MEMORANDUM

TO: CHIEF BARB SOLBERG
HIGHWAY DESIGN DIVISION

ATTN: ASSISTANT DIVISION CHIEF CORNELIUS BARMER

FROM: CHIEF LISA SHEMER
TRAVEL FORECASTING AND ANALYSIS DIVISION

SUBJECT: MD 355 AT CEDAR LANE, PHASE 4
MONTGOMERY COUNTY – MO593C21
OPERATIONAL ANALYSIS (INCLUDING MD 355 AT NORTH WOOD ROAD)

PREPARED BY: MATTHEW SNARE, P.E., PTOE, CONSULTANT, 410-545-5645

DATE: MAY 31, 2017

PURPOSE OF MEMORANDUM

The purpose of this memorandum is to present the findings of a traffic operational analysis conducted by the Maryland Department of Transportation - State Highway Administration (MDOT-SHA) Travel Forecasting and Analysis Division (TFAD) for two intersections (MD 355 at Cedar Lane and MD 355 at North Wood Road) located near Walter Reed National Military Medical Center in Bethesda, Maryland. This operational analysis was conducted to determine if additional improvements need to be implemented at these intersections to satisfy Base Realignment and Closure (BRAC) mitigation requirements.

INTRODUCTION

The MDOT-SHA Highway Design Division (HDD) is currently working on the design of Phase 4 improvements at the intersection of MD 355 at Cedar Lane. Phase 4 would convert the northbound right-turn lane into a shared through/right turn lane, and would widen northbound MD 355, north of Cedar Lane to provide a receiving lane. These changes would be expected to reduce delays and congestion during the PM peak period. Additionally, they would also make it possible to deactivate the traffic signal at the upstream intersection of MD 355 at North Wood Road, and instead provide a channelized free right turn lane for traffic exiting North Wood Road. TFAD evaluated the existing and proposed conditions at these two intersections under various potential Build scenarios. The study area included additional intersections along the MD 355 corridor, as shown in **Figure 1**.

PROJECT HISTORY

As part of the federally-mandated Base Realignment and Closure (BRAC), the former National Naval Medical Center in Bethesda expanded to include the operations from the Walter Reed Army Medical Center to form the Walter Reed National Military Medical Center (WRNMMC). These changes added approximately 2,200 new employees to the campus and attracted about 484,000 additional visitors per year. BRAC plans were approved by Congress in 2005 and the recommendations were implemented in 2011.

MDOT, in coordination with other local, state, and federal agencies, as well as various stakeholder groups, developed a series of proposed operational, safety, and access improvements for the transportation network surrounding the WRNMMC campus to mitigate the impact of the additional employees and visitors. The proposals included capacity improvements at the intersections of MD 185 at Jones Bridge Road, MD 355 at Jones Bridge Road, and MD 355 at Cedar Lane. Due to funding limitations, some of the proposed intersection improvements were delayed and/or broken down into phases.

The original plan for the MD 355 at Cedar Lane intersection included a fourth northbound through lane, which would tie into an unsignalized free right turn from North Wood Road to northbound MD 355 for vehicles exiting WRNMMC. However, the Navy requested that a signal be installed at the North Wood Road intersection, since the improvements to the Cedar Lane intersection would not be completed by the BRAC implementation date of 2011. Despite concerns that a signal at North Wood Road would increase delays for through traffic on northbound MD 355, MDOT-SHA agreed to install a signal with a triple right movement from North Wood Road. The signal was activated on July 28, 2011. Subsequently, the improvements at the intersection of MD 355 and Cedar Lane were broken into phases. Phases 1 through 3 ultimately received funding and construction was completed on the Phase 1 through 3 improvements in December 2016. Construction funding for Phase 4 was reallocated to the MD 355 Crossing project, which will provide a pedestrian tunnel under MD 355, south of South Wood Road, connecting WRNMMC to the Medical Center metro station. Phase 4 currently remains in the design phase, as described above.

TRAFFIC VOLUMES

Traffic volumes were developed for the study area by TFAD for use in the operational analysis. Because this is a mitigation study and the BRAC-related expansion of WRNMMC is already in place, the design year for the study is existing conditions (2017). New traffic counts were conducted in 2017 at the key intersections of MD 355 at Cedar Lane and MD 355 at North Wood Road to supplement previous traffic data that had been collected along the MD 355 corridor by MDOT-SHA. The new counts were conducted while schools were in session, following completion of the MD 355 at Cedar Lane Phase 1 through 3 improvements, but before construction of the MD 355 Crossing project, to represent typical conditions. Traffic volumes for the AM and PM peak hours were balanced throughout the study area, and the resulting peak hour volume network used in this study is shown in **Figure 2**. A copy of the raw count data is included in **Appendix A**.

OPERATIONAL ANALYSIS – EXISTING CONDITIONS

Synchro, version 9, and the companion simulation software SimTraffic were used to evaluate the existing traffic operations along MD 355 within the study area. A field visit was conducted to assist in model development and calibration. During the field visit, existing lane configurations were confirmed, existing signal timings were determined, and observations were made regarding queue lengths and general traffic behavior. Using the data obtained from the field and the traffic volumes shown in Figure 2, a calibrated Synchro model was developed for the AM and PM peak hours. Using the model, the existing level of service (LOS) and average delay per vehicle was calculated, as shown in **Table 1**. The Synchro model output worksheets are provided in **Appendix B**.

Table 1 – Existing (2017) Intersection Level of Service (LOS) and Average Delay

	AM Peak		PM Peak	
Intersection	**LOS**	**Delay (s/veh)**	**LOS**	**Delay (s/veh)**
MD 355 at Cedar Lane	D	52.5	E	64.1
MD 355 at North Wood Road	B	14.7	D	46.8

It should be noted that project needs were reevaluated from a practical design perspective prior to the start of this study. It was determined that operations would be deemed acceptable if the study area intersections operated at LOS E or better during the peak hours, consistent with the MDOT-SHA's threshold for intersections in urban areas. Therefore, based on the design criteria and the results presented in Table 1, the study intersections operate acceptably under existing conditions (i.e., Phases 1 through 3 complete at MD 355 at Cedar Lane, and an active traffic signal at MD 355 and North Wood Road). It should be noted that LOS F is not reached until the average delay is 80 seconds per vehicle. A sensitivity analysis conducted by TFAD indicated that LOS E operations can be maintained for approximately 15 to 20 years.

TRAVEL TIME RUNS

Travel time runs were conducted using GPS in April 2017 along northbound MD 355 from Cordell Avenue (south of the study area) to Pooks Hill Road (north of the study area), a distance of approximately 1.66 miles. The results of the travel time run study indicated that the average travel time between 3:30 PM and 6:00 PM was approximately 11.3 minutes per vehicle. Congestion is present throughout much of the corridor, with stop-and-go conditions between Cordell Avenue and Cedar Lane. North of the Cedar Lane signal, speeds increase to near free-flow levels.

MDOT-SHA had previously conducted similar travel time runs in April 2011. The 2011 travel time runs were conducted prior to the implementation of BRAC, prior to the installation of the signal at North Wood Road, and prior to the construction of any BRAC-related intersection improvements. A comparison of the April 2011 results and the April 2017 results is shown in **Table 2**. The results indicate that the average travel times along northbound MD 355 between Jones Bridge Road and Pooks Hill Road are nearly identical in 2011 and 2017. This indicates that the roadway changes implemented between 2011 and 2017 have effectively mitigated the changes in traffic demand in the study area during that time, including BRAC impacts. The results also indicate that travel times between Cordell Avenue and Jones Bridge Road are significantly better in 2017 than they were in 2011. This indicates that the intersection improvements implemented at Jones Bridge Road have been effective at improving operations during the PM peak period.

Table 2 – PM Peak Travel Time Run Comparison – April 2011 vs. April 2017

		April 2011	April 2017
Segment	**Length**	**Travel Time**	**Travel Time**
Cordell Ave to Jones Bridge Rd	2,210 ft.	318.4 sec	238.8 sec
Jones Bridge Rd to Pooks Hill Rd	6,571 ft.	438.5 sec	439.4 sec
Jones Bridge Rd to Wilson Drive	*2,072 ft.*	252.9 sec	258.4 sec
Wilson Drive to North Wood Rd	*613 ft.*	72.5 sec	70.2 sec
North Wood Rd to Cedar Lane	*762 ft.*	46.3 sec	53.6 sec
Cedar Lane to Pooks Hill Rd	*3,124 ft.*	66.8 sec	57.2 sec
Totals	8,781 ft. (1.66 mi)	756.9 sec (12.6 min)	678.2 sec (11.3 min)

Notes: 1. Results based on an average of runs conducted between 3:30 PM and 6:00 PM.
2. Data collection dates were April 14th, 27th, and 28th, 2011 and April 19th, 2017.

The travel time run reports are included with this memorandum in **Appendix C**.

PROJECTED TRAFFIC IMPACTS OF PHASE 4

As discussed earlier in this memorandum, Phase 4 of the MD 355 at Cedar Lane improvements would increase the capacity in the northbound direction, and would be expected to improve operations, particularly during the PM peak period. To quantify the projected benefits, the Synchro models were modified to include the Phase 4 improvements, and the LOS and delay results under 2017 traffic demand levels were re-calculated for the "Build Phase 4" condition. The results (versus Existing Conditions) are shown below in **Table 3**. It should be noted that these results assume that the signal at North Wood Road would remain (see the following section for a discussion of the impacts of deactivating the signal at North Wood Road).

Table 3 – Build Phase 4 - Level of Service (LOS) and Average Delay

MD 355 at Cedar Lane	AM Peak		PM Peak	
Conditions	**LOS**	**Delay (s/veh)**	**LOS**	**Delay (s/veh)**
Existing (Phases 1-3 Complete)	D	52.5	E	64.1
Build Phase 4*	D	52.9	E	63.7

**Note: These results assume signal remains at upstream North Wood Road intersection.*

The results of the Synchro analysis indicate that constructing Phase 4 alone is projected to have a minimal impact on the intersection LOS and delay of MD 355 at Cedar Lane if the signal remained at the upstream North Wood Road intersection. SimTraffic was also used to determine the network benefits of Phase 4. The results, summarized in **Table 4** below, indicate that Phase 4 would be projected to reduce network delay by approximately 10 percent during the PM peak hour compared to existing conditions.

Table 4 – Build Phase 4 – Network Parameters

MD 355 at Cedar Lane	AM Peak	PM Peak
Conditions	**Network Delay (hr)**	**Network Delay (hr)**
Existing (Phases 1-3 Complete)	448.0	301.4
Build Phase 4*	443.0	268.7
Percent Reduction	**1.1%**	**10.8%**

**Note: These results assume signal remains at upstream North Wood Road intersection.*

PROJECTED IMPACTS OF DEACTIVATING SIGNAL AT NORTH WOOD ROAD

As noted earlier in this memorandum, one potential additional benefit of constructing Phase 4 is that it would allow for the traffic signal at MD 355 and North Wood Road to be deactivated during the PM peak period. Traffic exiting WRNMMC at North Wood Road would be able to make a free right onto northbound MD 355 and continue traveling north on MD 355 through Cedar Lane in the new fourth through lane. Under this scenario, northbound traffic on MD 355 (including traffic exiting the National Institutes of Health at Wilson Drive) would not be required to stop at North Wood Road during the PM peak period. It should be noted that the signal would still be required during the AM peak period to accommodate southbound left turning traffic into North Wood Road. However, this is less of a concern, because the conflicting northbound through traffic on MD 355 is much lighter during the AM peak.

To quantify the projected benefits of deactivating the signal at North Wood Road, the PM peak Synchro models were modified to include the Phase 4 improvements and the removal of the signal. The LOS and delay results

assuming year 2017 traffic demand were determined for the "Build Phase 4 With Signal Deactivation" condition, as shown in **Table 5**. The results of the Synchro analysis indicate that constructing Phase 4 and deactivating the signal at North Wood Road would be projected to improve the level of service for MD 355 at Cedar Lane from LOS E to LOS D during the PM peak period. The improvement is based on better vehicle progression in the northbound direction, resulting in lower delay for northbound traffic.

Table 5 – Build Phase 4 With Signal Deactivation – Level of Service (LOS) and Average Delay

Conditions	MD 355 at North Wood Rd		MD 355 at Cedar Lane	
	PM Peak		PM Peak	
	LOS	Delay (s/veh)	LOS	Delay (s/veh)
Existing (Phases 1-3 Complete)	D	46.8	E	64.1
Build Phase 4 - Plus Signal Deactivation at North Wood Rd	N/A*	N/A*	D	45.6

**Note: LOS and delay are not reported, because all movements are free movements.*

SimTraffic was also used to determine the network benefits of the "Phase 4 With Signal Deactivation" condition. The results, summarized in **Table 6** below, indicate that Phase 4 would be projected to reduce network delay by approximately 15 percent during the PM peak hour compared to existing conditions.

Table 6 – Build Phase 4 With Signal Deactivation – Network Parameters

MD 355 at Cedar Lane	AM Peak	PM Peak
Conditions	**Network Delay (hr)**	**Network Delay (hr)**
Existing (Phases 1-3 Complete)	448.0	301.4
Build Phase 4 - Plus Signal Deactivation at North Wood Rd	443.0	253.8
Percent Reduction	**1.1%**	**15.8%**

It should be noted that there was some concern that the signal at North Wood Road has become the new bottleneck point along northbound MD 355 during the PM peak period, now that Phases 1 through 3 of the MD 355 at Cedar Lane improvements are completed. However, the travel time run information presented earlier in this report indicates that is not the case. The travel times approaching North Wood Road are similar in 2017 (with the signal) as they were before the signal (April 2011), and speeds do not pick up until traffic passes Cedar Lane. This suggests that the signal is reasonably timed, and in general, most northbound vehicles receive a red light indication at North Wood Road during periods when they would have been stopped already (i.e., signal progression along the corridor is relatively good). However, the field visit did indicate that the corridor experiences some queue spillback and cycle failures (vehicles do not clear in one cycle) at the intersections of North Wood Road, Wilson Drive, South Wood Road, and Jones Bridge Road. Also, there were occasions where some green time for northbound MD 355 at Cedar Lane appeared to be wasted while the light was red for northbound traffic at North Wood Road. Therefore, there may be room for improvement, and the signal offsets along the corridor could be re-evaluated.

