

# Wisteria Drive and Middlebrook Road Bicycle Lane Traffic Study

6/7/2023

## Study Objectives

To analyze impacts of bicycle lane alternatives on the Wisteria Drive and westbound Middlebrook Road corridors between Germantown Road (MD 118) and Great Seneca Highway (MD 119).

## Traffic Data

- Collected new vehicular turning movement and pedestrian/bicycle counts for eight study intersections along the two study corridors (November, 2022), and obtained vehicle classification data from the SHA I-TMS website.
- Obtained traffic signal timing data for the six signalized study intersections from MCDOT.
- Adjusted existing traffic volumes for balancing link volumes in the study network. Developed AM, PM, and PM school peak hour volumes.
- Downloaded traffic crash data for the study corridor sections from the Montgomery County Open Data website.
- Collected field travel time data along the two study corridors (January, 2023) and downloaded the corresponding INRIX travel time data for the Middlebrook Road corridor from RITIS.
- In the AM peak period, high school access traffic peaked between 7:15-7:45 AM. At the Wisteria Drive school access point queuing was observed due to drop-off and student parking traffic. In the school dismissal period (2:30-3 PM), many vehicles to pick up students were standing, mostly along the school side of Wisteria Drive between Crystal Rock Drive and MD 119.

## Existing Condition

- The Synchro/SimTraffic models were calibrated, based on the field/INRIX-measured travel time data so that the travel time deviation can be within  $\pm 10\%$  for each of the corridor sections.
- The existing condition includes two lanes EB and three WB lanes on Middlebrook Road, and one EB thru lane and one to two thru lanes on WB Wisteria Drive.
- From the Synchro-HCM model, it appears that the study intersections currently operate at LOS *D* or better during the AM, PM, and school peak periods, except for the high school entrance approach on Wisteria Drive in the AM peak period.
- From the SimTraffic simulation model, the Middlebrook Road WB and the Wisteria Drive WB segments from Crystal Rock Drive to MD 118 operate at a barely failing average speed, including signal delay, during the school and afternoon peak periods, respectively. All other segments operate at a LOS *E* or better in the three peaks when looking at average travel speed.

## Proposed Alternatives

### Middlebrook Road

- Alternatives 1 and 2: Provide a 12' wide two-way bicycle lane on the WB rightmost lane with a 3'-4' marked or raised buffer along the Middlebrook Road section, except for the 300' segment from MD 118 to the Bank of America entrance to provide a WB right turn lane to maintain more capacity and queue storage at the MD 118 intersection for vehicles. As a result, WB has two thru travel lanes instead of the three current three travel lanes from MD 118 to MD 119.

### Wisteria Drive

- Alternative 1: Provide an 8' wide two-way bicycle lane with 2' buffer on the WB rightmost lane along the Wisteria Drive section from MD 119 to Walter Johnson Road. EB has one thru travel lane from MD

118 to MD 119, while WB has two thru travel lanes. Several turn lanes have been removed and the WB bicycle lane ends at Walter Johnson Road instead of MD 118.

- Alternative 2A: Provide a 12' wide two-way bicycle lane with 6'-8' raised buffer on the WB rightmost lane along the Wisteria Drive section from MD 119 to the CVS entrance. EB and WB have one thru lane and the bicycle lane ends at the CVS entrance instead of MD 118.
- Alternative 2B: Provide 8'-14' wide side bicycle/pedestrian path using the existing sidewalk and grass area with widened right of way along both sides of the Wisteria Drive section. EB and WB both have one to two thru lanes along the corridor.
- Alternative 3: Provide 8' wide two-way bicycle lane with 2' buffer on the WB rightmost lane with widening of the south side of the Wisteria Drive from MD 118 to North Lake Professional Park entrance, maintaining the number of current travel lanes (EB one thru lane and WB: 1-2 thru lanes).
- All alternatives assume a new traffic signal at the Wisteria Drive/Walter Johnson Road intersection per direction from MCDOT.

