78	0.16
Control Delay	8.7	11.3	19.3	70.9	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	8.7	11.3	19.3	70.9	11.4
Queue Length 50th (ft)	54	243	293	264	0
Queue Length 95th (ft)	84	331	417	374	41
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	621	1313	1121	415	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.29	0.45	0.48	0.69	0.15
Intersection Summary					

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM - Alt. 3



Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	193	192	2722	417	43	2487
v/c Ratio	0.68	0.27	0.70	0.27	1.02	0.64
Control Delay	81.3	33.9	7.2	0.3	120.2	4.0
Queue Delay	0.0	0.0	0.8	0.0	0.0	0.3
Total Delay	81.3	33.9	8.1	0.3	120.2	4.3
Queue Length 50th (ft)	228	149	246	0	~24	142
Queue Length 95th (ft)	309	220	275	0	m#68	m170
Internal Link Dist (ft)		407	112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	388	702	3908	1531	42	3908
Starvation Cap Reductn	0	0	785	0	0	704
Spillback Cap Reductn	0	0	520	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.27	0.87	0.27	1.02	0.78

Intersection Summary

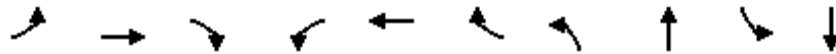
- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 3



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	55	107	56	419	208	324	145	2592	258	2766
v/c Ratio	0.43	0.46	0.49	0.74	0.72	0.77	0.85	1.12	1.18	1.05
Control Delay	87.6	84.1	92.0	77.3	83.5	44.9	98.5	82.1	182.4	71.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.6	84.1	92.0	77.3	83.5	44.9	98.5	82.1	182.4	71.8
Queue Length 50th (ft)	69	71	71	260	258	181	181	~1265	~364	~1291
Queue Length 95th (ft)	124	108	126	315	353	295	m#305	#1473	#559	#1508
Internal Link Dist (ft)		294			889			341		3121
Turn Bay Length (ft)	200		200	500		90	225		275	
Base Capacity (vph)	263	479	236	581	294	425	171	2313	218	2636
Starvation Cap Reductn	0	0	0	0	0	0	0	7	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.22	0.24	0.72	0.71	0.76	0.85	1.12	1.18	1.05

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

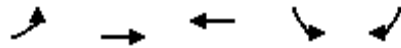
m Volume for 95th percentile queue is metered by upstream signal.

Queues

Hillandale Traffic Analysis

52: Riggs Rd/Powder Mill Rd

2040 PM - Alt. 3



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	204	924	892	475	127
v/c Ratio	0.93	0.78	0.95	0.96	0.25
Control Delay	86.6	26.3	55.6	84.4	13.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	86.6	26.3	55.6	84.4	13.9
Queue Length 50th (ft)	151	637	832	469	23
Queue Length 95th (ft)	#309	837	#1135	#694	77
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	223	1181	940	497	513
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.91	0.78	0.95	0.96	0.25

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 AM - Alt. 4

						
Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	77	153	2763	245	47	2912
v/c Ratio	0.48	0.25	0.65	0.16	0.89	0.68
Control Delay	85.6	41.6	5.5	0.2	77.7	3.5
Queue Delay	0.0	0.0	0.4	0.0	0.0	0.8
Total Delay	85.6	41.6	5.9	0.2	77.7	4.4
Queue Length 50th (ft)	92	132	162	0	26	204
Queue Length 95th (ft)	152	201	164	0	m#36	m197
Internal Link Dist (ft)		407	112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	451	605	4276	1531	53	4276
Starvation Cap Reductn	0	0	805	0	0	941
Spillback Cap Reductn	0	0	385	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.25	0.80	0.16	0.89	0.87
Intersection Summary						
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues

Hillandale Traffic Analysis

4: MD 650 & Powder Mill Rd

2040 AM - Alt. 4



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	47	88	50	546	279	141	82	2433	194	115	2674
v/c Ratio	0.39	0.40	0.46	0.69	0.71	0.29	0.72	1.08	0.25	0.81	1.08
Control Delay	87.0	83.5	92.1	67.1	72.6	8.9	130.6	69.9	6.5	117.5	84.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0
Total Delay	87.0	83.5	92.1	67.1	72.6	8.9	130.6	77.9	6.5	117.5	84.9
Queue Length 50th (ft)	59	58	63	324	332	0	101	~1156	16	136	~1284
Queue Length 95th (ft)	108	93	116	415	#500	61	m#176	#1233	58	#254	#1352
Internal Link Dist (ft)		294			889			341			3121
Turn Bay Length (ft)	200		200	500		300	225		125	275	
Base Capacity (vph)	263	476	236	786	395	492	114	2250	786	142	2483
Starvation Cap Reductn	0	0	0	0	0	0	0	58	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.18	0.21	0.69	0.71	0.29	0.72	1.11	0.25	0.81	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 AM - Alt. 4



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	180	589	535	285	62
v/c Ratio	0.33	0.45	0.48	0.78	0.16
Control Delay	8.7	11.3	19.3	70.9	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	8.7	11.3	19.3	70.9	11.4
Queue Length 50th (ft)	54	243	293	264	0
Queue Length 95th (ft)	84	331	417	374	41
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	621	1313	1121	415	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.29	0.45	0.48	0.69	0.15
Intersection Summary					