Finally, it should be noted that deactivating the signal at North Wood Road without constructing Phase 4 of the Cedar Lane improvements is not feasible. This scenario would dump a large volume of traffic from the WRNMMC into a right-turn only lane at Cedar Lane, and would create an undesirable weaving condition along northbound MD 355 between North Wood Road and Cedar Lane.

CONCLUSIONS AND RECOMMENDATIONS

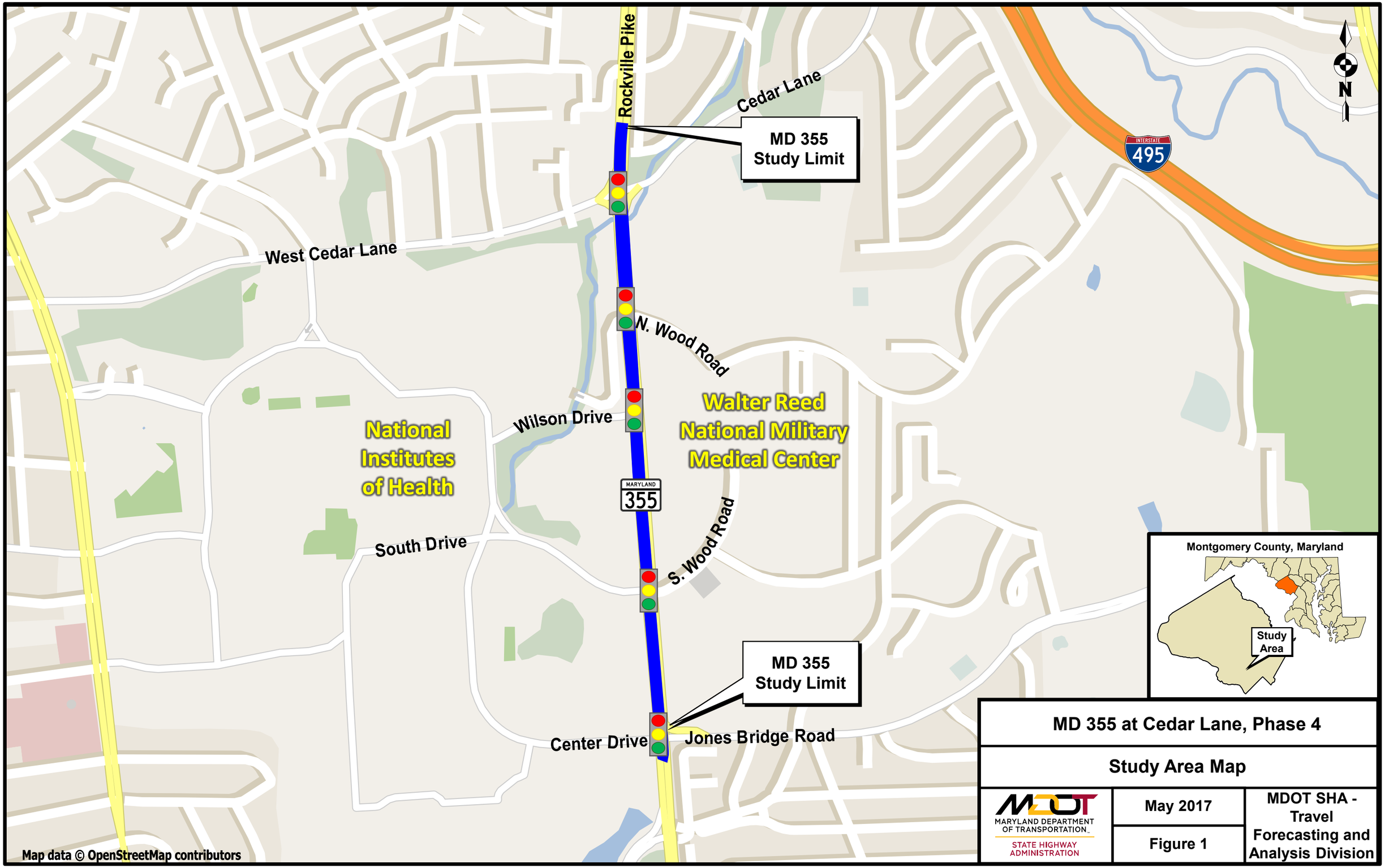
The results of the traffic operational analyses conducted by TFAD for the intersections of MD 355 at Cedar Lane and MD 355 at North Wood Road indicate the following:

- The intersection of MD 355 at Cedar Lane currently operates at LOS E or better during the peak hours, following completion of Phases 1 through 3 of the BRAC intersection improvements.
- The intersection of MD 355 at North Wood Road currently operates at LOS D or better during the peak hours as a signalized intersection with a triple right turn from North Wood Road to northbound MD 355 during the PM peak period.
- Constructing Phase 4 at the intersection of MD 355 at Cedar Lane would be expected to improve operations during the PM peak period, but the benefits would be relatively minor.
- A comparison of travel time run data between April 2011 (pre-BRAC and before a signal was installed at the intersection of MD 355 at North Wood Road) and April 2017 (post-BRAC and following completion of Phases 1 through 3 of the MD 355 at Cedar Lane improvements) indicates that travel times through the study area are nearly identical. The data suggests that the changes implemented in the corridor to date have effectively mitigated the impact of BRAC.
- Because the study intersections currently operate at LOS E or better and the travel time run data indicates that the impacts of BRAC have been effectively mitigated, Phase 4 is not required at this time, and the signal at North Wood Road can remain operational during the PM peak period.
- However, there are still operational issues along the corridor, including queue spillback, cycle failures, and long travel times. Therefore, a long-term improvement project, unrelated to BRAC, that considers a 20-year design horizon may be required to relieve congestion and queues that have been present on MD 355 since before BRAC and will likely continue to degrade over time.
- In the near term, MDOT-SHA and Montgomery County could re-evaluate the signal timing along the corridor, particularly intersection offsets, to ensure optimum traffic flow.

ATTACHMENTS

- Figure 1: Study Area Map
- Figure 2: Existing (2017) Traffic Volumes
- Appendix A: Traffic Count Data
- Appendix B: Synchro / SimTraffic Results Worksheets
- Appendix C: Travel Time Run Reports

cc: Mr. Jeff Davis, ICD, MDOT-SHA
Mr. Scott Holcomb, P.E., Gannett Fleming
Ms. Anyesha Mookherjee, ADE-Traffic, D3, MDOT-SHA



MD 355 at Cedar Lane, Phase 4

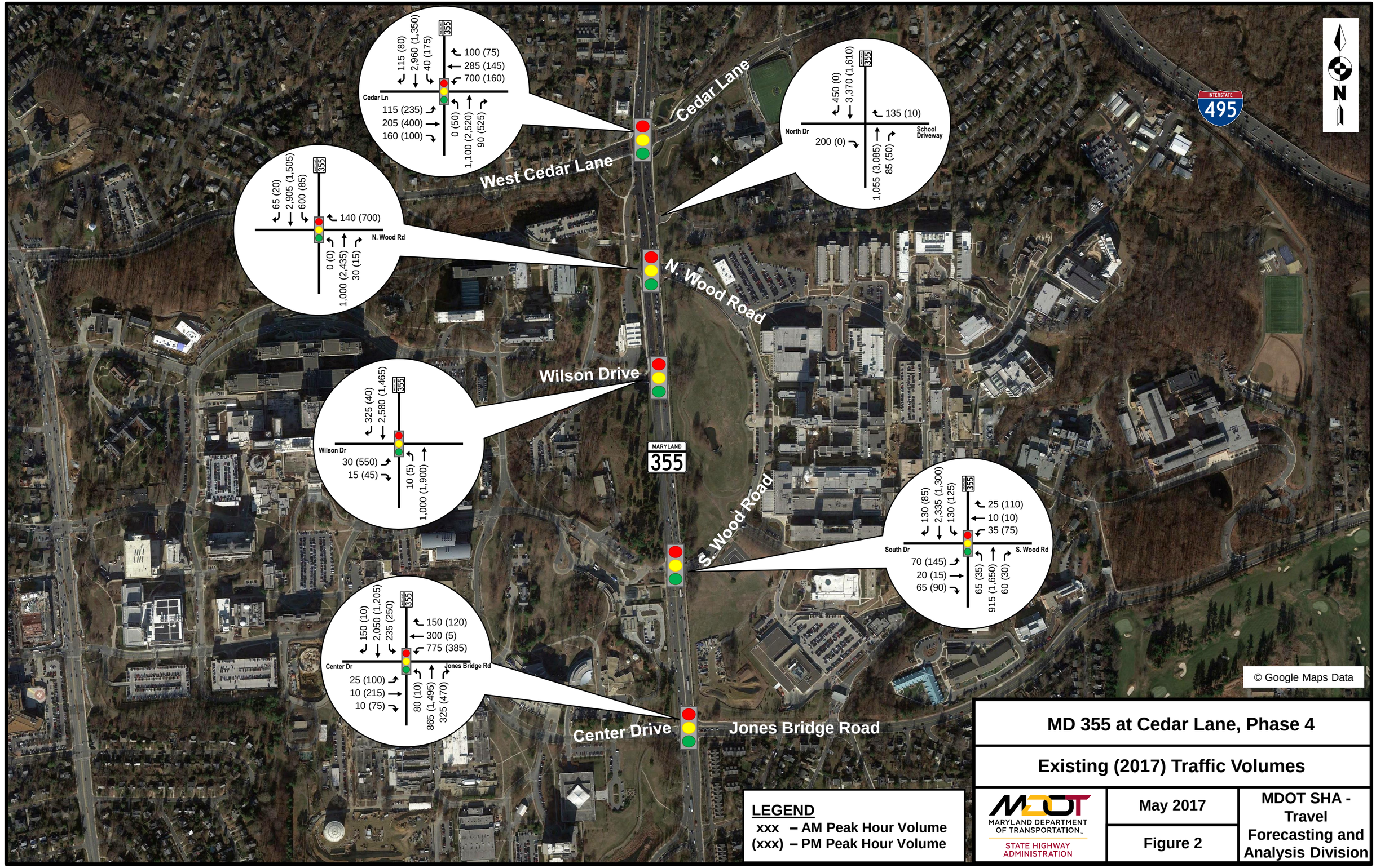
Study Area Map

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

May 2017

Figure 1

MDOT SHA - Travel Forecasting and Analysis Division



LEGEND

xxx – AM Peak Hour Volume
(xxx) – PM Peak Hour Volume

MD 355 at Cedar Lane, Phase 4

Existing (2017) Traffic Volumes

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

May 2017

Figure 2

MDOT SHA - Travel Forecasting and Analysis Division

Appendix A: Traffic Count Data

Turning Movement Counts - Field Sheet

Job No.:

Location: MD 355 at N Wood Rd
Date: 4/19/2017 Wednesday
Recorder: RJM
Interval (dd) : 15 (In Minutes)

County: Montgomery
Town: Bethesda
Weather: Clear

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-7:00PM	Start	End	Volume	LOS	V/C
		00:00	01:00	0				16:45	17:45	4537		

Street Name-->	MD 355					MD 355					N Wood Rd					NIH Entrance					GRAND TOTAL
HOUR	From North					From South					From East					From West					
ENDING	U turn	Left	Through	Right	Total	U turn	Left	Through	Right	Total	U turn	Left	Through	Right	Total	U turn	Left	Through	Right	Total	
00:15					0					0					0					0	0
00:30					0					0					0					0	0
00:45					0					0					0					0	0
01:00					0					0					0					0	0
01:15					0					0					0					0	0
01:30					0					0					0					0	0
01:45					0					0					0					0	0
02:00					0					0					0					0	0
02:15					0					0					0					0	0
02:30					0					0					0					0	0
02:45					0					0					0					0	0
03:00					0					0					0					0	0
03:15					0					0					0					0	0
03:30					0					0					0					0	0
03:45					0					0					0					0	0
04:00					0					0					0					0	0
04:15					0					0					0					0	0
04:30					0					0					0					0	0
04:45					0					0					0					0	0
05:00					0					0					0					0	0
05:15					0					0					0					0	0
05:30					0					0					0					0	0
05:45					0					0					0					0	0
06:00					0					0					0					0	0
06:15					0					0					0					0	0
06:30					0					0					0					0	0
06:45					0					0					0					0	0
07:00					0					0					0					0	0
07:15					0					0					0					0	0
07:30					0					0					0					0	0
07:45					0					0					0					0	0
08:00					0					0					0					0	0
08:15					0					0					0					0	0
08:30					0					0					0					0	0
08:45					0					0					0					0	0
09:00					0					0					0					0	0
09:15					0					0					0					0	0
09:30					0					0					0					0	0
09:45					0					0					0					0	0
10:00					0					0					0					0	0
10:15					0					0					0					0	0
10:30					0					0					0					0	0
10:45					0					0					0					0	0
11:00					0					0					0					0	0
11:15					0					0					0					0	0
11:30					0					0					0					0	0
11:45					0					0					0					0	0
12:00					0					0					0					0	0
12:15					0					0					0					0	0
12:30					0					0					0					0	0
12:45					0					0					0					0	0
13:00					0					0					0					0	0
13:15					0					0					0					0	0
13:30					0					0					0					0	0
13:45					0					0					0					0	0
14:00					0					0					0					0	0
14:15					0					0					0					0	0
14:30					0					0					0					0	0
14:45					0					0					0					0	0
15:00					0					0					0					0	0
15:15	0	15	259	5	279	0	0	494	2	496	0	0	0	187	187	0	0	0	0	0	962
15:30	1	17	312	5	335	0	3	447	2	452	0	0	0	197	197	0	0	0	0	0	984
15:45	3	15	335	4	357	0	0	493	3	496	0	0	0	206	206	0	0	0	0	0	1059
16:00	0	22	288	3	313	0	2	507	0	509	0	0	0	223	223	0	0	0	0	0	1045
16:15	1	18	306	3	328	1	1	510	2	514	0	0	0	195	195	0	0	0	0	0	1037
16:30	0	20	312	5	337	1	0	494	1	496	0	0	0	228	228	0	0	0	0	0	1061
16:45	1	42	299	3	345	0	1	555	1	557	0	0	0	184	184	0	0	0	0	0	1086
17:00	**0**	**33**	**340**	**4**	**377**	**0**	**2**	**549**	**0**	**551**	**0**	**0**	**0**	**176**	**176**	**0**	**0**	**0**	**0**	**0**	**1104**
17:15	**0**	**16**	**346**	**3**	**365**	**1**	**0**	**593**	**3**	**597**	**0**	**0**	**0**	**134**	**134**	**0**	**0**	**0**	**0**	**0**	**1096**
17:30	**1**	**15**	**385**	**5**	**406**	**1**	**0**	**624**	**1**	**626**	**0**	**0**	**0**	**122**	**122**	**0**	**0**	**0**	**0**	**0**	**1154**
17:45	**1**	**19**	**391**	**4**	**415**	**0**	**0**	**667**	**2**	**669**	**0**	**0**	**0**	**99**	**99**	**0**	**0**	**0**	**0**	**0**	**1183**
18:00	0	9	367	1	377	0	0	641	2	643	0	0	0	78	78	0	0	0	0	0	1098
18:15	0	15	342	1	358	0	1	623	0	624	0	0	0	81	81	0	0	0	0	0	1063
18:30	0	14	381	1	396	0	3	586	1	590	0	0	0	50	50	0	0	0	0	0	1036
18:45	3	13	364	2	382	0	1	577	0	578	0	0	0	63	63	0	0	0	0	0	1023
19:00	7	3	324	4	338	0	0	542	0	542	0	0	0	37	37	0	0	0	0	0	917
19:15					0					0					0					0	0
19:30					0					0					0					0	0
19:45					0					0					0					0	0
20:00					0					0					0					0	0
20:15					0					0					0					0	0
20:30					0					0					0					0	0
20:45					0					0					0					0	0
21:00					0					0					0					0	0
21:15					0					0					0					0	0
21:30					0					0					0					0	0
21:45					0					0					0					0	0
22:00					0					0					0					0	0
22:15					0					0					0					0	0
22:30					0					0					0					0	0
22:45					0					0					0					0	0
23:00					0					0					0					0	0
23:15					0					0					0					0	0
23:30					0					0					0					0	0
23:45					0					0					0					0	0
00:00					0					0					0					0	0
TOTAL	**18**	**286**	**5351**	**53**	**5708**	**4**	**14**	**8902**	**20**	**8940**	**0**	**0**	**0**	**2260**	**2260**	**0**	**0**	**0**	**0**	**0**	**16908**
AM Peak Vol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM Peak Vol	2	83	1462	16	1563	2	2	2433	6	2443	0	0	0	531	531	0	0	0	0	0	4537