## Alternative Analyses

### Middlebrook Road

- With the WB bicycle lane in Alternative 1 and the other alternatives, the Middlebrook Road intersections would maintain the same overall LOS as with the existing, except at Crystal Rock Drive which degrades from C to D during the PM peak period. The Middlebrook Road WB approach LOS at MD 118 would change from D to E during the PM and School peak periods.
- The traffic queues are generally not affected along Middlebrook Road with the removal of the third WB thru lane if a shorter (300') right turn lane is maintained approaching MD 118. The WB thru queue at Crystal Rock Drive does lengthen by 100 to 150 feet, which would not impact other entrances or intersections.
- Average travel times on WB Middlebrook Road traveling from MD 119 to MD 118 increase by 7 seconds or less with the proposed removal of the third thru lane between those two end points. Based on speeds, the WB LOS drops from a D to an E for the full section for the AM peak hour and drops from an E to an F for the shorter section between Crystal Rock Drive and MD 118 in the PM peak.

### Wisteria Drive

- It appeared that with the bicycle lane alternatives, overall LOS at the Wisteria Drive intersections would not degrade, except that the Wisteria Drive/MD 119 intersection LOS would change from C to D with Alt. 2A during the PM peak period. With the proposed new traffic signal, the Walter Johnson Road SB approach LOS would improve from D to C during the AM and school peak periods from the current unsignalized condition.
- The simulation model analyzed that with the bicycle lane, the average travel times along Wisteria Drive between MD 118 and MD 119 in both directions would increase by less than 15 seconds during the analysis periods, with the exception of Alternative 2A which has only one lane in each direction for most of the full length along Wisteria. For 2A, the Wisteria Drive EB travel times would increase close to 25-30 seconds during the peak periods from MD 118 to MD 119, and the Wisteria Drive EB travel speeds from Crystal Rock Drive to MD 119 would drop by 3 to 5 mph.
- The model also showed that the bicycle lane would not significantly impact the queue lengths along both corridors. With Alt. 1 and 2A, the 95th percentile queues on Wisteria Drive EB at MD 119 would increase from approximately 130' to 250'-450' feet in the AM peak period but would be accommodated within the provided storage. With Alt. 2A, the WB left turn queues on Wisteria Drive at MD 118 are forecast to increase from approximately 150 feet in the PM and School peaks to between 225 and 300 feet.

## Intersection Overall LOS Analysis Summary

Intersections	Existing		Alt. 1		Alt. 2A		Alt. 2B		Alt. 3	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
<b>AM Peak</b>										
1: MD 118 & Middlebrook Rd	D	41.7	D	41.8	D	41.8	D	41.8	D	41.8
2: Crystal Rock Dr & Middlebrook Rd	D	43.0	D	43.9	D	43.9	D	43.9	D	43.9
3: MD 119/Fetlock Dr & Middlebrook Rd	C	30.3	C	30.3	C	30.3	C	30.3	C	30.3
4: MD 118 & Wisteria Dr	D	36.6	D	36.7	D	36.7	D	36.7	D	36.7
5: Driveway/Crystal Rock Dr & Wisteria Dr	B	16.4	B	16.9	B	17.2	B	16.3	B	17.1
6: MD 119 & Wisteria Dr	C	30.0	C	30.4	C	33.4	C	30.1	C	30.1
*7: Circle Gate Dr/High School & Wisteria Dr	F	133.7	F	142.3	F	133.7	F	62.3	F	133.7
*8: Walter Johnson Rd & Wisteria Dr	D	26.4	C	30.3	C	30.3	C	29.3	C	30.8
<b>PM Peak</b>										
1: MD 118 & Middlebrook Rd.	D	45.3	D	46.4	D	46.4	D	46.4	D	46.4
2: Crystal Rock Dr. & Middlebrook Rd.	C	32.4	D	35.8	D	35.8	D	35.8	D	35.8
3: MD 119/Fetlock Dr & Middlebrook Rd.	C	32.7	C	32.7	C	32.7	C	32.5	C	32.7
4: MD 118 & Wisteria Dr.	D	37.2	D	37.5	D	37.3	D	37.5	D	37.5
5: Driveway/Crystal Rock Dr & Wisteria Dr	B	14.1	B	13.7	B	14.4	B	13.6	B	14.3
6: MD 119 & Wisteria Dr.	C	30.6	C	31.2	D	35.5	C	30.6	C	30.6
*7: Circle Gate Dr/High School & Wisteria Dr	C	18.7	C	18.2	C	18.7	B	14.8	C	18.7
*8: Walter Johnson Rd & Wisteria Dr.	C	20.0	C	26.8	C	28.9	C	24.7	C	27.2
<b>School Dismissal Peak</b>										
1: MD 118 & Middlebrook Rd	D	44.2	D	45.9	D	45.9	D	45.9	D	45.9
2: Crystal Rock Dr & Middlebrook Rd	C	30.4	C	32.2	C	32.2	C	32.2	C	32.2
3: MD 119/Fetlock Dr & Middlebrook Rd	C	30.0	C	29.9	C	29.0	C	29.9	C	29.9
4: MD 118 & Wisteria Dr.	D	38.8	D	39.0	D	38.9	D	39.0	D	39.0
5: Driveway/Crystal Rock Dr. & Wisteria Dr.	B	16.7	B	16.2	B	17.1	B	16.4	B	17.0
6: MD 119 & Wisteria Dr.	C	29.0	C	29.0	C	31.4	C	29.0	C	29.0
*7: Circle Gate Dr/High School & Wisteria Dr.	C	19.6	C	19.5	C	19.6	C	15.5	C	19.6
*8: Walter Johnson Rd & Wisteria Dr.	D	29.1	C	28.3	C	29.3	C	27.7	C	28.7