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis

2040 PM - Alt. 4



Lane Group	WBL	WBT	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	193	192	2722	417	43	2487
v/c Ratio	0.68	0.27	0.70	0.27	1.02	0.64
Control Delay	81.3	33.9	7.2	0.3	120.2	4.0
Queue Delay	0.0	0.0	0.8	0.0	0.0	0.3
Total Delay	81.3	33.9	8.1	0.3	120.2	4.3
Queue Length 50th (ft)	228	149	246	0	~24	142
Queue Length 95th (ft)	309	220	275	0	m#68	m170
Internal Link Dist (ft)		407	112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	388	702	3908	1531	42	3908
Starvation Cap Reductn	0	0	785	0	0	704
Spillback Cap Reductn	0	0	295	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.27	0.87	0.27	1.02	0.78

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 4

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	55	107	56	419	208	324	145	2306	286	258	2766
v/c Ratio	0.43	0.46	0.49	0.74	0.72	0.64	0.85	0.98	0.35	1.18	1.05
Control Delay	87.6	84.1	92.0	77.3	83.5	17.9	98.5	35.2	7.6	182.4	71.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	0.0	0.0	0.0
Total Delay	87.6	84.1	92.0	77.3	83.5	17.9	98.5	45.3	7.6	182.4	71.8
Queue Length 50th (ft)	69	71	71	260	258	51	181	497	55	~364	~1291
Queue Length 95th (ft)	124	108	126	315	353	158	m#305	#1218	112	#559	#1508
Internal Link Dist (ft)		294			889			341			3121
Turn Bay Length (ft)	200		200	500		300	225		125	275	
Base Capacity (vph)	263	479	236	581	294	508	171	2346	816	218	2636
Starvation Cap Reductn	0	0	0	0	0	0	0	93	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.22	0.24	0.72	0.71	0.64	0.85	1.02	0.35	1.18	1.05

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

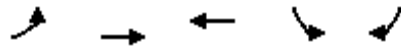
m Volume for 95th percentile queue is metered by upstream signal.

Queues

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 4



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	204	924	892	475	127
v/c Ratio	0.93	0.78	0.95	0.96	0.25
Control Delay	86.6	26.3	55.6	84.4	13.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	86.6	26.3	55.6	84.4	13.9
Queue Length 50th (ft)	151	637	832	469	23
Queue Length 95th (ft)	#309	837	#1135	#694	77
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	223	1181	940	497	513
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.91	0.78	0.95	0.96	0.25

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 AM - Alt. 5

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	109	27	2763	245	47	2889
v/c Ratio	0.55	0.16	0.66	0.16	0.96	0.69
Control Delay	84.5	63.6	6.0	0.2	95.0	4.1
Queue Delay	0.0	0.0	0.4	0.0	0.0	1.0
Total Delay	84.5	63.6	6.4	0.2	95.0	5.1
Queue Length 50th (ft)	124	25	177	0	28	199
Queue Length 95th (ft)	188	58	194	0	m#66	m194
Internal Link Dist (ft)	407		112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	475	419	4192	1531	49	4192
Starvation Cap Reductn	0	0	758	0	0	941
Spillback Cap Reductn	0	0	536	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.06	0.80	0.16	0.96	0.89
Intersection Summary						
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 5

										
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	47	88	50	607	308	139	108	2627	115	2674
v/c Ratio	0.39	0.40	0.46	0.77	0.78	0.28	0.95	1.18	0.81	1.08
Control Delay	87.0	83.5	92.1	70.3	77.3	8.6	162.2	109.9	117.5	84.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.0	83.5	92.1	70.3	77.3	8.6	162.2	109.9	117.5	84.9
Queue Length 50th (ft)	59	58	63	369	375	0	133	~1336	136	~1284
Queue Length 95th (ft)	108	93	116	#482	#583	59	m#266	#1410	#254	#1352
Internal Link Dist (ft)		294			889			341		3121
Turn Bay Length (ft)	200		200	500		90	225		275	
Base Capacity (vph)	263	476	236	786	395	492	114	2231	142	2483
Starvation Cap Reductn	0	0	0	0	0	0	0	3	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.18	0.21	0.77	0.78	0.28	0.95	1.18	0.81	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 AM - Alt. 5



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	179	589	545	285	62
v/c Ratio	0.33	0.45	0.49	0.78	0.16
Control Delay	8.8	11.3	19.5	70.9	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	8.8	11.3	19.5	70.9	11.4
Queue Length 50th (ft)	53	243	300	264	0
Queue Length 95th (ft)	84	331	427	374	41
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	613	1313	1121	415	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.29	0.45	0.49	0.69	0.15
Intersection Summary					