Turning Movement Counts - Field Sheet

Job No.:

Location: MD 355 at N Wood Rd
Date: 4/19/2017 Wednesday
Recorder: RJM
Interval (dd) : 15
(In Minutes)

County: Montgomery
Town: Bethesda
Weather: Clear

PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-7:00PM	Start	End	Volume	LOS	V/C
		00:00	01:00	0				16:45	17:45	4537		

PEDESTRIANS & BICYCLES

Hour Ending	From North MD 355			From South MD 355			From East N Wood Rd			From West NIH Entrance		
	N/A	Pedestrians	Bicycles	N/A	Pedestrians	Bicycles	N/A	Pedestrians	Bicycles	N/A	Pedestrians	Bicycles
00:15												
00:30												
00:45												
01:00												
01:15												
01:30												
01:45												
02:00												
02:15												
02:30												
02:45												
03:00												
03:15												
03:30												
03:45												
04:00												
04:15												
04:30												
04:45												
05:00												
05:15												
05:30												
05:45												
06:00												
06:15												
06:30												
06:45												
07:00												
07:15												
07:30												
07:45												
08:00												
08:15												
08:30												
08:45												
09:00												
09:15												
09:30												
09:45												
10:00												
10:15												
10:30												
10:45												
11:00												
11:15												
11:30												
11:45												
12:00												
12:15												
12:30												
12:45												
13:00												
13:15												
13:30												
13:45												
14:00												
14:15												
14:30												
14:45												
15:00												
15:15		0	0		0	0		8	0		1	0
15:30		0	0		1	0		8	0		2	0
15:45		0	0		0	0		8	0		1	0
16:00		0	0		1	0		4	0		1	0
16:15		0	0		1	0		9	0		0	1
16:30		0	0		1	0		8	0		0	0
16:45		0	0		1	0		10	0		0	0
17:00		**0**	**0**		**1**	**0**		**7**	**0**		**1**	**0**
17:15		**0**	**0**		**0**	**0**		**5**	**0**		**2**	**0**
17:30		**0**	**0**		**0**	**0**		**6**	**0**		**0**	**0**
17:45		**0**	**0**		**1**	**0**		**5**	**0**		**0**	**1**
18:00		0	1		0	0		3	0		1	1
18:15		0	0		0	0		6	0		1	1
18:30		0	0		0	0		7	0		0	0
18:45		0	0		0	0		5	0		0	0
19:00		0	0		0	0		3	0		0	0
19:15												
19:30												
19:45												
20:00												
20:15												
20:30												
20:45												
21:00												
21:15												
21:30												
21:45												
22:00												
22:15												
22:30												
22:45												
23:00												
23:15												
23:30												
23:45												
00:00												
TOTAL	**0**	**0**	**1**	**0**	**7**	**0**	**0**	**102**	**0**	**0**	**10**	**4**
AM Peak Vol	0	0	0	0	0	0	0	0	0	0	0	0
PM Peak Vol	0	0	0	0	2	0	0	23	0	0	3	1

Turning Movement Counts - Field Sheet

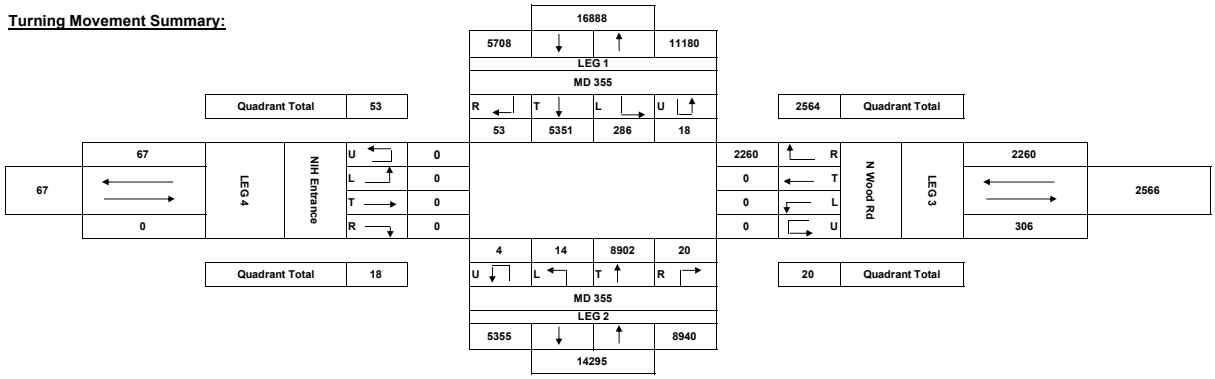
Job No.:

Location: MD 355 at N Wood Rd
Date: 4/19/2017 Wednesday
Recorder: RJM
Interval (dd) : 15
(In Minutes)

County: Montgomery
Town: Bethesda
Weather: Clear

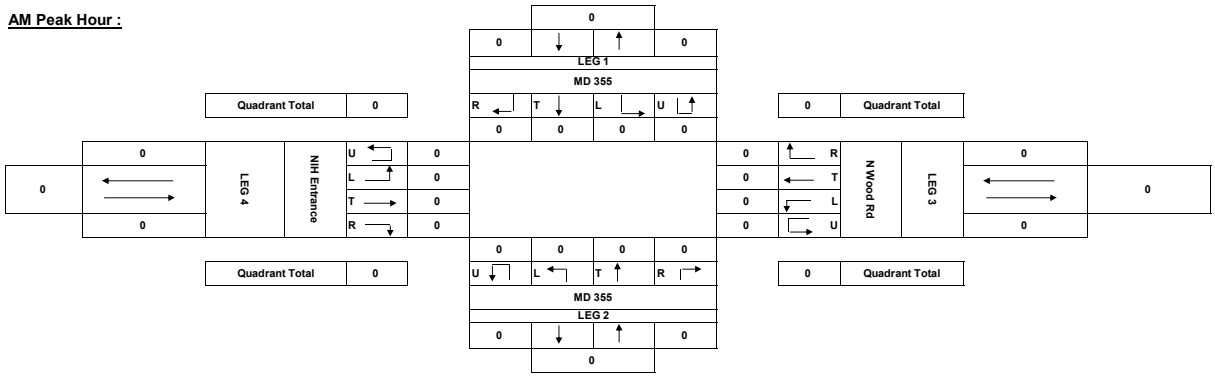
PEAK HOURS	AM PERIOD 6:00AM-12:00PM	Start	End	Volume	LOS	V/C	PM PERIOD 12:00PM-7:00PM	Start	End	Volume	LOS	V/C
		00:00	01:00	0				16:45	17:45	4537		

Turning Movement Summary:



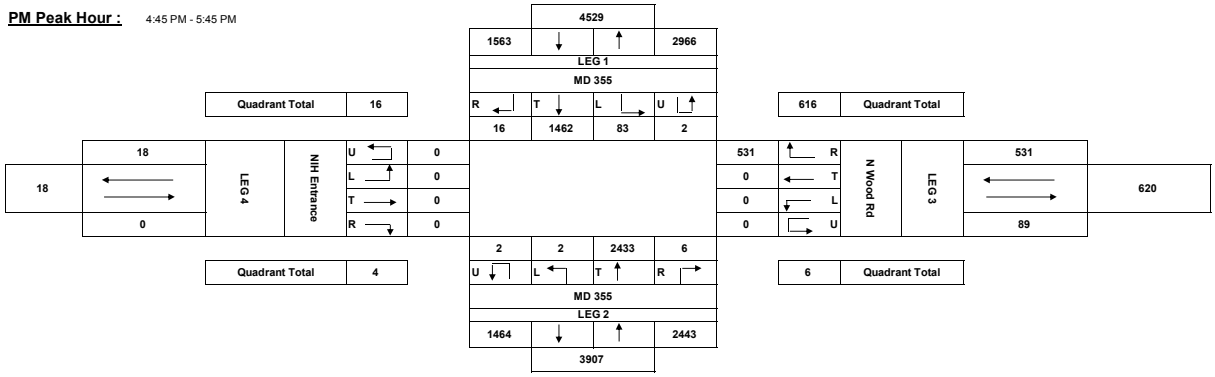
Comments:

AM Peak Hour :



PM Peak Hour :

4:45 PM - 5:45 PM



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

Station ID: S1997150068 **County:** Montgomery **Comments:**

Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

Hour Begin	MD 355 From North					MD 355 From South					Cedar La From East					Cedar La From West					Grand Total
	U.Tur	Left	Through	Right	TOTAL	U.Turn	Left	Throug	Right	TOTAL	U.Turn	Left	Throug	RIGHT	TOTAL	U.Turn	Left	Through	Right	TOTAL	
0:00	1	0	45	5	50	1	3	48	5	56	0	4	2	2	8	0	2	4	2	8	122
0:15	0	1	29	1	31	0	1	45	3	49	0	2	1	0	3	0	0	3	4	7	90
0:30	0	0	29	1	30	0	1	42	9	52	0	2	0	4	6	0	1	6	1	8	96
0:45	0	0	14	0	14	1	1	46	2	49	0	0	2	1	3	0	2	5	3	10	76
1:00	0	3	26	0	29	0	2	28	5	35	0	1	0	0	1	0	0	1	2	3	68
1:15	0	0	13	1	14	0	0	35	6	41	0	1	0	0	1	0	0	2	0	2	58
1:30	0	0	21	2	23	1	3	30	6	39	0	1	2	1	4	0	2	0	3	5	71
1:45	0	0	22	1	23	0	0	18	0	18	0	1	0	0	1	0	0	3	1	4	46
2:00	0	0	12	1	13	0	1	30	1	32	0	0	0	1	1	0	0	0	1	1	47
2:15	0	0	11	0	11	0	0	11	2	13	0	3	0	0	3	0	0	1	0	1	28
2:30	0	0	11	0	11	1	0	15	1	16	0	0	0	0	0	0	0	0	2	2	29
2:45	0	1	6	0	7	0	0	17	0	17	0	1	2	0	3	0	0	0	0	0	27
3:00	0	0	11	0	11	0	1	21	0	22	0	0	1	0	1	0	0	0	2	2	36
3:15	0	0	11	0	11	0	0	13	0	13	0	0	0	1	1	0	1	0	0	1	26
3:30	0	0	6	0	6	0	0	19	0	19	0	0	1	0	1	0	0	1	0	1	27
3:45	0	1	12	0	13	0	0	19	0	19	0	0	0	0	0	0	0	0	0	0	32
4:00	0	1	12	2	15	0	0	15	1	16	0	1	2	0	3	0	0	0	2	2	36
4:15	0	1	16	0	17	0	0	18	0	18	0	1	1	0	2	0	0	0	0	0	37
4:30	0	1	27	1	29	0	1	17	0	18	0	3	2	2	7	0	1	0	0	1	55
4:45	0	7	38	1	46	0	0	28	4	32	0	1	4	1	6	0	0	0	0	0	84

