

**MONTGOMERY VILLAGE MASTER PLAN**

**Appendix 1 Transportation Analysis**

**July 2015**



Montgomery County Planning Department  
The Maryland-National Capital Park and Planning Commission

### Master Plan and Study Area Boundaries

The transportation analysis for the Montgomery Village Master Plan takes into account a larger study area and smaller master plan area defined by the Plan boundary (see Figure 1).

The study area is comprised of the traffic analysis zones (TAZs) which are within and contiguous to the Plan boundary. The definition of the Plan area is important in that it is the first step in establishing the interface between the regional transportation model and the Master Plan local area model intersection analysis. The Plan boundary is formally established by the Planning Board during its deliberations on the Plan scope of work. The more detailed transportation analysis is conducted for the area within the Plan Boundary.

### Intersection Capacity and Roadway Traffic Volumes

There are a number of ways to measure the quality of service provided by a transportation network. In Montgomery County, the method of measuring network performance is established by the County's Subdivision Staging Policy (formerly called the Growth Policy). This policy requires consideration of the critical lane volume (CLV) at major intersections as the key metric used to measure the quality of service provided by the network. CLVs are essentially the sum of vehicles passing through an intersection at a single point during the peak hour. The level of CLVs considered acceptable varies by Policy Area within the County. Master Plan intersections included in this analysis are located within the Montgomery Village/Airpark Policy Area, which currently has a congestion standard of 1,425 CLV. Intersections at or above 1,425 CLV are considered to be "failing" or not within the acceptable standard for the Policy Area. Several intersections are located within the City of Gaithersburg which has a slightly higher congestion standard of 1,450 CLV.

### Master Plan Area Traffic Analysis

A traffic analysis was conducted to estimate projected levels of congestion in the year 2040 at key roadway intersections within and just outside of the Plan area. The analysis assumed that the roadway network in the year 2040 would include the funded I-270 interchange at Watkins Mill Road, un-built roadway links (including M-83 west of Montgomery Village Avenue), and other road widening projects, such as Goshen Road and Snouffer School Road from two to four lanes

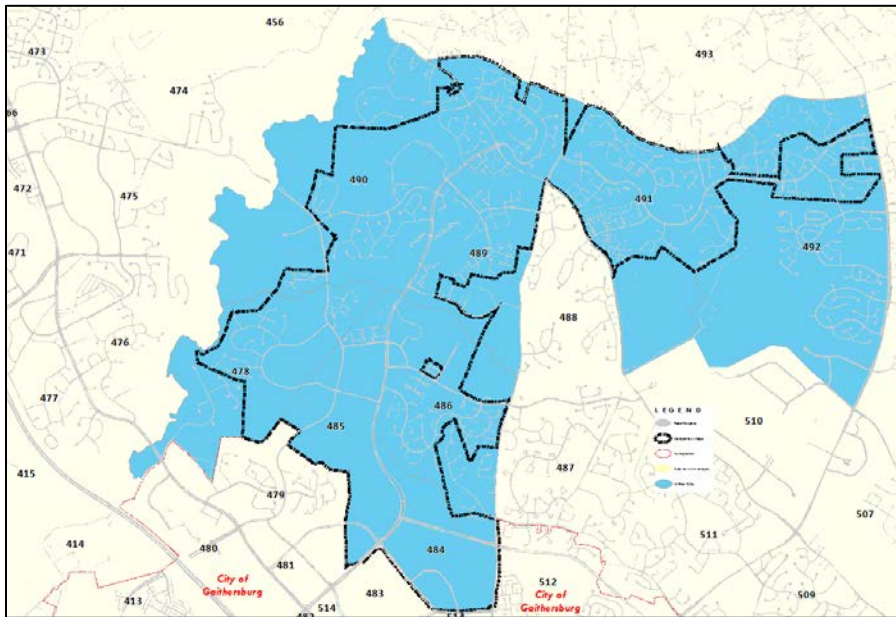


Figure 1: Master Plan and Study Area Boundaries



currently in the Transportation Planning Board (TPB) Constrained Long Range Plan (CLRP), and proposed network changes recommended in this Plan (such as the Stewartown Road extension). The following tables summarize the land use assumptions for the two study scenarios:

Current Adopted Master Plan (1985 Gaithersburg Vicinity Plan) – Year 2040				
Inside MV	256 Residential Units	90k SF Retail	No New Industrial	No New Office
Outside MV*	No New Residential	12k SF Retail	188k SF Industrial	No New Office
* This is the area just outside of Montgomery Village in the vicinity of the Airpark. Redevelopment of the Lakeforest Mall was not assumed.				

Proposed Master Plan (Montgomery Village Plan) – Year 2040				
Inside MV	2,460 Residential Units	261k SF Retail	-4k SF Industrial	88k SF Office
Outside MV*	No New Residential	12k SF Retail	188k SF Industrial	No New Office
* This is the area just outside of Montgomery Village in the vicinity of the Airpark. Redevelopment of the Lakeforest Mall was not assumed.				