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM - Alt. 5

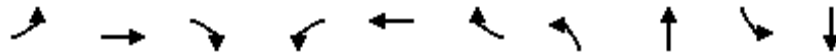
						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	339	77	2701	417	43	2385
v/c Ratio	0.86	0.22	0.74	0.27	1.10	0.66
Control Delay	87.6	52.8	9.4	0.3	144.4	5.1
Queue Delay	0.0	0.0	1.4	0.0	0.0	0.5
Total Delay	87.6	52.8	10.8	0.3	144.4	5.5
Queue Length 50th (ft)	385	67	268	0	~57	151
Queue Length 95th (ft)	#544	121	276	0	m#71	m162
Internal Link Dist (ft)	407		112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	408	362	3634	1528	39	3634
Starvation Cap Reductn	0	0	672	0	0	666
Spillback Cap Reductn	0	0	508	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.21	0.91	0.27	1.10	0.80
Intersection Summary						
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.						
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 5



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	55	107	56	393	197	309	198	2607	258	2766
v/c Ratio	0.43	0.46	0.49	0.72	0.72	0.75	1.16	1.11	1.18	1.04
Control Delay	87.6	84.1	92.0	77.5	84.1	42.1	164.5	76.5	182.4	66.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.6	84.1	92.0	77.5	84.1	42.1	164.5	76.5	182.4	66.5
Queue Length 50th (ft)	69	71	71	245	246	161	~280	~1254	~364	~1271
Queue Length 95th (ft)	124	108	126	295	335	270	m#450	#1489	#559	#1508
Internal Link Dist (ft)		294			889			341		3121
Turn Bay Length (ft)	200		200	500		90	225		275	
Base Capacity (vph)	263	479	236	567	286	419	171	2350	218	2672
Starvation Cap Reductn	0	0	0	0	0	0	0	15	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.22	0.24	0.69	0.69	0.74	1.16	1.12	1.18	1.04

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

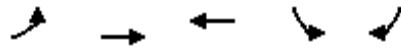
m Volume for 95th percentile queue is metered by upstream signal.

Queues

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 5



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	204	924	892	475	127
v/c Ratio	0.93	0.78	0.95	0.96	0.25
Control Delay	86.6	26.3	55.6	84.4	13.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	86.6	26.3	55.6	84.4	13.9
Queue Length 50th (ft)	151	637	832	469	23
Queue Length 95th (ft)	#309	837	#1135	#694	77
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	223	1181	940	497	513
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.91	0.78	0.95	0.96	0.25

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 AM - Alt. 6

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	109	27	2763	245	47	2889
v/c Ratio	0.55	0.16	0.66	0.16	0.96	0.69
Control Delay	84.5	63.6	6.0	0.2	95.0	4.1
Queue Delay	0.0	0.0	0.4	0.0	0.0	1.0
Total Delay	84.5	63.6	6.4	0.2	95.0	5.1
Queue Length 50th (ft)	124	25	177	0	28	199
Queue Length 95th (ft)	188	58	194	0	m#66	m194
Internal Link Dist (ft)	407		112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	475	419	4192	1531	49	4192
Starvation Cap Reductn	0	0	758	0	0	941
Spillback Cap Reductn	0	0	390	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.06	0.80	0.16	0.96	0.89
Intersection Summary						
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 AM - Alt. 6

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	47	88	50	607	308	139	108	2435	194	115	2674
v/c Ratio	0.39	0.40	0.46	0.77	0.78	0.28	0.95	1.08	0.25	0.81	1.08
Control Delay	87.0	83.5	92.1	70.3	77.3	8.6	162.0	70.0	6.2	117.5	84.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	0.0	0.0	0.0
Total Delay	87.0	83.5	92.1	70.3	77.3	8.6	162.0	77.7	6.2	117.5	84.9
Queue Length 50th (ft)	59	58	63	369	375	0	134	~1158	17	136	~1284
Queue Length 95th (ft)	108	93	116	#482	#583	59	m#266	#1235	56	#254	#1352
Internal Link Dist (ft)		294			889			341			3121
Turn Bay Length (ft)	200		200	500		300	225		125	275	
Base Capacity (vph)	263	476	236	786	395	492	114	2250	786	142	2483
Starvation Cap Reductn	0	0	0	0	0	0	0	60	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.18	0.21	0.77	0.78	0.28	0.95	1.11	0.25	0.81	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Queues
52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis
2040 AM - Alt. 6



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	179	589	545	285	62
v/c Ratio	0.33	0.45	0.49	0.78	0.16
Control Delay	8.8	11.3	19.5	70.9	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	8.8	11.3	19.5	70.9	11.4
Queue Length 50th (ft)	53	243	300	264	0
Queue Length 95th (ft)	84	331	427	374	41
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	613	1313	1121	415	419
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.29	0.45	0.49	0.69	0.15
Intersection Summary					

Queues
3: MD 650 & Elton Rd

Hillandale Traffic Analysis
2040 PM - Alt. 6

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	339	77	2701	417	43	2385
v/c Ratio	0.86	0.22	0.74	0.27	1.10	0.66
Control Delay	87.6	52.8	9.4	0.3	144.4	5.1
Queue Delay	0.0	0.0	1.4	0.0	0.0	0.5
Total Delay	87.6	52.8	10.8	0.3	144.4	5.5
Queue Length 50th (ft)	385	67	268	0	~57	151
Queue Length 95th (ft)	#544	121	276	0	m#71	m162
Internal Link Dist (ft)	407		112			229
Turn Bay Length (ft)					210	
Base Capacity (vph)	408	362	3634	1528	39	3634
Starvation Cap Reductn	0	0	672	0	0	666
Spillback Cap Reductn	0	0	285	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.21	0.91	0.27	1.10	0.80
Intersection Summary						
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.						
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						
m Volume for 95th percentile queue is metered by upstream signal.						