Station ID: S1997150068 **County:** Montgomery **Comments:**

Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

5:00	0	4	35	2	41	0	0	20	0	20	0	7	7	2	16	0	3	1	1	5	82
5:15	0	1	46	3	50	0	1	30	2	33	0	2	5	1	8	0	1	0	4	5	96
5:30	1	1	83	2	86	0	0	44	6	50	0	4	13	4	21	0	3	0	5	8	165
5:45	0	3	102	6	111	2	0	53	5	58	0	16	14	4	34	0	4	2	6	12	215
6:00	0	5	145	6	156	0	2	62	4	68	0	27	22	6	55	0	6	0	2	8	287
6:15	0	6	254	9	269	0	1	68	11	80	0	36	29	11	76	0	4	0	1	5	430
6:30	0	10	311	5	326	0	1	76	10	87	0	58	46	6	110	0	5	1	7	13	536
6:45	1	9	473	11	493	1	0	144	14	158	0	80	62	11	153	0	7	0	12	19	823
7:00	0	13	455	8	476	0	1	166	11	178	0	66	65	18	149	0	12	2	14	28	831
7:15	0	29	521	7	557	0	2	192	16	210	0	78	60	20	158	0	17	3	21	41	966
7:30	0	59	651	21	731	0	1	268	28	297	0	122	106	19	247	0	25	9	24	58	1333
7:45	0	66	734	24	824	0	0	315	33	348	0	131	102	38	271	0	26	3	30	59	1502
8:00	0	15	694	26	735	0	0	269	25	294	0	132	74	19	225	0	27	17	49	93	1347
8:15	0	6	680	31	717	0	0	295	25	320	0	157	68	33	258	0	27	23	24	74	1369
8:30	**0**	**7**	**727**	**21**	**755**	**0**	**0**	**201**	**16**	**217**	**0**	**175**	**66**	**25**	**266**	**0**	**38**	**61**	**29**	**128**	**1366**
8:45	**2**	**3**	**737**	**28**	**768**	**0**	**0**	**287**	**23**	**310**	**0**	**175**	**78**	**14**	**267**	**0**	**26**	**70**	**42**	**138**	**1483**
9:00	**2**	**11**	**736**	**26**	**773**	**0**	**0**	**250**	**15**	**265**	**0**	**175**	**43**	**21**	**239**	**0**	**26**	**38**	**31**	**95**	**1372**
9:15	**1**	**13**	**760**	**38**	**811**	**0**	**0**	**264**	**17**	**281**	**0**	**145**	**64**	**21**	**230**	**0**	**27**	**37**	**38**	**102**	**1424**
9:30	0	12	728	33	773	0	0	255	16	271	0	148	53	14	215	0	13	40	32	85	1344
9:45	0	16	717	25	758	0	0	241	17	258	0	169	39	13	221	0	10	26	43	79	1316
10:00	1	9	628	39	676	0	0	251	25	276	0	140	28	14	182	0	17	26	26	69	1203
10:15	0	11	589	30	630	0	1	254	17	272	0	115	30	8	153	0	10	25	28	63	1118
10:30	0	11	579	36	626	3	7	292	22	321	0	100	30	9	139	0	13	23	16	52	1138
10:45	0	8	564	25	597	3	5	252	17	274	0	59	28	10	97	0	16	29	34	79	1047
11:00	0	10	520	31	561	0	11	289	15	315	0	60	17	14	91	0	17	29	28	74	1041
11:15	0	12	472	26	510	3	9	316	23	348	0	38	20	7	65	0	18	21	14	53	976

Station ID: S1997150068 **County:** Montgomery **Comments:**

Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

11:30	1	8	391	21	420	3	5	361	21	387	0	33	26	15	74	0	22	19	21	62	943
11:45	1	11	388	32	431	2	9	351	34	394	0	37	26	11	74	0	14	16	18	48	947
12:00	1	15	314	11	340	2	1	345	19	365	0	32	29	5	66	0	22	17	22	61	832
12:15	1	10	260	18	288	2	9	377	22	408	0	20	18	18	56	0	18	25	25	68	820
12:30	0	11	335	24	370	1	11	357	23	391	0	29	29	19	77	0	21	22	12	55	893
12:45	0	15	300	18	333	2	9	371	16	396	0	28	24	16	68	0	22	25	25	72	869
13:00	0	12	289	16	317	5	9	350	23	382	0	24	28	9	61	0	28	24	22	74	834
13:15	0	14	303	26	343	3	17	418	38	473	0	28	21	14	63	0	31	27	16	74	953
13:30	0	14	319	18	351	0	9	377	32	418	0	24	22	12	58	0	20	36	15	71	898
13:45	0	15	334	14	363	2	13	407	28	448	0	25	30	11	66	0	15	31	19	65	942
14:00	0	21	307	17	345	2	13	384	39	436	0	12	34	18	64	0	30	21	14	65	910
14:15	1	22	298	24	344	4	9	519	50	578	0	32	30	15	77	0	35	20	18	73	1072
14:30	0	26	321	20	367	1	8	517	61	586	0	29	29	7	65	0	41	30	20	91	1109
14:45	0	28	291	21	340	2	17	529	67	613	0	20	29	11	60	0	32	37	20	89	1102
15:00	1	34	260	19	313	3	12	521	71	604	0	17	37	17	71	0	40	39	11	90	1078
15:15	0	38	289	18	345	1	11	623	72	706	0	26	37	37	100	0	42	54	26	122	1273
15:30	1	29	285	24	338	1	9	571	120	700	0	18	43	18	79	0	54	42	16	112	1229
15:45	0	22	283	29	334	0	13	584	125	722	0	23	40	25	88	0	72	43	18	133	1277
16:00	0	28	234	18	280	2	15	609	109	733	0	24	33	22	79	0	62	67	24	153	1245
16:15	3	23	256	17	296	1	16	609	131	756	0	27	30	19	76	0	59	89	18	166	1294
16:30	0	31	276	20	327	1	15	618	120	753	0	35	34	15	84	0	65	84	12	161	1325
16:45	0	40	257	16	313	3	9	607	127	743	0	35	37	19	91	0	66	100	20	186	1333
17:00	**1**	**40**	**289**	**25**	**354**	**1**	**12**	**631**	**139**	**782**	**0**	**24**	**39**	**16**	**79**	**0**	**59**	**108**	**22**	**189**	**1404**
17:15	**1**	**38**	**258**	**17**	**313**	**1**	**12**	**638**	**136**	**786**	**0**	**35**	**34**	**24**	**93**	**0**	**62**	**95**	**13**	**170**	**1362**
17:30	**1**	**52**	**285**	**17**	**354**	**1**	**12**	**594**	**112**	**718**	**0**	**37**	**37**	**16**	**90**	**0**	**59**	**108**	**29**	**196**	**1358**
17:45	**0**	**33**	**304**	**22**	**359**	**2**	**7**	**655**	**136**	**798**	**0**	**48**	**35**	**17**	**100**	**0**	**55**	**88**	**21**	**164**	**1421**

Station ID: S1997150068 **County:** Montgomery **Comments:**

Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

18:00	0	39	292	25	356	1	15	597	116	728	0	38	40	23	101	0	53	100	22	175	1360
18:15	0	35	355	19	409	1	15	556	98	669	0	32	38	23	93	0	36	107	22	165	1336
18:30	1	25	408	30	463	1	10	503	75	588	0	39	35	20	94	0	21	104	25	150	1295
18:45	2	22	335	31	388	1	6	448	79	533	0	34	36	19	89	0	40	106	29	175	1185
19:00	1	27	321	20	368	0	14	443	68	525	0	36	25	19	80	0	20	69	13	102	1075
19:15	1	27	305	29	361	0	6	446	63	515	0	28	23	11	62	0	23	97	21	141	1079
19:30	0	14	247	14	275	0	9	389	53	451	0	21	15	6	42	0	14	74	17	105	873
19:45	1	24	263	22	309	2	11	297	46	354	0	27	11	9	47	0	24	61	24	109	819
20:00	1	15	242	18	275	2	11	265	35	311	0	28	18	8	54	0	17	43	19	79	719
20:15	0	15	176	10	201	3	9	300	28	337	0	14	13	8	35	0	7	35	14	56	629
20:30	0	6	161	17	184	1	11	211	25	247	0	10	13	6	29	0	14	20	11	45	505
20:45	0	13	132	6	151	1	8	251	36	295	0	12	9	1	22	0	6	29	9	44	512
21:00	0	12	127	12	151	1	15	221	24	260	0	12	9	4	25	0	11	22	11	44	480
21:15	0	7	139	7	153	3	13	227	34	274	0	16	3	10	29	0	13	27	10	50	506
21:30	1	6	113	9	128	0	10	204	23	237	0	8	6	9	23	0	3	11	6	20	408
21:45	0	4	106	8	118	0	4	156	26	186	0	12	6	6	24	0	4	8	5	17	345
22:00	0	2	110	9	121	1	5	178	36	219	0	9	6	4	19	0	9	16	4	29	388
22:15	0	4	99	7	110	1	10	166	23	199	0	8	5	5	18	0	5	20	6	31	358
22:30	0	5	112	5	122	0	2	144	12	158	0	6	7	0	13	0	2	14	3	19	312
22:45	0	3	106	3	112	2	4	106	13	123	0	3	1	1	5	0	1	7	4	12	252
23:00	0	5	81	3	89	0	5	111	17	133	0	8	0	1	9	0	6	8	4	18	249
23:15	0	4	77	1	82	0	1	101	15	117	0	3	2	2	7	0	4	11	7	22	228
23:30	0	0	61	2	63	0	3	80	10	93	0	8	1	1	10	0	4	10	2	16	182
23:45	0	0	65	8	73	0	6	59	9	74	0	4	4	5	13	0	5	3	6	14	174

Station ID: S1997150068 **County:** Montgomery **Comments:**

Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

TOTAL:	30	1310	25472	1372	28154	85	541	25051	3293	28885	0	3575	2326	1002	6903	0	1795	2781	1375	5951	69893
AM Peak:	5	34	2960	113	3107	0	0	1002	71	1073	0	670	251	81	1002	0	117	206	140	463	5645
PM Peak:	3	163	1136	81	1380	5	43	2518	523	3084	0	144	145	73	362	0	235	399	85	719	5545

Station ID: S1997150068 **County:** Montgomery **Comments:**

Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

	MD 355 North Leg			MD 355 South Leg			Cedar La East Leg			Cedar La West Leg		
Hour Ending	School Children	Pedestrians	Bicycles	School Children	Pedestrains	Bicycles	School Children	Pedestrians	Bicycles	School Children	Pedestrians	Bicycles
0:00	0	0	0	0	0	0	0	0	0	0	1	0
0:15	0	0	0	0	0	0	0	0	0	0	0	0
0:30	0	0	0	0	0	0	0	0	0	0	0	0
0:45	0	0	0	0	0	0	0	0	0	0	0	0
1:00	0	0	0	0	0	0	0	0	0	0	0	0
1:15	0	0	0	0	0	0	0	0	0	0	0	0
1:30	0	0	0	0	0	0	0	0	0	0	0	0
1:45	0	0	0	0	0	0	0	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0
2:15	0	0	0	0	0	0	0	0	0	0	0	0
2:30	0	0	0	0	0	0	0	0	0	0	0	0
2:45	0	0	0	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0
3:15	0	0	0	0	0	0	0	0	0	0	0	0
3:30	0	0	0	0	0	0	0	0	0	0	0	0
3:45	0	0	0	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0
4:15	0	0	0	0	0	0	0	0	0	0	0	0
4:30	0	0	0	0	0	0	0	0	0	0	0	0
4:45	0	0	0	0	0	0	0	0	0	0	0	0
5:00	0	0	0	0	0	0	0	1	0	0	0	0
5:15	0	0	0	0	0	0	0	1	0	0	0	0
5:30	0	0	0	0	0	0	0	1	0	0	0	0
5:45	0	0	0	0	0	0	0	0	0	0	0	0
6:00	0	0	0	0	0	0	0	0	1	0	0	0
6:15	0	0	0	0	0	0	0	2	0	0	0	0
6:30	0	0	0	0	0	0	0	0	0	0	0	0
6:45	0	0	0	0	0	0	0	3	0	0	0	0

Station ID: S1997150068 **County:** Montgomery **Comments:**

Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

7:00	0	0	0	0	0	0	0	1	0	0	2	0
7:15	0	0	0	0	1	0	0	4	0	0	0	1
7:30	0	0	0	0	0	0	0	1	1	0	0	0
7:45	0	0	0	0	0	0	0	2	0	0	0	0
8:00	0	0	0	0	0	0	0	0	0	0	4	0
8:15	0	0	0	0	0	0	0	3	0	0	1	0
8:30	0	0	0	0	0	0	0	4	1	0	3	0
8:45	0	0	0	0	0	0	0	3	0	0	3	0
9:00	0	0	0	0	0	0	0	0	0	0	2	0
9:15	0	0	1	0	0	0	0	1	1	0	3	0
9:30	0	0	0	0	0	0	0	0	0	0	4	0
9:45	0	0	1	0	0	0	0	0	0	0	3	0
10:00	0	0	0	0	0	0	0	0	2	0	2	0
10:15	0	0	0	0	2	0	0	0	1	0	4	0
10:30	0	0	0	0	0	0	0	1	0	0	3	0
10:45	0	1	0	0	1	0	0	1	0	0	2	0
11:00	0	0	0	0	0	0	0	2	0	0	1	0
11:15	0	0	0	0	0	0	0	0	2	0	0	0
11:30	0	0	0	0	0	0	0	0	0	0	0	0
11:45	0	0	0	0	0	0	0	0	1	0	1	0
12:00	0	0	0	0	0	0	0	0	0	0	1	0
12:15	0	0	0	0	0	0	0	0	1	0	2	0
12:30	0	0	0	0	0	0	0	0	0	0	1	0
12:45	0	0	0	0	0	0	0	3	0	0	0	0
13:00	0	0	0	0	0	0	0	0	1	0	0	0
13:15	0	0	0	0	0	0	0	1	0	0	1	0
13:30	0	0	0	0	0	0	0	0	0	0	1	0
13:45	0	0	0	0	0	0	0	1	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	1	0	0	0	0
14:30	0	0	0	0	0	0	0	1	0	0	1	0
14:45	0	1	0	0	0	0	0	1	0	0	0	0