\*: Intersections 7 and 8 are unsignalized intersections in Existing, and Intersection 8 is a signalized intersection in the alternatives. For unsignalized, the worst approach LOS/delays are presented in this table.

Wisteria Dr. and Middlebrook Rd. - Intersection LOS Analysis Summary - New Option\*

Intersections	Approaches	AM Peak										PM Peak										School Dismissal Peak										
		Existing		Alt. 1		Alt. 2A		Alt. 2B		Alt. 3		Existing		Alt. 1		Alt. 2A		Alt. 2B		Alt. 3		Existing		Alt. 1		Alt. 2A		Alt. 2B		Alt. 3		
		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	
1: MD 118 & Middlebrook Rd	Overall	D	41.7	D	41.8	D	41.8	D	41.8	D	41.8	D	45.3	D	46.4	D	46.4	D	46.4	D	46.4	D	44.2	D	45.9	D	45.9	D	45.9	D	45.9	
	EB	E	58.4	E	58.4	E	58.4	E	58.4	E	58.4	E	58.9	E	58.7	E	58.7	E	58.7	E	58.7	E	60.0	E	58.5	E	58.5	E	58.5	E	58.5	
	WB	E	55.7	E	56.3	E	56.3	E	56.3	E	56.3	E	54.6	E	59.7	E	59.7	E	59.7	E	59.7	E	54.1	E	60.4	E	60.4	E	60.4	E	60.4	
	Signalized	NB	C	29.8	C	29.8	C	29.8	C	29.8	C	29.8	C	34.1	C	33.8	C	34.0	C	33.8	C	33.8	C	32.9	C	33.7	C	33.9	C	33.7	C	33.7
	SB	D	37.2	D	37.2	D	37.2	D	37.2	D	37.2	D	42.8	D	43.0	D	43.0	D	43.0	D	43.0	D	39.5	D	40.7	D	40.7	D	40.7	D	40.7	
2: Crystal Rock Dr & Middlebrook Rd	Overall	D	43.0	D	43.9	D	43.9	D	43.9	D	43.9	C	32.4	D	35.8	D	35.8	D	35.8	D	35.8	C	30.4	C	32.2	C	32.2	C	32.2	C	32.2	
	EB	D	43.3	D	43.5	D	43.5	D	43.5	D	43.5	C	24.4	C	24.6	C	24.6	C	24.6	C	24.6	C	33.2	C	33.4	C	33.4	C	33.4	C	33.4	
	WB	C	28.8	C	31.6	C	31.6	C	31.6	C	31.6	C	27.0	C	33.4	C	33.4	C	33.4	C	33.4	C	20.3	C	24.5	C	24.6	C	24.5	C	24.5	
	Signalized	NB	D	52.2	D	52.2	D	52.2	D	52.2	D	52.2	E	56.7	E	56.7	E	56.7	E	56.7	E	56.7	D	41.6	D	41.6	D	41.6	D	41.6	D	41.6
	SB	E	57.2	E	57.2	E	57.2	E	57.2	E	57.2	E	56.7	E	56.7	E	56.7	E	56.7	E	56.7	E	46.7	D	46.7	D	46.7	D	46.7	D	46.7	