Queues

4: MD 650 & Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 6

											
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	55	107	56	393	197	309	198	2321	286	258	2766
v/c Ratio	0.43	0.46	0.49	0.72	0.72	0.63	1.16	0.98	0.35	1.18	1.04
Control Delay	87.6	84.1	92.0	77.5	84.1	15.8	164.5	32.7	7.1	182.4	66.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.7	0.0	0.0	0.0
Total Delay	87.6	84.1	92.0	77.5	84.1	15.8	164.5	42.4	7.1	182.4	66.5
Queue Length 50th (ft)	69	71	71	245	246	36	~280	424	27	~364	~1271
Queue Length 95th (ft)	124	108	126	295	335	136	m#450	#1232	124	#559	#1508
Internal Link Dist (ft)		294			889			341			3121
Turn Bay Length (ft)	200		200	500		300	225		125	275	
Base Capacity (vph)	263	479	236	567	286	503	171	2380	826	218	2672
Starvation Cap Reductn	0	0	0	0	0	0	0	102	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.22	0.24	0.69	0.69	0.61	1.16	1.02	0.35	1.18	1.04

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

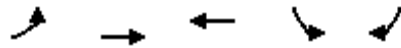
m Volume for 95th percentile queue is metered by upstream signal.

Queues

52: Riggs Rd/Powder Mill Rd

Hillandale Traffic Analysis

2040 PM - Alt. 6



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	201	924	922	475	127
v/c Ratio	0.92	0.78	0.98	0.96	0.25
Control Delay	84.9	26.3	61.7	84.4	13.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	84.9	26.3	61.7	84.4	13.9
Queue Length 50th (ft)	148	637	888	469	23
Queue Length 95th (ft)	#303	837	#1199	#694	77
Internal Link Dist (ft)		1208	200	166	
Turn Bay Length (ft)	110				
Base Capacity (vph)	223	1181	942	497	513
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.90	0.78	0.98	0.96	0.25

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Appendix A-6

LOS and Queue Summaries

Hillandale LOS Analysis Summary

Intersections	Approach	Existing with Adjusted Volume				2040 No Build with Adjusted Volumes				Alt 1: 2040 with Adjusted Volumes				Alt 2: 2040 with Adjusted Volumes - Improvements*				Alt 3: 2040 with Adjusted Volumes with 4 lanes from Hillandale Development				Alt 4: 2040 with Adjusted Volumes - Improvements* with 4 lanes from Hillandale Development				Alt 4A: 2040 with Adjusted Volumes - Improvements** with 4 lanes from Hillandale Development				Alt 5: 2040 with Adjusted Volumes - 4 lanes from Hillandale Development and no Elton Ramp				Alt 6: 2040 with Adjusted Volumes - Improvements* with 4 lanes from Hillandale Development and no Elton Ramp				Alt 6A: 2040 with Adjusted Volumes - Improvements** with 4 lanes from Hillandale Development, Signal Timing Adjustment, and no Elton Ramp			
		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM					
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay				
MD 650 & Elton Rd	Overall	A	4.8	B	10.2	A	6.2	B	12.4	A	5.9	A	8.7	A	6.0	A	8.6	A	6.0	A	8.6	A	6.0	A	8.6	A	6.2	A	8.6	A	6.4	B	12.4	A	6.4	B	12.4	A	6.6	B	12.4
	EB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	WB	E	78.9	E	72.3	E	77.6	E	79.4	D	54.0	E	55.4	D	54.0	E	55.4	D	54.0	E	55.4	D	54.0	E	55.4	E	77.6	E	79.4	E	77.6	E	79.4	E	77.6	E	79.4	E	77.6	E	79.4
	NB	A	3.0	A	6.0	A	4.8	A	7.7	A	4.4	A	5.5	A	4.4	A	5.5	A	4.4	A	5.5	A	4.4	A	5.5	A	4.8	A	7.7	A	4.8	A	7.7	A	4.8	A	7.7	A	4.8	A	7.7
	SB	A	3.0	A	4.5	A	4.4	A	7.1	A	3.7	A	5.4	A	3.9	A	5.3	A	3.9	A	5.3	A	3.9	A	5.3	A	4.3	A	5.3	A	4.8	A	7.1	A	4.8	A	7.1	A	5.2	A	7.1
MD 650 & Powder Mill Rd	Overall	D	51.5	D	43.9	F	96.1	F	96.5	F	94.6	F	98.5	E	75.9	E	65.3	F	93.4	F	82.1	E	75.7	E	63.2	E	75.5	E	79.1	F	94.3	F	80.2	E	77.0	E	62.3	E	77.5	E	79.8
	EB	F	83.2	F	80.3	E	79.7	E	79.3	E	79.7	E	79.3	F	81.7	F	81.7	F	81.1	F	80.7	F	81.1	F	80.7	F	81.1	F	80.7	F	81.1	F	80.7	F	81.1	F	80.7	F	81.1	F	80.7
	WB	E	64.8	E	75.7	E	78.3	E	78.2	E	70.8	E	78.8	E	63.9	E	72.7	E	62.8	E	75.1	E	62.8	E	72.1	E	70.7	E	72.1	E	66.5	E	75.1	E	66.5	E	72.4	E	78.0	E	72.4
	NB	D	48.9	D	39.8	F	112.0	F	104.0	F	110.5	F	103.1	E	67.0	D	36.4	F	110.5	F	81.4	E	67.0	C	34.5	F	86.2	E	70.5	F	112.0	F	82.3	E	69.2	D	39.1	F	88.3	F	82.3
	SB	D	47.8	D	35.7	F	88.3	F	96.3	F	88.3	F	101.9	F	88.3	F	87.9	F	88.3	F	85.0	F	88.3	F	85.0	E	66.5	F	89.0	F	88.3	E	79.6	F	88.3	E	79.6	E	66.5	E	79.6