Station ID: S1997150068 **County:** Montgomery **Comments:**

Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

15:00	0	0	0	0	0	0	0	0	0	0	0	0	
15:15	0	1	0	0	0	0	0	2	0	0	0	0	
15:30	0	0	0	0	0	0	0	1	0	0	2	0	
15:45	0	2	0	0	1	0	0	3	0	0	1	0	
16:00	0	0	0	0	0	0	0	4	0	0	2	0	
16:15	0	0	0	0	1	0	0	1	0	0	1	0	
16:30	0	0	0	0	1	0	0	2	0	0	2	0	
16:45	0	0	0	0	0	0	0	4	0	0	4	0	
17:00	0	0	0	0	0	0	0	1	0	0	1	0	
17:15	0	0	0	0	0	0	0	0	0	0	1	0	
17:30	0	0	0	0	0	0	0	1	0	0	1	0	
17:45	0	0	0	0	0	0	0	2	0	0	3	1	
18:00	0	0	0	0	0	0	0	2	0	0	4	0	
18:15	0	0	0	0	5	0	0	0	0	0	3	0	
18:30	0	0	0	0	0	0	0	2	0	0	4	0	
18:45	0	0	0	0	0	0	0	0	0	0	6	0	
19:00	0	0	0	0	0	1	0	1	0	0	5	0	
19:15	0	0	0	0	0	0	0	2	0	0	6	0	
19:30	0	0	0	0	0	0	0	0	0	0	4	0	
19:45	0	0	0	0	0	1	0	0	0	0	3	0	
20:00	0	0	0	0	0	0	0	0	0	0	0	0	
20:15	0	0	0	0	0	1	0	0	0	0	3	0	
20:30	0	0	0	0	0	0	0	0	0	0	2	0	
20:45	0	0	0	0	0	0	0	0	0	0	1	0	
21:00	0	0	0	0	0	1	0	0	0	0	0	0	
21:15	0	0	0	0	0	0	0	0	0	0	1	0	
21:30	0	0	0	0	0	0	0	0	0	0	0	0	
21:45	0	0	0	0	0	1	0	0	0	0	1	0	
22:00	0	0	0	0	0	1	0	0	0	0	0	0	
22:15	0	0	0	0	0	0	0	0	0	0	0	0	
22:30	0	0	0	0	0	0	0	1	0	0	0	0	
22:45	0	0	0	0	0	0	0	0	0	0	0	0	

Station ID: S1997150068 **County:** Montgomery **Comments:**

Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

23:00	0	0	1	0	0	0	0	0	0	0	0	0	
23:15	0	0	0	0	0	0	0	0	0	0	1	0	
23:30	0	0	0	0	0	0	0	0	0	0	0	0	
23:45	0	0	0	0	0	0	0	0	0	0	0	0	
Total:	**0**	**5**	**3**	**0**	**12**	**6**	**0**	**68**	**12**	**0**	**108**	**2**	
AM Pe	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**8**	**2**	**0**	**11**	**0**	
PM Pe	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**6**	**1**	

Station ID: S1997150068 **County:** Montgomery **Comments:**

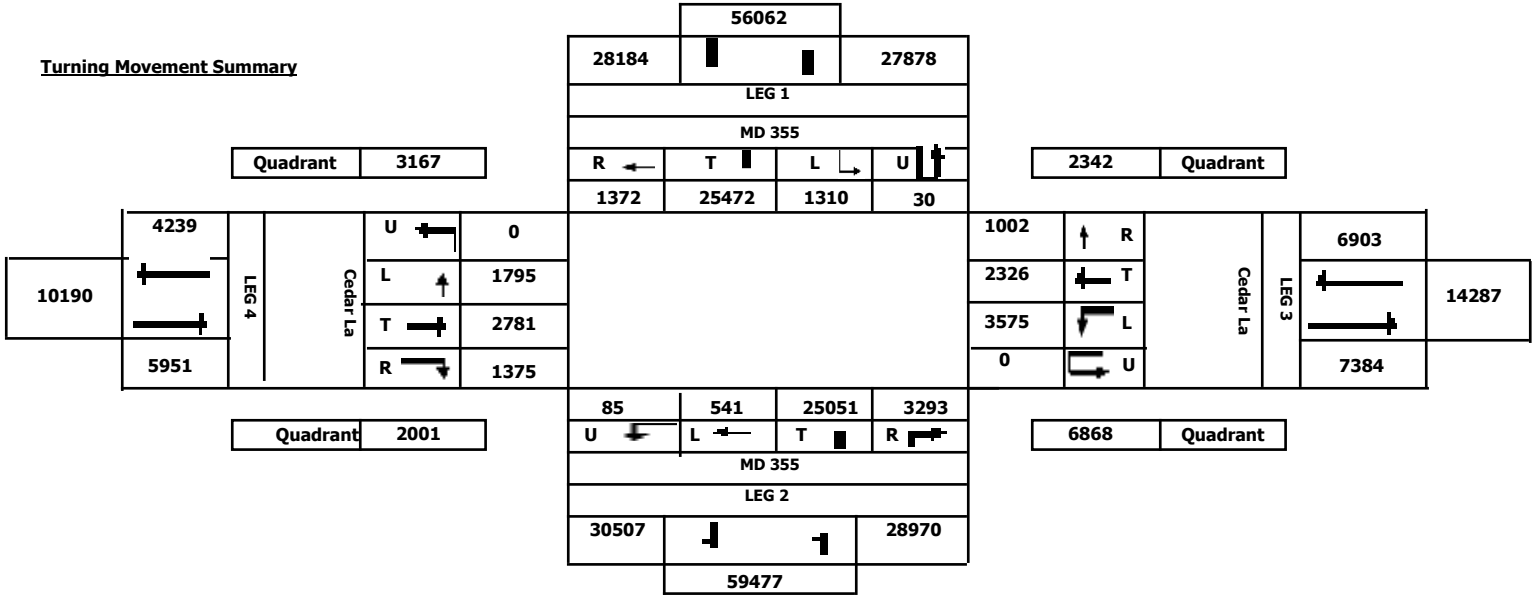
Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

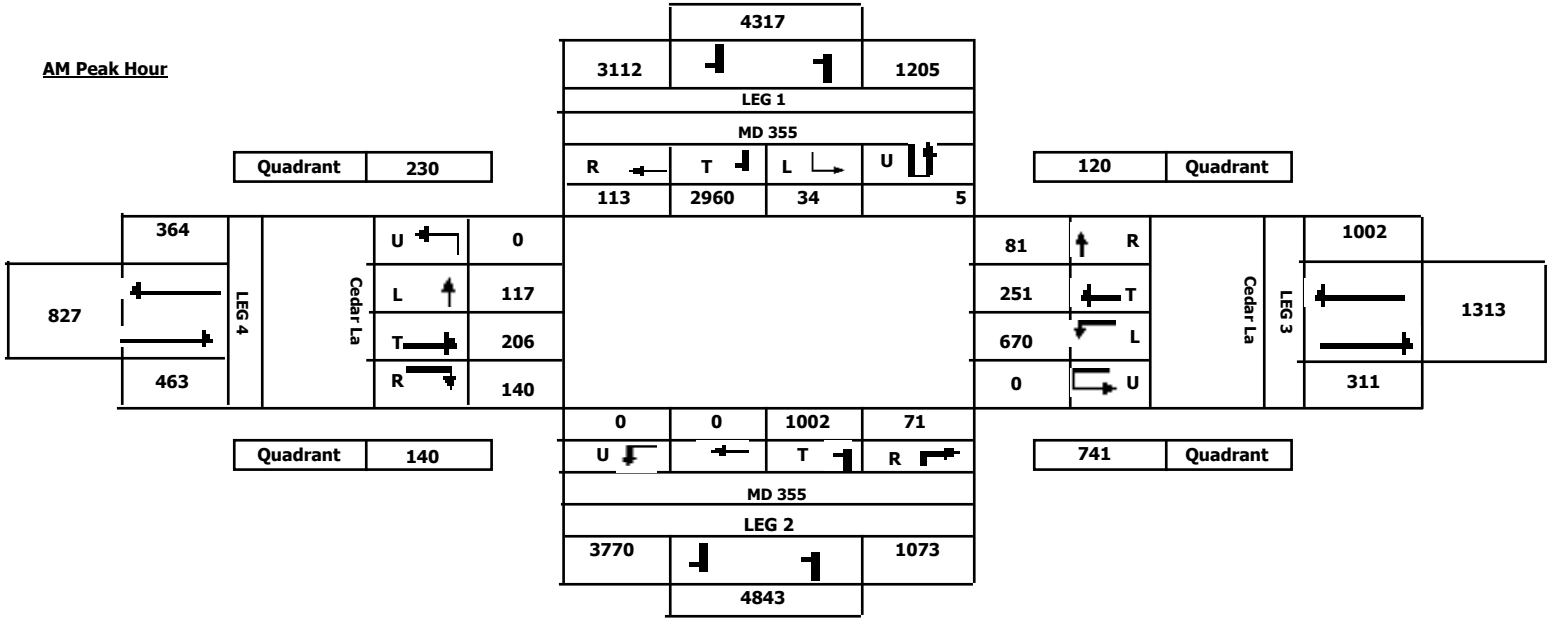
Interval (dd): 15 min

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

Turning Movement Summary



AM Peak Hour



Station ID: S1997150068 **County:** Montgomery **Comments:**

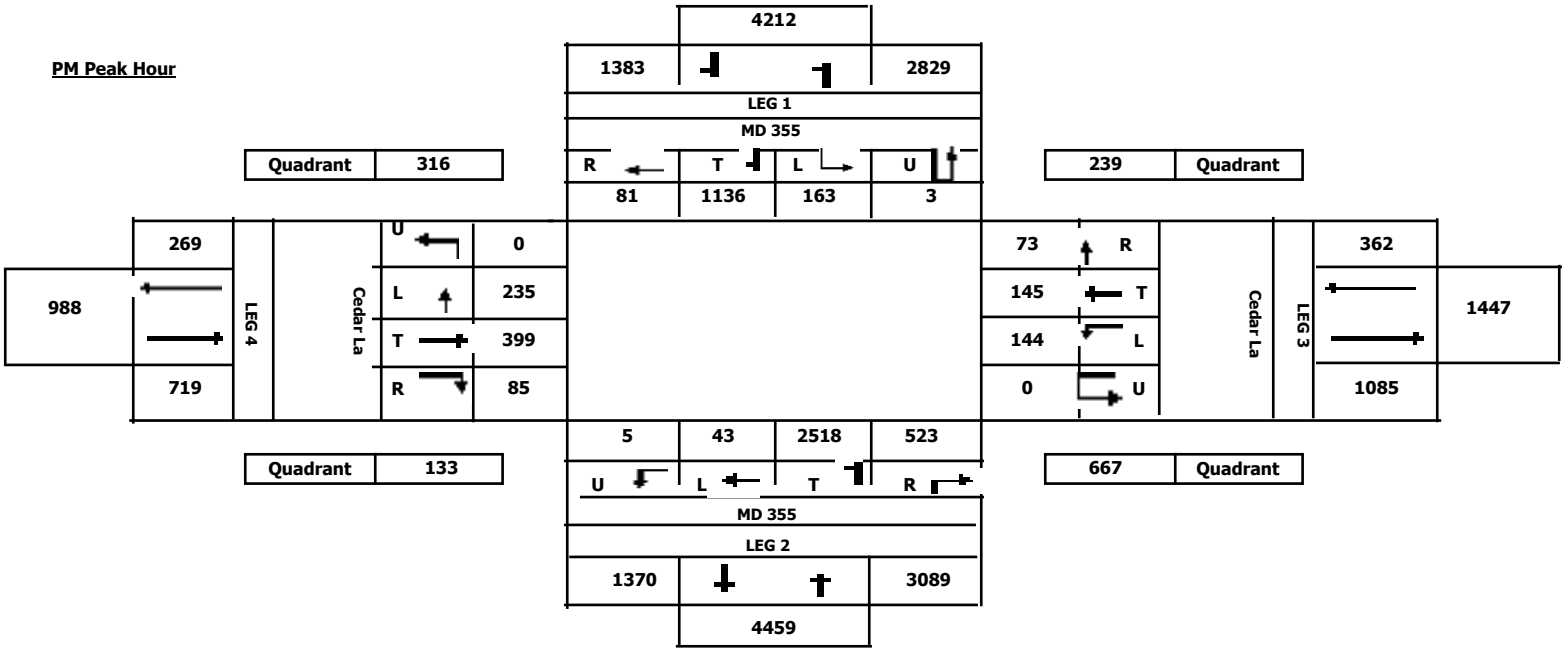
Date: Tuesday 01/10/2017 **Town:** none

Location: MD 355 at Cedar La **Weather:** Clear

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
		08:30	09:30	5645	D	0.90		17:00	18:00	5545	E	0.92

PM Peak Hour

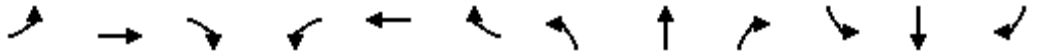


Appendix B: Synchro / SimTraffic Results Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	205	160	700	285	100	5	1100	85	40	2960	115
Future Volume (veh/h)	115	205	160	700	285	100	5	1100	85	40	2960	115
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	125	223	174	761	310	109	5	1196	92	43	3052	125
Adj No. of Lanes	2	2	1	2	2	0	1	3	1	1	4	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	191	315	128	832	711	245	55	2782	843	59	3834	156
Arrive On Green	0.06	0.09	0.08	0.24	0.28	0.27	0.18	0.18	0.18	0.03	0.60	0.60
Sat Flow, veh/h	3442	3539	1583	3442	2584	891	66	5085	1574	1774	6363	259
Grp Volume(v), veh/h	125	223	174	761	210	209	5	1196	92	43	2299	878
Grp Sat Flow(s),veh/h/ln	1721	1770	1583	1721	1770	1705	66	1695	1574	1774	1602	1815
Q Serve(g_s), s	6.4	11.0	14.5	38.7	17.6	18.2	13.0	37.6	8.8	4.3	65.6	66.9
Cycle Q Clear(g_c), s	6.4	11.0	14.5	38.7	17.6	18.2	69.9	37.6	8.8	4.3	65.6	66.9
Prop In Lane	1.00		1.00	1.00		0.52	1.00		1.00	1.00		0.14
Lane Grp Cap(c), veh/h	191	315	128	832	487	469	55	2782	843	59	2896	1094
V/C Ratio(X)	0.65	0.71	1.36	0.91	0.43	0.44	0.09	0.43	0.11	0.73	0.79	0.80
Avail Cap(c_a), veh/h	229	315	128	860	487	469	55	2782	843	59	2896	1094
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.61	0.61	0.61
Uniform Delay (d), s/veh	83.3	79.7	82.8	66.4	53.7	54.2	89.9	48.8	38.0	86.2	27.2	27.5
Incr Delay (d2), s/veh	6.3	7.8	206.0	14.2	0.9	0.9	3.3	0.5	0.3	23.6	1.4	3.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	5.7	13.6	20.0	8.7	8.7	0.3	17.8	3.9	2.5	29.3	34.6
LnGrp Delay(d),s/veh	89.6	87.6	288.7	80.6	54.5	55.2	93.2	49.3	38.3	109.8	28.7	31.4
LnGrp LOS	F	F	F	F	D	E	F	D	D	F	C	C
Approach Vol, veh/h		522			1180			1293			3220	
Approach Delay, s/veh		155.1			71.5			48.7			30.5	
Approach LOS		F			E			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	8
Phs Duration (G+Y+Rc), s	10.0	102.5	47.5	20.0		112.5	14.0	53.5
Change Period (Y+Rc), s	4.5	6.0	5.5	5.5		6.0	5.5	5.5
Max Green Setting (Gmax), s	5.5	95.0	43.5	14.5		105.0	10.5	47.5
Max Q Clear Time (g_c+I1), s	6.3	71.9	40.7	16.5		68.9	8.4	20.2
Green Ext Time (p_c), s	0.0	20.9	1.3	0.0		31.0	0.1	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	52.5
HCM 2010 LOS	D