3: MD 119/Fetlock Dr & Middlebrook Rd	Overall	C	30.3	C	30.3	C	30.3	C	30.3	C	30.3	C	32.7	C	32.7	C	32.7	C	32.5	C	32.7	C	30.0	C	29.6	C	29.0	C	29.0	C	29.0	
	EB	B	18.6	B	18.6	B	18.6	B	18.6	B	18.6	C	22.5	C	22.5	C	22.5	C	21.4	C	22.5	B	15.6	B	15.6	B	15.6	B	15.6	B	15.6	
	WB	C	21.9	C	21.9	C	21.9	C	21.9	C	21.9	C	27.3	C	27.3	C	27.3	C	27.3	C	27.3	C	24.4	C	24.4	C	24.4	C	24.4	C	24.4	
	Signalized	NB	E	56.1	E	56.1	E	56.1	E	56.1	E	56.1	D	51.1	D	51.1	D	51.1	D	51.1	D	51.1	D	51.9	D	50.6	D	48.6	D	51.8	D	51.8
	SB	A	4.1	A	4.1	A	4.1	A	4.1	A	4.1	A	5.6	A	5.6	A	5.6	A	5.6	A	5.6	A	5.4	A	5.4	A	5.4	A	5.4	A	5.4	
4: MD 118 & Wisteria Dr	Overall	D	36.6	D	36.7	D	36.7	D	36.7	D	36.7	D	37.2	D	37.5	D	37.3	D	37.5	D	37.5	D	38.8	D	39.0	D	38.9	D	39.0	D	39.0	
	EB	E	56.3	E	55.7	E	56.1	E	55.7	E	55.7	E	56.9	E	56.5	E	56.8	E	56.5	E	56.5	E	55.9	E	55.6	E	55.9	E	55.6	E	55.6	
	WB	E	59.7	E	59.5	E	59.5	E	59.5	E	59.5	E	59.2	E	59.5	E	59.3	E	59.5	E	59.5	E	57.4	E	57.8	E	57.7	E	57.8	E	57.8	
	Signalized	NB	C	26.7	C	27.2	C	27.0	C	27.2	C	27.2	C	32.1	C	32.7	C	32.4	C	32.7	C	32.7	C	31.1	C	31.7	C	31.4	C	31.7	C	31.7
	SB	C	21.1	C	21.5	C	21.3	C	21.5	C	21.3	C	24.3	C	24.6	C	24.4	C	24.6	C	24.6	C	25.6	C	25.8	C	25.6	C	25.8	C	25.8	
5: Driveway/Crystal Rock Dr & Wisteria Dr	Overall	B	16.4	B	16.9	B	17.2	B	16.3	B	17.1	B	14.1	B	13.7	B	14.4	B	13.6	B	14.3	B	16.7	B	16.2	B	17.1	B	16.4	B	17.0	
	EB	B	17.7	B	19.4	B	19.0	B	17.0	B	18.8	B	13.1	B	13.5	B	13.4	B	11.2	B	13.1	B	16.6	B	17.4	B	16.8	B	14.7	B	16.6	
	WB	B	14.7	B	14.1	B	15.3	B	15.3	B	15.3	B	13.1	B	11.6	B	13.4	B	13.4	B	13.4	B	17.4	B	15.8	B	17.8	B	17.8	B	17.8	
	signalized	NB	C	25.2	C	22.8	C	22.0	C	22.0	C	22.0	C	21.0	C	21.1	C	21.4	C	21.4	C	21.4	B	17.4	B	16.6	B	17.8	B	17.8	B	17.8