Note: Alt.1-4 scenarios assume the slip ramp onto I-495 WB at MD 650/Elton Rd.

*For MD 650/Powder Mill Rd, the improvements include

NB approach: Add Right turn Lane (125 feet).

WB approach: Extend the Right Turn lane to 300 ft from 90 ft.

EB approach: Alt.2: Convert the middle lane to the Thru/Right Turn shared lane for lane use L-Th/R-R.

Alt. 3-6: Add one lane for lane use L-L/Th-Th/R-R.

** Alt. 4A and 6A do not add the NB right turn lane at MD 650/Powder Mill Road.

Hillandale Queue Summary by Synchro Model

Intersections	Exisitng						2040 No Build with Adjusted Volumes						Alt. 1: 2040 with Adjusted Volumes						Alt. 2: 2040 with Adjusted Volumes - Improvements*						Alt. 3: 2040 with Adjusted Volumes with 4 lanes from Hillandale Development						Alt. 4: 2040 with Adjusted Volumes - Improvements* with 4 lanes from Hillandale Development						Alt. 5: 2040 with Adjusted Volumes - 4 lanes from Hillandale Development and no Elton Ramp						Alt. 6: 2040 with Adjusted Volumes - Improvements* with 4 lanes from Hillandale Development and no Elton Ramp							
			AM		PM				AM		PM				AM		PM				AM		PM				AM		PM				AM		PM				AM		PM				AM		PM			
			Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)			Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)			Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)			Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)			Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)			Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)			Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)			Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)
	Mvmt	Stor. (ft)	Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)	Mvmt	Stor. (ft)	Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)	Mvmt	Stor. (ft)	Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)	Mvmt	Stor. (ft)	Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)	Mvmt	Stor. (ft)	Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)	Mvmt	Stor. (ft)	Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)	Mvmt	Stor. (ft)	Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)	Mvmt	Stor. (ft)	Queue 50th (ft)	Queue 95th (ft)	Queue 50th (ft)	Queue 95th (ft)		
3: MD 650 & Elton Rd	WBL	410	69	105	220	269	WBL	410	124	188	385	#544	WBL	410	92	152	228	309	WBL	410	92	152	228	309	WBL	410	92	152	228	309	WBL	410	124	188	385	#544	WBL	410	124	188	385	#544	WBL	410	124	188	385	#544		
	WBT						WBT						WBTR	410	132	201	149	220	WBTR	410	132	201	149	220	WBTR	410	132	201	149	220	WBT					WBT					WBT					WBT				
	WBR	410					WBR	410	25	58	67	121																									WBR	410	25	58	67	121	WBR	410	25	58	67	121		
	NBT	110	135	135	270	301	NBT	110	177	194	268	276	NBT	110	162	164	246	275	NBT	110	162	164	246	275	NBT	110	162	164	246	275	NBT	110	177	194	268	276	NBT	110	177	194	268	276	NBT	110	177	194	268	276		
	NBR						NBR						NBR						NBR						NBR						NBR					NBR					NBR					NBR				
	SBL	210	8	m13	4	m23	SBL	210	28	m#34	~58	m#69	SBL	210	26	m31	~24	m#65	SBL	210	26	m#33	~23	m#68	SBL	210	26	m#36	~24	m#68	SBL	210	28	m#66	~57	m#71	SBL	210	28	m#66	~57	m#71	SBL	210	28	m#66	~57	m#71		
4: MD 650 & Powder Mill Rd	SBT	580	201	268	104	280	SBT	580	199	m194	156	m154	SBT	580	203	m196	138	m156	SBT	580	204	m197	138	m168	SBT	580	204	m197	142	m170	SBT	580	199	m194	151	m162	SBT	580	199	m194	151	m162	SBT	580	199	m194	151	m162		