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	235	400	100	160	145	75	50	2520	525	175	1350	80
Future Volume (veh/h)	235	400	100	160	145	75	50	2520	525	175	1350	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	255	435	109	174	158	82	54	2739	571	190	1392	87
Adj No. of Lanes	2	2	1	2	2	0	1	3	1	1	4	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	306	563	239	242	323	160	74	2929	892	187	3974	248
Arrive On Green	0.09	0.16	0.15	0.07	0.14	0.13	0.01	0.19	0.19	0.11	0.64	0.64
Sat Flow, veh/h	3442	3539	1583	3442	2296	1136	1774	5085	1578	1774	6211	388
Grp Volume(v), veh/h	255	435	109	174	120	120	54	2739	571	190	1076	403
Grp Sat Flow(s),veh/h/ln	1721	1770	1583	1721	1770	1662	1774	1695	1578	1774	1602	1793
Q Serve(g_s), s	13.1	21.2	11.3	8.9	11.2	12.1	5.5	95.5	60.2	19.0	18.7	18.8
Cycle Q Clear(g_c), s	13.1	21.2	11.3	8.9	11.2	12.1	5.5	95.5	60.2	19.0	18.7	18.8
Prop In Lane	1.00		1.00	1.00		0.68	1.00		1.00	1.00		0.22
Lane Grp Cap(c), veh/h	306	563	239	242	249	234	74	2929	892	187	3075	1147
V/C Ratio(X)	0.83	0.77	0.46	0.72	0.48	0.51	0.73	0.94	0.64	1.01	0.35	0.35
Avail Cap(c_a), veh/h	306	767	330	306	383	360	187	2929	892	187	3075	1147
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.93	0.93
Uniform Delay (d), s/veh	80.7	72.6	69.7	81.9	71.3	72.1	87.7	69.6	56.3	80.5	15.0	15.1
Incr Delay (d2), s/veh	18.2	4.2	1.9	7.2	2.1	2.5	12.8	7.1	3.5	67.2	0.3	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.0	10.7	5.1	4.5	5.6	5.7	2.9	46.9	27.2	12.8	8.4	9.5
LnGrp Delay(d),s/veh	98.9	76.7	71.6	89.1	73.4	74.6	100.5	76.7	59.8	147.8	15.3	15.8
LnGrp LOS	F	E	E	F	E	E	F	E	E	F	B	B
Approach Vol, veh/h		799			414			3364			1669	
Approach Delay, s/veh		83.1			80.3			74.2			30.5	
Approach LOS		F			F			E			C	

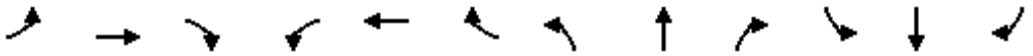
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	23.0	107.7	16.7	32.6	11.5	119.2	20.0	29.3
Change Period (Y+Rc), s	4.5	6.0	5.5	5.5	4.5	6.0	5.5	5.5
Max Green Setting (Gmax), s	18.5	88.0	14.5	37.5	18.5	88.0	14.5	37.5
Max Q Clear Time (g_c+I1), s	21.0	97.5	10.9	23.2	7.5	20.8	15.1	14.1
Green Ext Time (p_c), s	0.0	0.0	0.3	3.9	0.1	55.6	0.0	4.7

Intersection Summary	
HCM 2010 Ctrl Delay	64.1
HCM 2010 LOS	E

Movement	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER
Lane Configurations										
Traffic Volume (vph)	0	140	0	1000	30	600	2905	65	0	0
Future Volume (vph)	0	140	0	1000	30	600	2905	65	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0		4.0	4.0			
Lane Util. Factor		1.00		0.91		1.00	0.86			
Frt		0.86		1.00		1.00	1.00			
Flt Protected		1.00		1.00		0.95	1.00			
Satd. Flow (prot)		1611		5063		1770	6387			
Flt Permitted		1.00		1.00		0.95	1.00			
Satd. Flow (perm)		1611		5063		1770	6387			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	152	0	1087	33	652	3158	71	0	0
RTOR Reduction (vph)	0	6	0	2	0	0	0	0	0	0
Lane Group Flow (vph)	0	146	0	1118	0	652	3229	0	0	0
Turn Type		Over	Perm	NA		Prot	NA			
Protected Phases		1		2		1	Free			
Permitted Phases			2							
Actuated Green, G (s)		92.6		79.4		92.6	180.0			
Effective Green, g (s)		92.6		79.4		92.6	180.0			
Actuated g/C Ratio		0.51		0.44		0.51	1.00			
Clearance Time (s)		4.0		4.0		4.0				
Vehicle Extension (s)		3.0		3.0		3.0				
Lane Grp Cap (vph)		828		2233		910	6387			
v/s Ratio Prot		0.09		0.22		c0.37	0.51			
v/s Ratio Perm										
v/c Ratio		0.18		0.50		0.72	0.51			
Uniform Delay, d1		23.3		36.1		33.6	0.0			
Progression Factor		1.00		1.31		0.76	1.00			
Incremental Delay, d2		0.1		0.8		1.7	0.2			
Delay (s)		23.4		47.9		27.3	0.2			
Level of Service		C		D		C	A			
Approach Delay (s)	23.4			47.9			4.7		0.0	
Approach LOS	C			D			A		A	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	700	0	2435	15	85	1505	20
Future Volume (vph)	0	0	0	0	0	700	0	2435	15	85	1505	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)						4.0		4.0		4.0	4.0	
Lane Util. Factor						0.76		0.91		1.00	0.86	
Frt						0.85		1.00		1.00	1.00	
Flt Protected						1.00		1.00		0.95	1.00	
Satd. Flow (prot)						3610		5081		1770	6395	
Flt Permitted						1.00		1.00		0.95	1.00	
Satd. Flow (perm)						3610		5081		1770	6395	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	761	0	2647	16	92	1636	22
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	0	761	0	2663	0	92	1658	0
Turn Type						Over	Perm	NA		Prot	NA	
Protected Phases						1		2		1	Free	
Permitted Phases							2					
Actuated Green, G (s)						26.0		146.0		26.0	180.0	
Effective Green, g (s)						26.0		146.0		26.0	180.0	
Actuated g/C Ratio						0.14		0.81		0.14	1.00	
Clearance Time (s)						4.0		4.0		4.0		
Vehicle Extension (s)						3.0		3.0		3.0		
Lane Grp Cap (vph)						521		4121		255	6395	
v/s Ratio Prot						c0.21		c0.52		0.05	0.26	
v/s Ratio Perm												
v/c Ratio						1.46		0.65		0.36	0.26	
Uniform Delay, d1						77.0		6.7		69.5	0.0	
Progression Factor						1.00		0.40		1.37	1.00	
Incremental Delay, d2						217.7		0.6		0.8	0.1	
Delay (s)						294.7		3.3		96.1	0.1	
Level of Service						F		A		F	A	
Approach Delay (s)		0.0			294.7			3.3			5.1	
Approach LOS		A			F			A			A	

Intersection Summary			
HCM 2000 Control Delay	46.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	205	160	700	285	100	0	1100	90	40	2960	115
Future Volume (veh/h)	115	205	160	700	285	100	0	1100	90	40	2960	115
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	125	223	174	761	310	109	0	1196	98	43	3052	125
Adj No. of Lanes	2	2	1	2	2	0	1	4	0	1	4	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	191	315	128	832	711	245	40	3327	271	59	3834	156
Arrive On Green	0.06	0.09	0.08	0.24	0.28	0.27	0.00	0.18	0.18	0.03	0.60	0.60
Sat Flow, veh/h	3442	3539	1583	3442	2584	891	66	6081	496	1774	6363	259
Grp Volume(v), veh/h	125	223	174	761	210	209	0	944	350	43	2299	878
Grp Sat Flow(s),veh/h/ln	1721	1770	1583	1721	1770	1705	66	1602	1772	1774	1602	1815
Q Serve(g_s), s	6.4	11.0	14.5	38.7	17.6	18.2	0.0	31.0	31.2	4.3	65.6	66.9
Cycle Q Clear(g_c), s	6.4	11.0	14.5	38.7	17.6	18.2	0.0	31.0	31.2	4.3	65.6	66.9
Prop In Lane	1.00		1.00	1.00		0.52	1.00		0.28	1.00		0.14
Lane Grp Cap(c), veh/h	191	315	128	832	487	469	40	2629	969	59	2896	1094
V/C Ratio(X)	0.65	0.71	1.36	0.91	0.43	0.44	0.00	0.36	0.36	0.73	0.79	0.80
Avail Cap(c_a), veh/h	229	315	128	860	487	469	40	2629	969	59	2896	1094
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	83.3	79.7	82.8	66.4	53.7	54.2	0.0	46.1	46.2	86.2	27.2	27.5
Incr Delay (d2), s/veh	6.3	7.8	206.0	14.2	0.9	0.9	0.0	0.4	1.0	35.9	2.3	6.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	5.7	13.6	20.0	8.7	8.7	0.0	13.9	15.6	2.7	29.6	35.3
LnGrp Delay(d),s/veh	89.6	87.6	288.7	80.6	54.5	55.2	0.0	46.5	47.3	122.1	29.6	33.7
LnGrp LOS	F	F	F	F	D	E		D	D	F	C	C
Approach Vol, veh/h		522			1180			1294			3220	
Approach Delay, s/veh		155.1			71.5			46.7			32.0	
Approach LOS		F			E			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4		6	7	8
Phs Duration (G+Y+Rc), s	10.0	102.5	47.5	20.0		112.5	14.0	53.5
Change Period (Y+Rc), s	4.5	6.0	5.5	5.5		6.0	5.5	5.5
Max Green Setting (Gmax), s	5.5	95.0	43.5	14.5		105.0	10.5	47.5
Max Q Clear Time (g_c+I1), s	6.3	33.2	40.7	16.5		68.9	8.4	20.2
Green Ext Time (p_c), s	0.0	47.1	1.3	0.0		30.6	0.1	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	52.9
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	235	400	100	160	145	75	50	2520	525	175	1350	80
Future Volume (veh/h)	235	400	100	160	145	75	50	2520	525	175	1350	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	255	435	109	174	158	82	54	2739	571	190	1392	87
Adj No. of Lanes	2	2	1	2	2	0	1	4	0	1	4	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	320	511	215	238	277	137	74	3118	621	213	4075	254
Arrive On Green	0.09	0.14	0.14	0.07	0.12	0.11	0.01	0.19	0.19	0.12	0.66	0.66
Sat Flow, veh/h	3442	3539	1583	3442	2296	1136	1774	5400	1075	1774	6211	388
Grp Volume(v), veh/h	255	435	109	174	120	120	54	2423	887	190	1076	403
Grp Sat Flow(s),veh/h/ln	1721	1770	1583	1721	1770	1662	1774	1602	1669	1774	1602	1793
Q Serve(g_s), s	13.1	21.6	11.5	8.9	11.5	12.4	5.5	88.1	93.9	19.0	17.9	17.9
Cycle Q Clear(g_c), s	13.1	21.6	11.5	8.9	11.5	12.4	5.5	88.1	93.9	19.0	17.9	17.9
Prop In Lane	1.00		1.00	1.00		0.68	1.00		0.64	1.00		0.22
Lane Grp Cap(c), veh/h	320	511	215	238	213	200	74	2775	964	213	3153	1176
V/C Ratio(X)	0.80	0.85	0.51	0.73	0.56	0.60	0.73	0.87	0.92	0.89	0.34	0.34
Avail Cap(c_a), veh/h	344	531	224	249	216	203	118	2775	964	237	3153	1176
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	79.9	75.1	72.2	82.1	74.7	75.5	87.8	66.5	69.0	78.0	13.7	13.7
Incr Delay (d2), s/veh	12.4	12.8	2.6	10.9	4.1	5.7	13.0	4.2	15.2	29.8	0.3	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.8	11.5	5.2	4.6	5.9	6.0	3.0	40.3	47.5	11.1	8.0	9.1
LnGrp Delay(d),s/veh	92.3	87.9	74.8	93.1	78.8	81.2	100.8	70.6	84.1	107.8	14.0	14.5
LnGrp LOS	F	F	E	F	E	F	F	E	F	F	B	B
Approach Vol, veh/h		799			414			3364			1669	
Approach Delay, s/veh		87.5			85.5			74.7			24.8	
Approach LOS		F			F			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	25.6	107.9	16.5	30.0	11.5	122.1	20.8	25.7
Change Period (Y+Rc), s	4.5	6.0	5.5	5.5	4.5	6.0	5.5	5.5
Max Green Setting (Gmax), s	23.5	98.0	11.5	25.5	11.5	110.0	16.5	20.5
Max Q Clear Time (g_c+I1), s	21.0	95.9	10.9	23.6	7.5	19.9	15.1	14.4
Green Ext Time (p_c), s	0.1	2.1	0.0	0.9	0.0	68.9	0.2	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	63.7
HCM 2010 LOS	E

Total Network Performance

Denied Delay (hr)	329.8
Denied Del/Veh (s)	127.9
Total Delay (hr)	448.0
Total Del/Veh (s)	174.5

Total Network Performance

Denied Delay (hr)	152.4
Denied Del/Veh (s)	64.4
Total Delay (hr)	301.4
Total Del/Veh (s)	124.1

Total Network Performance

Denied Delay (hr)	299.1
Denied Del/Veh (s)	115.8
Total Delay (hr)	433.0
Total Del/Veh (s)	167.9