	SB	B	16.9	B	17.8	B	17.1	B	17.0	B	17.1	B	16.9	B	17.0	B	17.2	B	17.2	B	17.2	B	16.0	B	15.3	B	16.5	B	16.4	B	16.5	
6: MD 119 & Wisteria Dr	Overall	C	30.0	C	30.4	C	33.4	C	30.1	C	30.1	C	30.6	C	31.2	D	35.5	C	30.6	C	30.6	C	29.0	C	29.0	C	31.4	C	29.0	C	29.0	
	EB	D	42.5	D	42.9	D	51.7	D	42.8	D	42.8	D	44.3	D	42.6	D	47.6	D	43.8	D	43.8	D	45.6	D	42.4	D	46.9	D	45.5	D	45.5	
	WB	D	41.0	D	38.9	D	35.2	D	40.4	D	40.4	D	44.1	D	42.3	D	46.3	D	43.0	D	43.0	D	46.7	D	40.5	D	36.9	D	46.1	D	46.1	
	Signalized	NB	C	20.8	C	22.0	C	25.2	C	21.0	C	21.0	C	22.3	C	24.2	C	28.4	C	22.7	C	22.7	B	18.1	C	21.2	C	24.8	B	18.3	B	18.3
	SB	C	20.7	C	21.9	C	25.2	C	21.0	C	21.0	C	23.2	C	25.2	C	29.2	C	23.7	C	23.7	B	18.5	C	21.2	C	24.0	B	18.7	B	18.7	
7: Circle Gate Dr/High School Entr. & Wisteria Dr	Overall	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	EB	A	1.4	A	1.4	A	1.4	A	1.4	A	1.4	A	0.5	A	0.5	A	0.5	A	0.5	A	0.5	A	0.5	A	0.5	A	0.5	A	0.5	A	0.5	
	WB	A	0.3	A	0.3	A	0.3	A	0.3	A	0.3	A	0.4	A	0.4	A	0.4	A	0.4	A	0.4	A	0.4	A	0.4	A	0.4	A	0.4	A	0.4	
	Unsignalized	NB	D	27.9	C	18.3	D	27.8	C	17.7	D	27.8	C	17.0	B	14.3	C	17.0	B	13.8	C	17.0	C	16.6	B	14.8	C	16.6	B	14.3	C	16.6
	SB	F	133.7	F	142.3	F	133.7	F	62.3	F	133.7	C	18.7	C	18.2	C	18.7	B	14.8	C	18.7	C	19.6	C	19.5	C	19.6	C	15.5	C	19.6	
8: Walter Johnson Rd & Wisteria Dr	Overall	-	-	A	4.3	A	4.6	A	3.5	A	4.3	-	-	A	6.8	A	7.4	A	6.3	A	6.8	-	-	A	5.6	A	7.0	A	5.3	A	5.6	
	EB	A	0.3	A	3.5	A	3.4	A	2.2	A	3.4	A	0.6	A	4.1	A	3.9	A	3.4	A	4.0	A	0.5	A	3.6	A	3.7	A	2.8	A	3.5	
	WB	A	0.6	A	2.3	A	3.0	A	2.1	A	2.2	A	0.3	A	3.4	A	4.3	A	3.6	A	3.3	A	0.4	A	3.2	A	5.4	A	3.2	A	3.2	
	Unsignalized /	NB	B	14.4	C	30.6	C	30.6	C	29.7	C	31.1	B	14.5	C	25.4	C	27.3	C	23.4	C	25.8	B	12.5	C	26.1	C	29.3	C	25.6	C	26.6
	Signalized	SB	D	26.4	C	30.3	C	29.3	C	30.8	C	20.0	C	26.8	C	28.9	C	24.7	C	27.2	D	29.1	C	28.3	C	29.3	C	27.7	C	28.7		