	EBL	200	18	46	44	85	EBL	200	66	114	81	134	EBL	200	66	114	81	134	EBL	200	68	118	84	139	EBL	200	59	108	69	124	EBL	200	59	108	69	124	EBL	200	59	108	69	124	EBL	200	59	108	69	124		
	EBT	240	9	29	18	44	EBT	290	28	62	36	72	EBT	290	28	62	36	72	EBT	290	78	135	89	148	EBT	290	58	93	71	108	EBT	290	58	93	71	108	EBT	290	58	93	71	108	EBT	290	58	93	71	108		
	EBR	200	57	104	83	139	EBR	200	115	180	129	196	EBR	200	115	180	129	196	EBR	200	73	128	86	145	EBR	200	63	116	71	126	EBR	200	63	116	71	126	EBR	200	63	116	71	126	EBR	200	63	116	71	126		
	WBL	500	317	391	208	254	WBL	500	384	#559	245	311	WBL	500	337	#475	260	332	WBL	500	326	419	260	319	WBL	500	324	415	260	315	WBL	500	369	#482	245	295	WBL	500	369	#482	245	295	WBL	500	369	#482	245	295		
	WBT	860	320	445	212	295	WBT	890	391	#660	246	352	WBT	890	346	#578	258	#379	WBT	890	335	#515	258	359	WBT	890	332	#500	258	353	WBT	890	375	#583	246	335	WBT	890	375	#583	246	335	WBT	890	375	#583	246	335		
	WBR	90		28	107	207	WBR	90		62	161	285	WBR	90		64	181	312	WBR	300		62	51	160	WBR	300		61	181	295	WBR	300		59	161	270	WBR	300		59	161	270	WBR	300		59	161	270		
	NBL	225	89	138	96	m164	NBL	225	133	m#266	~280	m#450	NBL	225	101	m#176	181	m#305	NBL	225	101	m#176	181	m#305	NBL	225	101	m#176	181	m#305	NBL	225	133	m#266	~280	m#450	NBL	225	134	m#266	~280	m#450	NBL	225	134	m#266	~280	m#450		
	NBT	600	694	#778	511	#1324	NBT	600	~1336	#1410	~1322	#1489	NBT	600	~1336	#1409	~1333	#1473	NBT	600	~1156	#1233	608	#1218	NBT	600	~1336	#1409	~1265	#1473	NBT	600	~1156	#1233	497	#1218	NBT	600	~1336	#1410	~1254	#1489	NBT	600	~1158	#1235	424	#1232		
	NBR						NBR						NBR						NBR	125	16	58	55	112	NBR	125	16	58	55	112	NBR	125	16	58	55	112	NBR	125	16	58	55	112	NBR	125	17	56	27	124		
	SBL	150	118	#221	112	183	SBL	275	136	#254	~364	#559	SBL	275	136	#254	~364	#559	SBL	275	136	#254	~364	#559	SBL	275	136	#254	~364	#559	SBL	275	136	#254	~364	#559	SBL	275	136	#254	~364	#559	SBL	275	136	#254	~364	#559		
	SBT	4840	864	#1090	742	#1071	SBT	3120	~1284	#1352	~1345	#1508	SBT	3120	~1284	#1352	~1364	#1508	SBT	3120	~1284	#1352	~1309	#1508	SBT	3120	~1284	#1352	~1291	#1508	SBT	3120	~1284	#1352	~1291	#1508	SBT	3120	~1284	#1352	~1271	#1508	SBT	3120	~1284	#1352	~1271	#1508		
	SBR						SBR						SBR						SBR						SBR						SBR					SBR					SBR					SBR				
52: Riggs Rd/Powder Mill Rd	EBL	110	29	56	37	60	EBL	110	49	78	104	#206	EBL	110	54	84	151	#309	EBL	110	54	84	151	#309	EBL	110	54	84	151	#309	EBL	110	53	84	151	#309	EBL	110	53	84	148	#303	EBL	110	53	84	148	#303		
	EBT	820	203	312	475	620	EBT	1210	243	331	637	837	EBT	1210	243	331	637	837	EBT	1210	243	331	637	837	EBT	1210	243	331	637	837	EBT	1210	243	331	637	837	EBT	1210	243	331	637	837	EBT	1210	243	331	637	837		
	WBT	1000	239	372	653	951	WBT	1000	298	423	832	#1135	WBT	1000	293	417	832	#1135	WBT	1000	293	417	832	#1135	WBT	1000	293	417	832	#1135	WBT	1000	300	427	832	#1135	WBT	1000	300	427	888	#1199	WBT	1000	300	427	888	#1199		
	SBL	800	223	321	~469	#688	SBL	800	264	374	469	#694	SBL	800	264	374	469	#694	SBL	800	264	374	469	#694	SBL	800	264	374	469	#694	SBL	800	264	374	469	#694	SBL	800	264	374	469	#694	SBL	800	264	374	469	#694		
	SBR	800		37	20	75	SBR	800		41	23	77	SBR	800		41	23	77	SBR	800		41	23	77	SBR	800		41	23	77	SBR	800		41	23	77	SBR	800		41	23	77	SBR	800		41	23	77		

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.