In general, the analysis indicates that most intersections within Montgomery Village (with the exception of those along Midcounty Highway) would operate well below the area congestion standard of 1,425 critical lane volume (CLV). Intersections outside of the Plan area, particularly along MD

355 in the City of Gaithersburg (CLV congestion standard of 1,450), that are currently congested will continue to be challenging for drivers (see Figure 2). For a complete analysis, please refer to the Transportation Evaluation White Paper, prepared by Renaissance Planning Group, regarding the travel demand modeling assumptions and results of the CLV analysis. This White Paper is presented later in this Appendix.

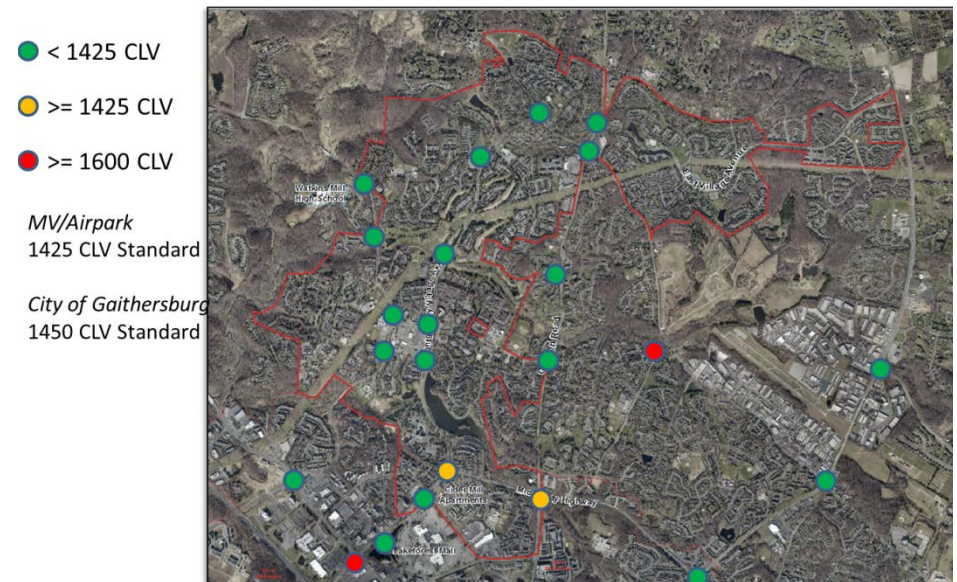


Figure 2: Existing CLVs





Figure 3: 1985 Gaithersburg Vicinity 2040 (p.m. Peak-hour)

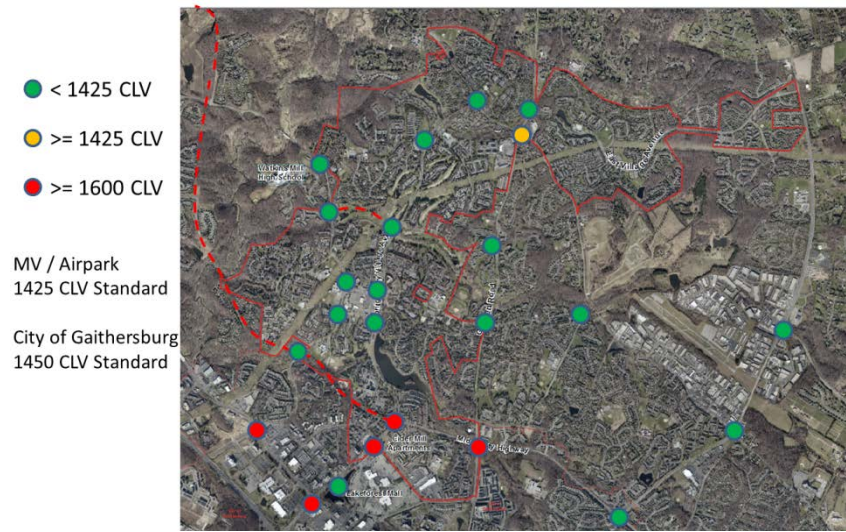


Figure 3: MVPlan 2040 (p.m. Peak-hour)