Note \*: New option includes 1) 300' WB Right Turn lane on WB Middlebrook Road at Germantown Road for all alternatives, 2) Signalize for Walter Johnson Rd/Wisteria Drive intersection for all alternatives, and 3) For Alt. 1 and Alt 2A, WB Wisteria Drive at Germantown Road has the same lane configuration as Existing, while the WB bicycle lane ends at Walter Johnson Road

**Simulation Model Arterial MOE by Alternative - Wisteria Drive and Middlebrook Road - New Option\*\***

Arterial Sections		Distance (miles)	Existing				Alt. 1			Alt. 2A			Alt. 2B			Alt. 3		
			BFFS* (mph)	Travel Time (s)	Speed (mph)	LOS	Travel Time (s)	Speed (mph)	LOS	Travel Time (s)	Speed (mph)	LOS	Travel Time (s)	Speed (mph)	LOS	Travel Time (s)	Speed (mph)	LOS
<b>AM Peak</b>																		
Middlebrook Rd EB	MD 118 to Crystal Rock Dr	0.21	39	57.9	13.1	E	58.1	13.0	E	58.0	13.0	E	58.0	13.0	E	60.1	12.6	E
	Crystal Rock Dr to MD 119	0.23	39	30.5	27.1	B	29.5	28.1	B	29.8	27.8	B	31.4	26.4	B	32.6	25.4	C
	<b>Total</b>	<b>0.44</b>	<b>39</b>	<b>88.4</b>	<b>17.9</b>	<b>D</b>	<b>87.6</b>	<b>18.1</b>	<b>D</b>	<b>87.8</b>	<b>18.0</b>	<b>D</b>	<b>89.4</b>	<b>17.7</b>	<b>D</b>	<b>92.7</b>	<b>17.1</b>	<b>D</b>
Middlebrook Rd WB	MD 119 to Crystal Rock Dr	0.23	39	43.6	19.0	D	44.7	18.5	D	45.0	18.4	D	46.5	17.8	D	45.1	18.4	D
	Crystal Rock Dr to MD 118	0.21	39	54.6	13.8	E	56.4	13.4	E	54.7	13.8	E	55.1	13.7	E	56.9	13.3	E
	<b>Total</b>	<b>0.44</b>	<b>39</b>	<b>98.2</b>	<b>16.1</b>	<b>D</b>	<b>101.1</b>	<b>15.7</b>	<b>D</b>	<b>99.7</b>	<b>15.9</b>	<b>D</b>	<b>101.6</b>	<b>15.6</b>	<b>E</b>	<b>102.0</b>	<b>15.5</b>	<b>E</b>
Wisteria Dr EB	MD 118 to Crystal Rock Dr	0.26	38	47.9	19.5	C	50.0	18.7	D	52.0	18.0	D	45.3	20.7	C	52.5	17.8	D
	Crystal Rock Dr to MD 119	0.34	37	71.4	17.1	D	84.2	14.5	E	98.0	12.5	E	73.6	16.6	D	74.9	16.3	D
	<b>Total</b>	<b>0.60</b>	<b>37</b>	<b>119.3</b>	<b>18.1</b>	<b>D</b>	<b>134.2</b>	<b>16.1</b>	<b>D</b>	<b>150.0</b>	<b>14.4</b>	<b>E</b>	<b>118.9</b>	<b>18.2</b>	<b>D</b>	<b>127.4</b>	<b>17.0</b>	<b>D</b>
Wisteria Dr WB	MD 119 to Crystal Rock Dr	0.34	37	58.1	21.1	C	53.3	23.0	C	58.2	21.0	C	55.8	21.9	C	57.0	21.5	C
	Crystal Rock Dr to MD 118	0.26	38	80.1	11.7	E	77.7	12.0	E	80.3	11.7	E	80.4	11.6	E	81.0	11.6	F