Appendix B

Conceptual Cost Estimates

Powder Mill Road and MD 650 Intersection Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	\$15.00	\$0.00
Removal of Existing Pavement	0	CY	\$30.00	\$0.00
Common Excavation	911	CY	\$25.00	\$22,775
			Total Category 2 Cost:	\$22,775.00
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	\$150.00	\$0.00
Retaining Wall - less than 4 feet	0	SF	\$120.00	\$0.00
			Total Category 4 Cost:	\$0.00
Category 5: Paving				
Fine Milling Asphalt Pavement	10,720	SY	\$2.00	\$21,440.00
HMA Surface Course (2")	1,422	TON	\$80.00	\$113,760.00
HMA Base Course (8")	644	TON	\$75.00	\$48,300.00
6" Graded Aggregate Base	2,734	SY	\$10.00	\$27,340.00
5" Thermoplastic White Pavement Markings	6,250	LF	\$1.50	\$9,375.00
12" Thermoplastic White Pavement Markings	960	LF	\$4.00	\$3,840.00
24" Thermoplastic White Pavement Markings	192	LF	\$10.00	\$1,920.00
5" Thermoplastic Yellow Pavement Markings	2,020	LF	\$1.50	\$3,030.00
Pavement Marking Symbols	96	SF	\$7.00	\$672.00
			Total Category 5 Cost:	\$229,677.00
Category 6: Shoulders				
5 Inch Concrete Sidewalk	5,470	SF	\$8.00	\$43,760.00
Standard Type A Curb and Gutter	1,350	LF	\$30.00	\$40,500.00
6 Ft Monolithic Concrete Median	600	LF	\$140.00	\$84,000.00
			Total Category 6 Cost:	\$168,260.00
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.28	CPM	\$17,600.00	\$4,928.00
New Traffic Signal - T intersection with pedestrians	0	EA	\$200,000.00	\$0.00
New Traffic Signal - 4 leg with pedestrians	1	EA	\$250,000.00	\$250,000.00
Existing Signal Modification/Impact - per leg	0	EA	\$65,000.00	\$0.00
Pedestrian/Ornamental/Decorative Lighting - Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	\$1,408,000.00	\$0.00
			Total Category 9 Cost:	\$254,928.00
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6				
	1	LS	\$168,284.80	\$168,284.80
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6				
	1	LS	\$147,249.20	\$147,249.20
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6				
	1	LS	\$12,621.36	\$12,621.36
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6				
	1	LS	\$21,035.60	\$21,035.60
			Subtotal	\$1,024,831.00
Design Contingency	50%			\$512,415.50
Admin. / Overhead	15.30%			\$156,799.14
Total Construction Cost				\$1,694,045.64
Cost of Powder Mill Road Developer Improvements				\$514,843.02
Right of Way Costs	4400	SF	\$150.00	\$660,000.00
Total Cost				\$2,868,888.66
SAY				\$2,868,900.00

Elton Road Slip Ramp and MD 650 Intersection Improvements (NO Queue jump)

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	40	LF	\$15.00	\$600.00
Removal of Existing Pavement	0	CY	\$30.00	\$0.00
Common Excavation	290	CY	\$25.00	\$7,250
			Total Category 2 Cost:	\$7,850.00
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	\$150.00	\$0.00
Retaining Wall - less than 4 feet	0	SF	\$120.00	\$0.00
			Total Category 4 Cost:	\$0.00
Category 5: Paving				
Fine Milling Asphalt Pavement	2,017	SY	\$2.00	\$4,034.00
HMA Surface Course (2")	289	TON	\$80.00	\$23,120.00
HMA Base Course (8")	205	TON	\$75.00	\$15,375.00
6" Graded Aggregate Base	870	SY	\$10.00	\$8,700.00
5" Thermoplastic White Pavement Markings	720	LF	\$1.50	\$1,080.00
12" Thermoplastic White Pavement Markings	150	LF	\$4.00	\$600.00
24" Thermoplastic White Pavement Markings	36	LF	\$10.00	\$360.00
5" Thermoplastic Yellow Pavement Markings	700	LF	\$1.50	\$1,050.00
Pavement Marking Symbols	64	SF	\$7.00	\$448.00
			Total Category 5 Cost:	\$54,767.00
Category 6: Shoulders				
5 Inch Concrete Sidewalk	200	SF	\$8.00	\$1,600.00
Standard Type A Curb and Gutter	450	LF	\$30.00	\$13,500.00
			Total Category 6 Cost:	\$15,100.00
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.11	CPM	\$17,600.00	\$1,936.00
New Traffic Signal - T intersection with pedestrians	0	EA	\$200,000.00	\$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	\$250,000.00	\$0.00
Existing Signal Modification/Impact - per leg	2	EA	\$65,000.00	\$130,000.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	\$1,408,000.00	\$0.00
			Total Category 9 Cost:	\$131,936.00
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6				
	1	LS	\$31,086.80	\$31,086.80
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6				
	1	LS	\$27,200.95	\$27,200.95
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6				
	1	LS	\$2,331.51	\$2,331.51
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6				
	1	LS	\$3,885.85	\$3,885.85
			Subtotal	\$274,158.00
Design Contingency	50%			\$137,079.00
Admin. / Overhead	15.30%			\$41,946.17
Total Construction Cost				\$453,183.17
Right of Way Costs	0	SF		\$0.00
			Total Cost	\$453,183.17
			SAY	\$453,200.00

Elton Road Slip Ramp and MD 650 Intersection Improvements (With Queue jump)