Total Network Performance

Denied Delay (hr)	156.6
Denied Del/Veh (s)	66.2
Total Delay (hr)	268.7
Total Del/Veh (s)	111.0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	235	400	100	160	145	75	50	2520	525	175	1350	80
Future Volume (veh/h)	235	400	100	160	145	75	50	2520	525	175	1350	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	255	435	109	174	158	82	54	2739	571	190	1392	87
Adj No. of Lanes	2	2	1	2	2	0	1	4	0	1	4	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.97	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	320	511	215	238	277	137	73	3118	621	213	4076	254
Arrive On Green	0.09	0.14	0.14	0.07	0.12	0.11	0.04	0.58	0.57	0.12	0.66	0.66
Sat Flow, veh/h	3442	3539	1583	3442	2296	1136	1774	5400	1075	1774	6211	388
Grp Volume(v), veh/h	255	435	109	174	120	120	54	2423	887	190	1076	403
Grp Sat Flow(s),veh/h/ln	1721	1770	1583	1721	1770	1662	1774	1602	1669	1774	1602	1793
Q Serve(g_s), s	13.1	21.6	11.5	8.9	11.5	12.4	5.4	77.4	86.5	19.0	17.9	17.9
Cycle Q Clear(g_c), s	13.1	21.6	11.5	8.9	11.5	12.4	5.4	77.4	86.5	19.0	17.9	17.9
Prop In Lane	1.00		1.00	1.00		0.68	1.00		0.64	1.00		0.22
Lane Grp Cap(c), veh/h	320	511	215	238	213	200	73	2775	964	213	3154	1177
V/C Ratio(X)	0.80	0.85	0.51	0.73	0.56	0.60	0.74	0.87	0.92	0.89	0.34	0.34
Avail Cap(c_a), veh/h	344	531	224	249	216	203	118	2775	964	237	3154	1177
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	79.9	75.1	72.2	82.1	74.7	75.5	85.3	32.4	34.9	78.0	13.7	13.7
Incr Delay (d2), s/veh	12.4	12.8	2.6	10.9	4.1	5.7	13.3	4.2	15.2	29.8	0.3	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.8	11.5	5.2	4.6	5.9	6.0	2.9	35.2	43.8	11.1	8.0	9.1
LnGrp Delay(d),s/veh	92.3	87.9	74.8	93.1	78.8	81.2	98.6	36.6	50.1	107.8	14.0	14.5
LnGrp LOS	F	F	E	F	E	F	F	D	D	F	B	B
Approach Vol, veh/h		799			414			3364			1669	
Approach Delay, s/veh		87.5			85.5			41.1			24.8	
Approach LOS		F			F			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	25.6	107.9	16.5	30.0	11.4	122.1	20.8	25.7
Change Period (Y+Rc), s	4.5	6.0	5.5	5.5	4.5	6.0	5.5	5.5
Max Green Setting (Gmax), s	23.5	98.0	11.5	25.5	11.5	110.0	16.5	20.5
Max Q Clear Time (g_c+I1), s	21.0	88.5	10.9	23.6	7.4	19.9	15.1	14.4
Green Ext Time (p_c), s	0.1	9.2	0.0	0.9	0.0	68.9	0.2	2.4

Intersection Summary	
HCM 2010 Ctrl Delay	45.6
HCM 2010 LOS	D

Total Network Performance

Denied Delay (hr)	153.3
Denied Del/Veh (s)	64.5
Total Delay (hr)	253.8
Total Del/Veh (s)	104.3

Appendix C: Travel Time Run Reports

RJM Engineering, Inc.

SHA Travel Time Study

MD 355 (PM-NB)

Study Name **: SHA RKK MD355-NB PM**
Study Date **: 5/13/2011**
Page No. **: 1**

Study Summary

Runs Used in This Study

Run Title	Start Date	Start Time	Length	Before/ After	Run Type
SHA RKK MD355-NB-PM-001	04/27/11	14:03	8805	Before	Secondary
SHA RKK MD355-NB-PM-002	04/27/11	14:21	8571	Before	Secondary
SHA RKK MD355-NB-PM-003	04/27/11	14:41	8780	Before	Secondary
SHA RKK MD355-NB-PM-004	04/27/11	15:04	8783	Before	Secondary
SHA RKK MD355-NB-PM-005	04/27/11	15:29	8704	Before	Secondary
SHA RKK MD355-NB-PM-006	04/14/11	15:30	8590	Before	Secondary
SHA RKK MD355-NB-PM-007	04/28/11	16:02	8821	Before	Secondary
SHA RKK MD355-NB-PM-008	04/28/11	16:30	8672	Before	Secondary
SHA RKK MD355-NB-PM-009	04/14/11	16:55	8645	Before	Primary
SHA RKK MD355-NB-PM-010	04/28/11	17:04	8821	Before	Secondary
SHA RKK MD355-NB-PM-011	04/28/11	17:30	8650	Before	Secondary
SHA RKK MD355-NB-PM-012	04/14/11	17:40	8719	Before	Secondary
SHA RKK MD355-NB-PM-013	04/28/11	18:02	8777	Before	Secondary
SHA RKK MD355-NB-PM-014	04/14/11	18:24	8630	Before	Secondary
SHA RKK MD355-NB-PM-015	04/28/11	18:27	8848	Before	Secondary

Node Info

#	Len	Name
1	0	Cordell Ave
2	2104	Jones Bridge Rd
3	3412	Cedar Ln
4	3129	Pooks Hill Rd

Length of Study Route = 8,645 feet

Notes:

RJM Engineering, Inc.

SHA Travel Time Study

MD 355 (PM-NB)

Study Name **: SHA RKK MD355-NB PM**
Study Date **: 5/13/2011**
Page No. **: 2**

Overall Output Statistics

Node #	Length	Node	Travel Time	# of Stops	Avg Speed	Total Delay	Time <= 0 MPH	Time <= 35 MPH	Time <= 55 MPH
1	0	Cordell Ave							
2	2104	Jones Bridge Rd	243.7	4.2	5.9	187.1	128.7	242.5	243.7
3	3412	Cedar Ln	305.8	4.1	7.6	238.9	142.7	303.7	305.8
4	3129	Pooks Hill Rd	128.7	0.3	16.6	70.9	60.1	89.9	128.5
Total	**8,645**		**678.2**	**8.6**	**8.7**	**497.0**	**331.5**	**636.1**	**678.0**

Stats based on 15 BEFORE runs.
Stops based on a Stop Speed of 5 MPH.

RJM Engineering, Inc.

SHA Travel Time Study

MD 355 (PM-NB)

Study Name **: SHA RKK MD355-NB PM**

Study Date **: 5/13/2011**

Detailed Statistics By Run

Travel Time (sec) by Section

SHA RKK MD355-NB-PM-001
SHA RKK MD355-NB-PM-002
SHA RKK MD355-NB-PM-003
SHA RKK MD355-NB-PM-004
SHA RKK MD355-NB-PM-005
SHA RKK MD355-NB-PM-006
SHA RKK MD355-NB-PM-007
SHA RKK MD355-NB-P

Node #	Length	Node Name	Run #1	Run #2	Run #3	Run #4	Run #5	Run #6	Run #7	Run #8
1	0	Cordell Ave								
2	2104	Jones Bridge Rd	155	43	179	121	106	455	173	345
3	3412	Cedar Ln	114	233	379	365	383	419	413	395
4	3129	Pooks Hill Rd	145	138	78	58	56	48	58	53
Totals	**8645**		**414**	**414**	**636**	**544**	**545**	**922**	**644**	**793**

RJM Engineering, Inc.

SHA Travel Time Study

MD 355 (PM-NB)

Study Name **: SHA RKK MD355-NB PM**

Study Date **: 5/13/2011**

Detailed Statistics By Run

Travel Time (sec) by Section

SHA RKK MD355-NB-PM-009
SHA RKK MD355-NB-PM-010
SHA RKK MD355-NB-PM-011
SHA RKK MD355-NB-PM-012
SHA RKK MD355-NB-PM-013
SHA RKK MD355-NB-PM-014
SHA RKK MD355-NB-PM-015

Node #	Length	Node Name	Run #9	Run #10	Run #11	Run #12	Run #13	Run #14	Run #15
1	0	Cordell Ave							
2	2104	Jones Bridge Rd	480	178	278	532	190	367	53
3	3412	Cedar Ln	394	238	372	359	175	168	180
4	3129	Pooks Hill Rd	59	147	57	56	58	58	862
Totals	**8645**		**933**	**563**	**707**	**947**	**423**	**593**	**1,095**

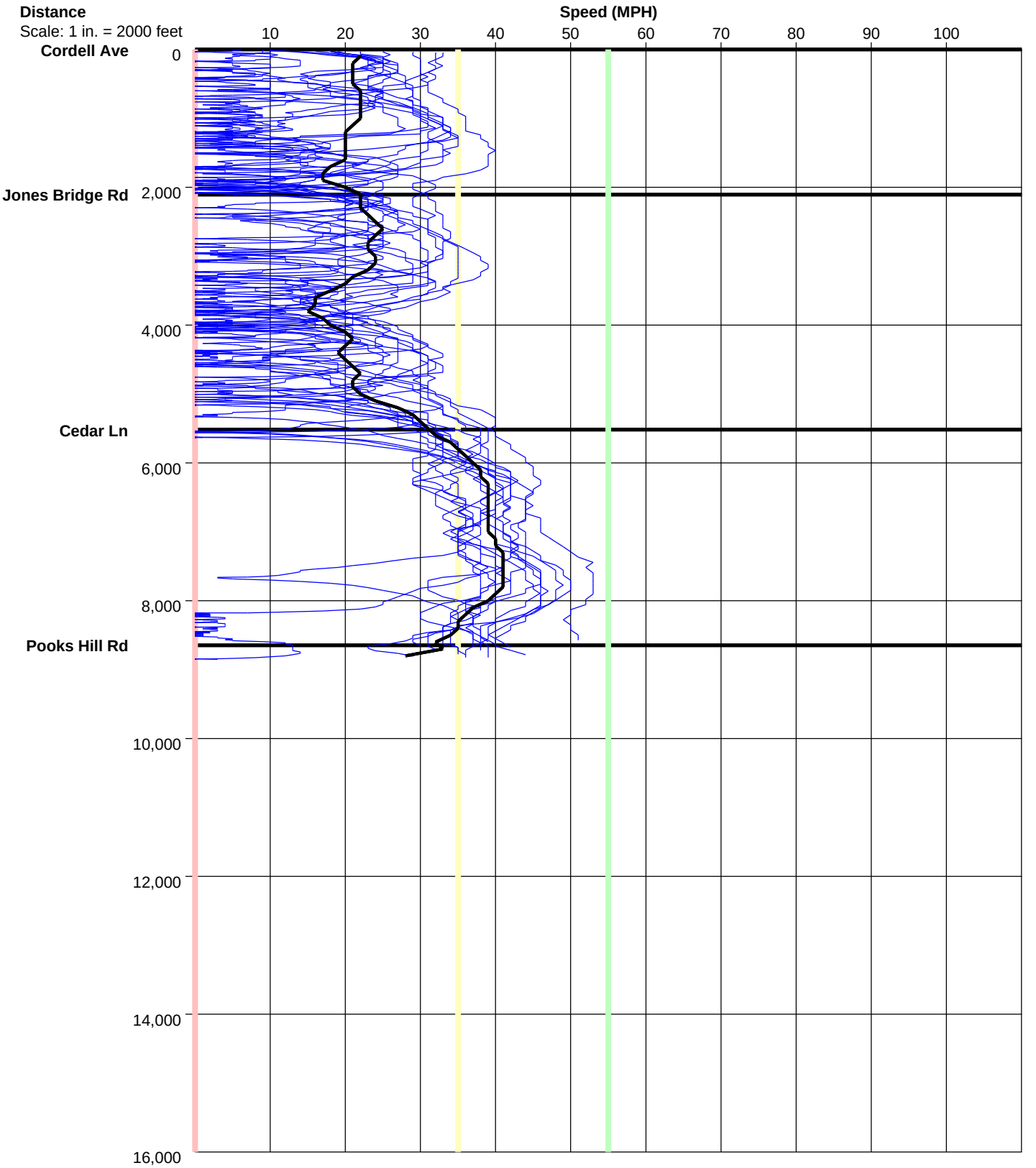
RJM Engineering, Inc.