	<b>Total</b>	<b>0.60</b>	<b>37</b>	<b>138.2</b>	<b>15.6</b>	<b>D</b>	<b>131.0</b>	<b>16.5</b>	<b>D</b>	<b>138.5</b>	<b>15.6</b>	<b>D</b>	<b>136.2</b>	<b>15.9</b>	<b>D</b>	<b>138.0</b>	<b>15.7</b>	<b>D</b>
<b>PM Peak</b>																		
Middlebrook Rd EB	MD 118 to Crystal Rock Dr	0.21	39	47.4	15.9	D	46.5	16.3	D	46.8	16.2	D	46.1	16.4	D	46.6	16.2	D
	Crystal Rock Dr to MD 119	0.23	39	46.5	17.8	D	46.1	18.0	D	45.9	18.0	D	44.2	18.7	D	47.1	17.6	D
	<b>Total</b>	<b>0.44</b>	<b>39</b>	<b>93.9</b>	<b>16.9</b>	<b>D</b>	<b>92.6</b>	<b>17.1</b>	<b>D</b>	<b>92.7</b>	<b>17.1</b>	<b>D</b>	<b>90.3</b>	<b>17.5</b>	<b>D</b>	<b>93.7</b>	<b>16.9</b>	<b>D</b>
Middlebrook Rd WB	MD 119 to Crystal Rock Dr	0.23	39	35.0	23.7	C	40.4	20.5	C	39.5	21.0	C	40.8	20.3	C	41.8	19.8	C
	Crystal Rock Dr to MD 118	0.21	39	70.8	10.7	F	71.5	10.6	F	71.4	10.6	F	71.3	10.6	F	70.1	10.8	F
	<b>Total</b>	<b>0.44</b>	<b>39</b>	<b>105.8</b>	<b>15.0</b>	<b>E</b>	<b>111.9</b>	<b>14.2</b>	<b>E</b>	<b>110.9</b>	<b>14.3</b>	<b>E</b>	<b>112.1</b>	<b>14.1</b>	<b>E</b>	<b>111.9</b>	<b>14.2</b>	<b>E</b>
Wisteria Dr EB	MD 118 to Crystal Rock Dr	0.26	38	41.6	22.5	C	46.5	20.1	C	46.4	20.2	C	42.3	22.1	C	48.0	19.5	C
	Crystal Rock Dr to MD 119	0.34	37	76.2	16.1	D	78.5	15.6	D	100.9	12.1	E	76.2	16.1	D	77.0	15.9	D
	<b>Total</b>	<b>0.60</b>	<b>37</b>	<b>117.8</b>	<b>18.3</b>	<b>D</b>	<b>125.0</b>	<b>17.3</b>	<b>D</b>	<b>147.3</b>	<b>14.7</b>	<b>E</b>	<b>118.5</b>	<b>18.2</b>	<b>D</b>	<b>125.0</b>	<b>17.3</b>	<b>D</b>
Wisteria Dr WB	MD 119 to Crystal Rock Dr	0.34	37	50.8	24.1	C	50.8	24.1	C	53.2	23.0	C	49.8	24.6	C	51.9	23.6	C
	Crystal Rock Dr to MD 118	0.26	38	75.4	12.4	E	79.3	11.8	E	82.7	11.3	F	79.8	11.7	E	79.7	11.7	E
	<b>Total</b>	<b>0.60</b>	<b>37</b>	<b>126.2</b>	<b>17.1</b>	<b>D</b>	<b>130.1</b>	<b>16.6</b>	<b>D</b>	<b>135.9</b>	<b>15.9</b>	<b>D</b>	<b>129.6</b>	<b>16.7</b>	<b>D</b>	<b>131.6</b>	<b>16.4</b>	<b>D</b>
<b>School Peak</b>																		
Middlebrook Rd EB	MD 118 to Crystal Rock Dr	0.21	39	50.4	15.0	E	53.5	14.1	E	52.8	14.3	E	54.2	13.9	E	52.6	14.4	E
	Crystal Rock Dr to MD 119	0.23	39	36.1	22.9	C	38.0	21.8	C	36.0	23.0	C	37.6	22.0	C	37.2	22.3	C