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	\$15.00	\$0.00
Removal of Existing Pavement	0	CY	\$30.00	\$0.00
Common Excavation	504	CY	\$25.00	\$12,600
			Total Category 2 Cost:	\$12,600.00
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	\$150.00	\$0.00
Retaining Wall - less than 4 feet	0	SF	\$120.00	\$0.00
			Total Category 4 Cost:	\$0.00
Category 5: Paving				
Fine Milling Asphalt Pavement	3,601	SY	\$2.00	\$7,202.00
HMA Surface Course (2")	513	TON	\$80.00	\$41,040.00
HMA Base Course (8")	356	TON	\$75.00	\$26,700.00
6" Graded Aggregate Base	1,512	SY	\$10.00	\$15,120.00
5" Thermoplastic White Pavement Markings	1,090	LF	\$1.50	\$1,635.00
12" Thermoplastic White Pavement Markings	370	LF	\$4.00	\$1,480.00
24" Thermoplastic White Pavement Markings	84	LF	\$10.00	\$840.00
5" Thermoplastic Yellow Pavement Markings	700	LF	\$1.50	\$1,050.00
Pavement Marking Symbols	192	SF	\$7.00	\$1,344.00
			Total Category 5 Cost:	\$96,411.00
Category 6: Shoulders				
5 Inch Concrete Sidewalk	1,320	SF	\$8.00	\$10,560.00
Standard Type A Curb and Gutter	675	LF	\$30.00	\$20,250.00
			Total Category 6 Cost:	\$30,810.00
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.16	CPM	\$17,600.00	\$2,816.00
New Traffic Signal - T intersection with pedestrians	0	EA	\$200,000.00	\$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	\$250,000.00	\$0.00
Existing Signal Modification/Impact - per leg	3	EA	\$65,000.00	\$195,000.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	\$1,408,000.00	\$0.00
Bus Shelter	1	EA	\$27,000.00	\$27,000.00
			Total Category 9 Cost:	\$224,816.00
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6				
	1	LS	\$55,928.40	\$55,928.40
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6				
	1	LS	\$48,937.35	\$48,937.35
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6				
	1	LS	\$4,194.63	\$4,194.63
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6				
	1	LS	\$6,991.05	\$6,991.05
			Subtotal	\$480,688.00
Design Contingency	50%			\$240,344.00
Admin. / Overhead	15.30%			\$73,545.26
Total Construction Cost				\$794,577.26
Right of Way Costs	0	SF		\$0.00
			Total Cost	\$794,577.26
			SAY	\$794,600.00

Powder Mill Road and Riggs Road Intersection Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	\$15.00	\$0.00
Removal of Existing Pavement	0	CY	\$30.00	\$0.00
Common Excavation	427	CY	\$25.00	\$10,675
			Total Category 2 Cost:	\$10,675.00
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	\$150.00	\$0.00
Retaining Wall - less than 4 feet	0	SF	\$120.00	\$0.00
			Total Category 4 Cost:	\$0.00
Category 5: Paving				
Fine Milling Asphalt Pavement	8,807	SY	\$2.00	\$17,614.00
HMA Surface Course (2")	1,112	TON	\$80.00	\$88,960.00
HMA Base Course (8")	302	TON	\$75.00	\$22,650.00
6" Graded Aggregate Base	1,280	SY	\$10.00	\$12,800.00
5" Thermoplastic White Pavement Markings	2,800	LF	\$1.50	\$4,200.00
12" Thermoplastic White Pavement Markings	200	LF	\$4.00	\$800.00
24" Thermoplastic White Pavement Markings	70	LF	\$10.00	\$700.00
5" Thermoplastic Yellow Pavement Markings	3,130	LF	\$1.50	\$4,695.00
Pavement Marking Symbols	176	SF	\$7.00	\$1,232.00
			Total Category 5 Cost:	\$153,651.00
Category 6: Shoulders				
5 Inch Concrete Sidewalk	350	SF	\$8.00	\$2,800.00
Standard Type A Curb and Gutter	1,270	LF	\$30.00	\$38,100.00
6 Ft Monolithic Concrete Median	150	LF	\$140.00	\$21,000.00
			Total Category 6 Cost:	\$61,900.00
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.25	CPM	\$17,600.00	\$4,400.00
New Traffic Signal - T intersection with pedestrians	0	EA	\$200,000.00	\$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	\$250,000.00	\$0.00
Existing Signal Modification/Impact - per leg	3	EA	\$65,000.00	\$195,000.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	\$1,408,000.00	\$0.00
			Total Category 9 Cost:	\$199,400.00
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6				
	1	LS	\$90,490.40	\$90,490.40
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6				
	1	LS	\$79,179.10	\$79,179.10
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6				
	1	LS	\$6,786.78	\$6,786.78
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6				
	1	LS	\$11,311.30	\$11,311.30
			Subtotal	\$613,394.00
Design Contingency	50%			\$306,697.00
Admin. / Overhead	15.30%			\$93,849.28
Total Construction Cost				\$1,013,940.28
Right of Way Costs	0	SF		\$0.00
			Total Cost	\$1,013,940.28
			SAY	\$1,014,000.00