SHA Travel Time Study

MD 355 (PM-NB)

Study Name : **SHA RKK MD355-NB PM**
Study Date : **5/13/2011**
Page No. : **5**

Speed/Distance Profiles of All Runs



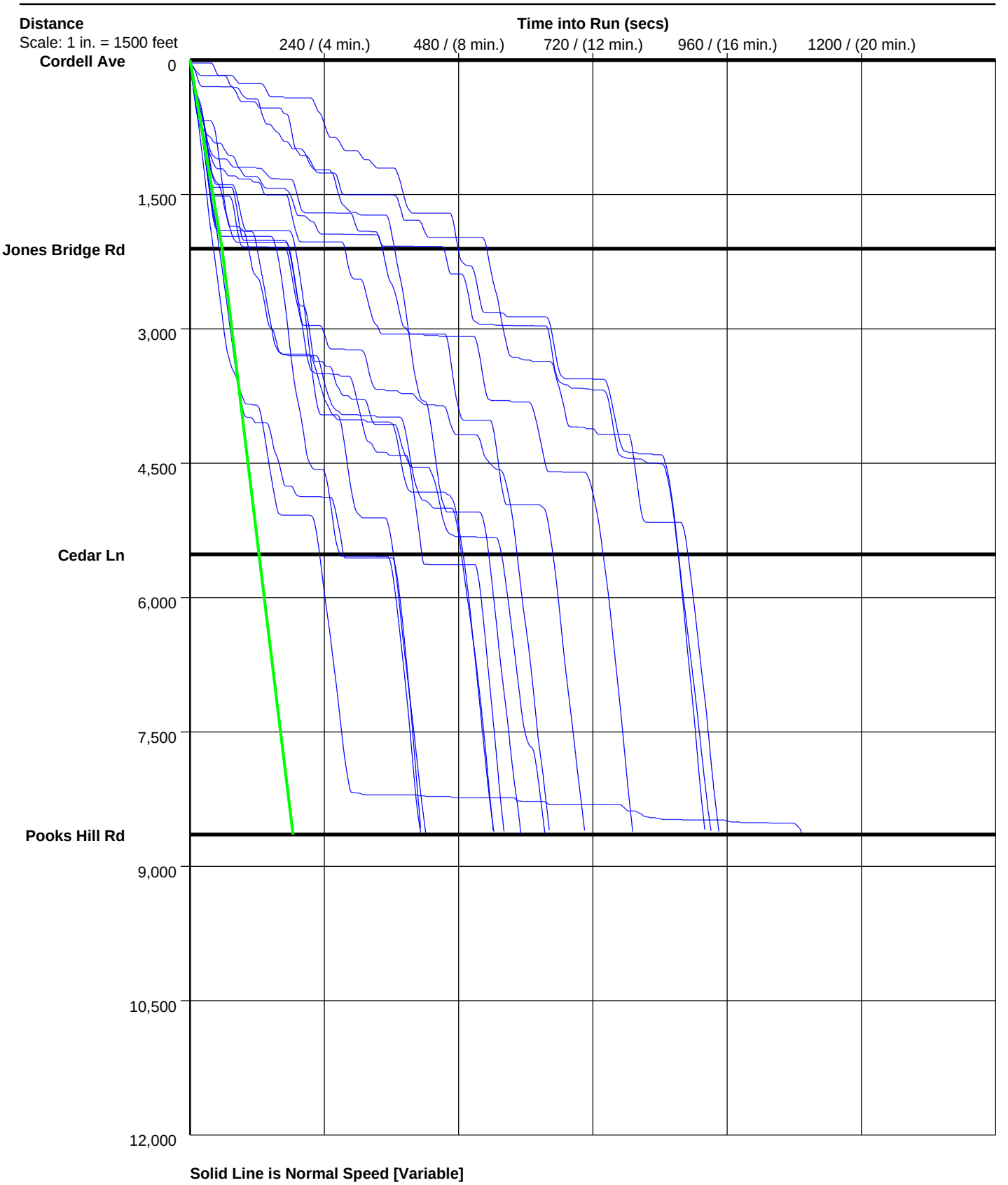
RJM Engineering, Inc.

SHA Travel Time Study

MD 355 (PM-NB)

Study Name : **SHA RKK MD355-NB PM**
Study Date : **5/13/2011**
Page No. : **6**

Time/Space Trajectories of All Runs



Solid Line is Normal Speed [Variable]

RJM Engineering

Travel Study

MD 355 NB

Study Name **: MD 355 NB PM**
Study Date **: 4/19/2017**
Page No. **: 1**

Study Summary

Runs Used in This Study

Run Title	Start Date	Start Time	Length	Before/ After	Run Type
MD 355-NB-001	04/19/17	15:00	8781	Before	Primary
MD 355-NB-002	04/19/17	15:19	8781	Before	Secondary
MD 355-NB-003	04/19/17	15:41	8767	Before	Secondary
MD 355-NB-004	04/19/17	16:03	8769	Before	Secondary
MD 355-NB-005	04/19/17	16:23	8797	Before	Secondary
MD 355-NB-006	04/19/17	17:21	8762	Before	Secondary
MD 355-NB-007	04/19/17	17:42	8742	Before	Secondary
MD 355-NB-008	04/19/17	18:05	8735	Before	Secondary
MD 355-NB-009	04/19/17	18:25	8681	Before	Secondary
MD 355-NB-010	04/19/17	18:46	8788	Before	Secondary

Node Info

#	Len	Name
1	0	Cordell Ave
2	2210	Jones Bridge Rd
3	2072	Wilson Ln
4	613	N Wood Rd
5	762	Cedar Ln
6	3124	Pooks Hill Rd

Length of Study Route = 8,781 feet

Notes:

RJM Engineering

Travel Study

MD 355 NB

Study Name **: MD 355 NB PM**
Study Date **: 4/19/2017**
Page No. **: 2**

Overall Output Statistics

Node #	Length	Node	Travel Time	# of Stops	Avg Speed	Total Delay	Time <= 0 MPH	Time <= 35 MPH	Time <= 55 MPH
1	0	Cordell Ave							
2	2210	Jones Bridge Rd	207.6	3.6	7.3	146.9	100.1	205.3	207.6
3	2072	Wilson Ln	191.1	4.2	7.4	150.5	82.9	191.1	191.1
4	613	N Wood Rd	49.8	1.1	8.4	37.7	15.5	49.8	49.8
5	762	Cedar Ln	51.1	0.8	10.2	35.9	22.9	48.7	51.1
6	3124	Pooks Hill Rd	57.4	0.1	37.1	1.5	0.0	15.2	56.8
Total	**8,781**		**557.0**	**9.8**	**10.7**	**372.5**	**221.4**	**510.1**	**556.4**

Stats based on 10 BEFORE runs.
Stops based on a Stop Speed of 5 MPH.

RJM Engineering

Travel Study

MD 355 NB

Study Name **: MD 355 NB PM**
Study Date **: 4/19/2017**

Detailed Statistics By Run

Travel Time (sec) by Section

Node #	Length	Node Name	Run #1	Run #2	Run #3	Run #4	Run #5	Run #6	Run #7	Run #8
			MD 355-NB-001	MD 355-NB-002	MD 355-NB-003	MD 355-NB-004	MD 355-NB-005	MD 355-NB-006	MD 355-NB-007	MD 355-NB-008
1	0	Cordell Ave								
2	2210	Jones Bridge Rd	121	217	194	131	185	325	359	211
3	2072	Wilson Ln	107	177	350	303	325	169	145	116
4	613	N Wood Rd	20	73	62	41	112	34	102	24
5	762	Cedar Ln	67	16	16	66	86	15	85	53
6	3124	Pooks Hill Rd	58	54	55	54	49	52	76	61
Totals	**8781**		**373**	**537**	**677**	**595**	**757**	**595**	**767**	**465**

RJM Engineering

Travel Study

MD 355 NB

Study Name **: MD 355 NB PM**
Study Date **: 4/19/2017**

Detailed Statistics By Run

Travel Time (sec) by Section

Node #	Length	Node Name	Run #9 (MD 355-NB-009)	Run #10 (MD 355-NB-010)
1	0	Cordell Ave		
2	2210	Jones Bridge Rd	240	93
3	2072	Wilson Ln	122	97
4	613	N Wood Rd	15	15
5	762	Cedar Ln	56	51
6	3124	Pooks Hill Rd	55	60
Totals	**8781**		**488**	**316**

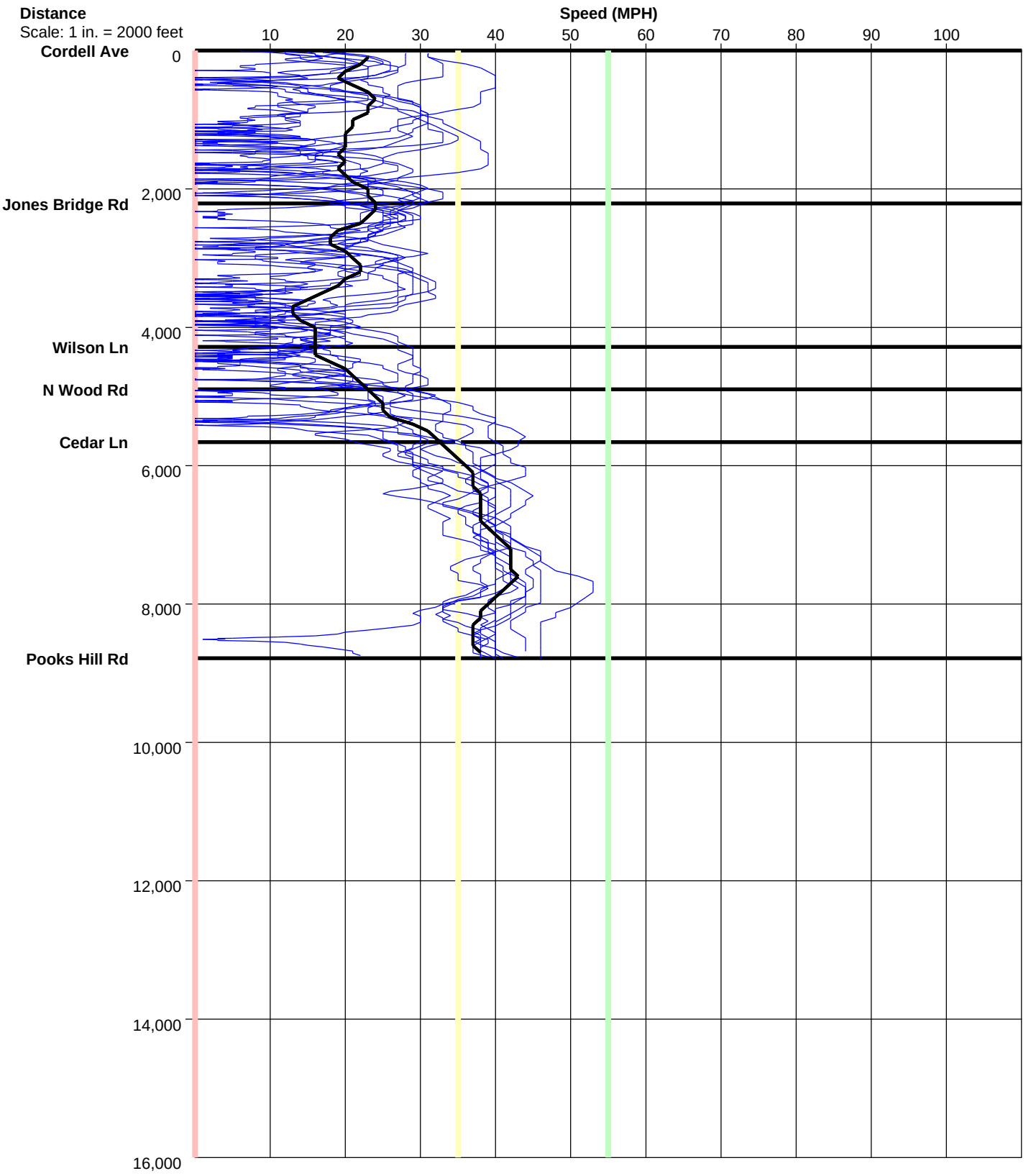
RJM Engineering

Travel Study

MD 355 NB

Study Name : **MD 355 NB PM**
Study Date : **4/19/2017**
Page No. : **5**

Speed/Distance Profiles of All Runs



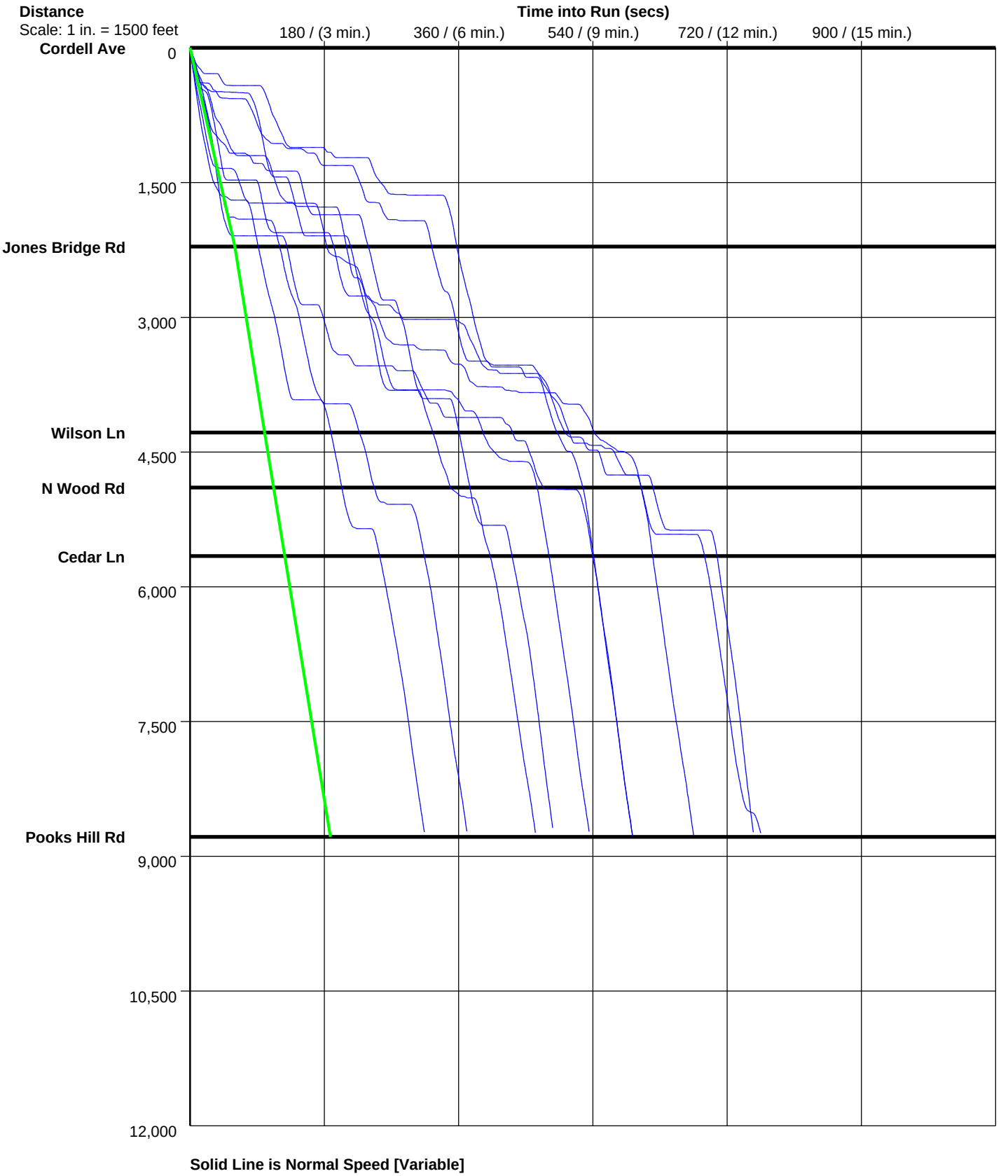
RJM Engineering

Travel Study

MD 355 NB

Study Name **: MD 355 NB PM**
Study Date **: 4/19/2017**
Page No. **: 6**

Time/Space Trajectories of All Runs



Solid Line is Normal Speed [Variable]