	<b>Total</b>	<b>0.44</b>	<b>39</b>	<b>86.5</b>	<b>18.3</b>	<b>D</b>	<b>91.5</b>	<b>17.3</b>	<b>D</b>	<b>88.8</b>	<b>17.8</b>	<b>D</b>	<b>91.8</b>	<b>17.3</b>	<b>D</b>	<b>89.8</b>	<b>17.6</b>	<b>D</b>
Middlebrook Rd WB	MD 119 to Crystal Rock Dr	0.23	39	40.7	20.3	C	42.8	19.3	D	41.9	19.8	C	43.2	19.2	D	43.9	18.9	D
	Crystal Rock Dr to MD 118	0.21	39	64.0	11.8	E	68.0	11.1	F	69.5	10.9	F	67.3	11.2	F	68.7	11.0	F
	<b>Total</b>	<b>0.44</b>	<b>39</b>	<b>104.7</b>	<b>15.1</b>	<b>E</b>	<b>110.8</b>	<b>14.3</b>	<b>E</b>	<b>111.4</b>	<b>14.2</b>	<b>E</b>	<b>110.5</b>	<b>14.3</b>	<b>E</b>	<b>112.6</b>	<b>14.1</b>	<b>E</b>
Wisteria Dr EB	MD 118 to Crystal Rock Dr	0.26	38	42.6	22.0	C	45.3	20.7	C	45.2	20.7	C	41.9	22.3	C	45.8	20.4	C
	Crystal Rock Dr to MD 119	0.34	37	72.2	17.0	D	73.3	16.7	D	93.0	13.2	E	71.3	17.2	D	69.8	17.5	D
	<b>Total</b>	<b>0.60</b>	<b>37</b>	<b>114.8</b>	<b>18.8</b>	<b>C</b>	<b>118.6</b>	<b>18.2</b>	<b>D</b>	<b>138.2</b>	<b>15.6</b>	<b>D</b>	<b>113.2</b>	<b>19.1</b>	<b>C</b>	<b>115.6</b>	<b>18.7</b>	<b>C</b>
Wisteria Dr WB	MD 119 to Crystal Rock Dr	0.34	37	60.0	20.4	C	57.9	21.1	C	59.4	20.6	C	60.9	20.1	C	59.8	20.5	C
	Crystal Rock Dr to MD 118	0.26	38	82.9	11.3	F	83.5	11.2	F	88.0	10.6	F	86.9	10.8	F	87.0	10.8	F
	<b>Total</b>	<b>0.60</b>	<b>37</b>	<b>142.9</b>	<b>15.1</b>	<b>D</b>	<b>141.4</b>	<b>15.3</b>	<b>D</b>	<b>147.4</b>	<b>14.7</b>	<b>E</b>	<b>147.8</b>	<b>14.6</b>	<b>E</b>	<b>146.8</b>	<b>14.7</b>	<b>E</b>

\* BBFS (Base Free Flow Speed) is calculated, based on Eq. 18-3 and Exhibit 18-11 in HCM 6th Edition.

Note: LOS is determined by below Travel Speed Threshold by BBFS interpolated, based on Exhibit 16-3/Exhibit 18-1 in HCM 6th Edition.

BFFS \ LOS	A	B	C	D	E	F
39 mph	>31.2	>26.2	>19.6	>15.6	>11.8	≤11.8
38 mph	>30.4	>25.4	>19.2	>15.2	>11.6	≤11.6
37 mph	>29.6	>24.9	>18.5	>14.8	>11.1	≤11.1

\*\* New option includes 1) 300' WB Right Turn lane on WB Middlebrook Road at Germantown Road for all alternatives,

2) Signalize for Walter Johnson Rd/Wisteria Drive intersection for all alternatives, and

3) For Alt. 1 and Alt 2A, WB Wisteria Drive at Germantown Road has the same lane configuration as Existing, while the WB bicycle lane ends at Walter Johnson Road.