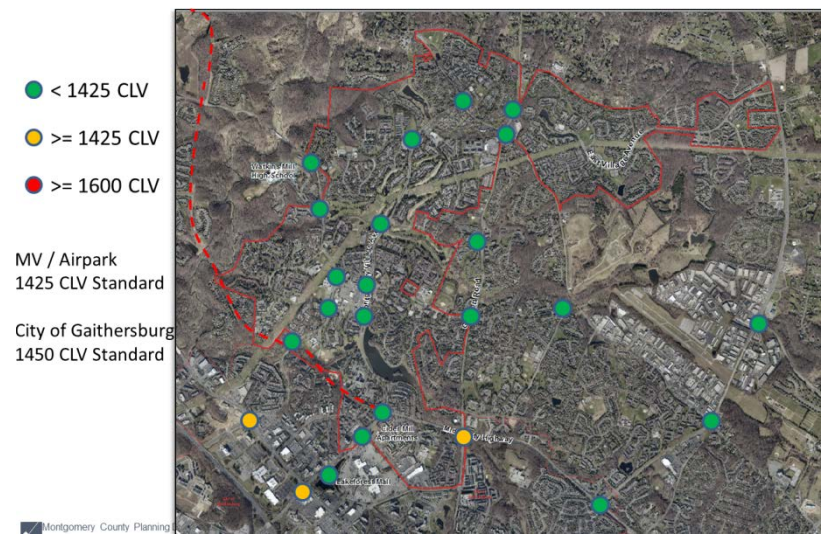


Figure 4: 1985 Gaithersburg Vicinity 2040 (PM Peak-hour w/intersection improvements)

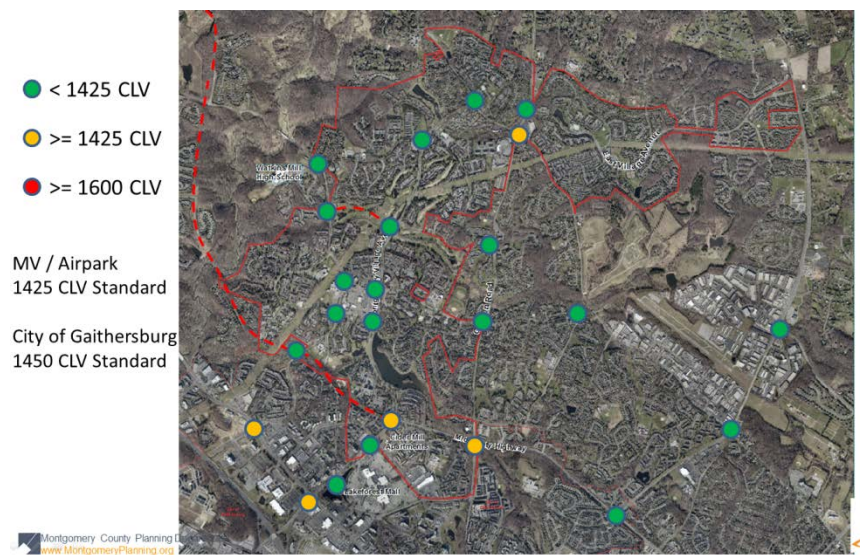


Figure 4: MVPlan 2040 (P.M. Peak-hour w/intersection improvements)

Table 4A and 4B provided in the accompanying Transportation Evaluation White Paper summarizes the intersection analysis results for the 1985 Gaithersburg Vicinity Plan in 2040 relative to the future Montgomery Village Master Plan in 2040.

A list of potential specific roadway mitigation options (beyond the currently planned widenings or funded CIP/SHA projects) that could help alleviate additional traffic generated by new development in the Master Plan area are listed below.

- Midcounty Highway & Goshen Road
  - Construct a second westbound left-turn lane on Goshen Road
- Midcounty Highway and Montgomery Village Avenue
  - Construct a northbound left-turn lane on Montgomery Village Avenue
  - Construct eastbound left- and right-turn lanes on future Midcounty Highway
  - Convert all free-right/channelized ramps to right-turn lanes
- Midcounty Highway (future) & Watkins Mill Road
  - Construct left- and right-turn lanes on all four approaches
- MD 355 & Montgomery Village Avenue
  - Construct a fourth eastbound through lane on MD 355
  - Construct third and fourth westbound through lanes on MD 355 and remove a westbound left-turn lane
- MD 355 & Watkins Mill Road
  - Construct a third northbound left-turn lane on Watkins Mill Road
  - Construct a second eastbound right-turn lane on MD 355
  - Construct a second westbound left-turn lane on MD 355
  - Construct a third westbound through lane on MD 355
- Lost Knife Road and Montgomery Village Avenue
  - Construct a second southbound left-turn lane on Montgomery Village Avenue
  - Construct a second westbound right-turn lane on Lost Knife Road
  - Convert all free-right/channelized ramps to right-turn lanes
- Montgomery Village Avenue and Stewartown Road
  - Construct northbound and southbound left-turn lanes on Montgomery Village Avenue
  - Construct a southbound right-turn lane on Montgomery Village Avenue
- Watkins Mill Road and Crested Iris Drive / (future) Stewartown Road
  - Construct northbound and southbound left-turn lanes on Watkins Mill Road
  - Construct a northbound right-turn lane on Watkins Mill Road

Note that the analysis conducted for this Master Plan is not intended to be a blanket traffic study for new development in Montgomery Village. Instead, it is intended to demonstrate

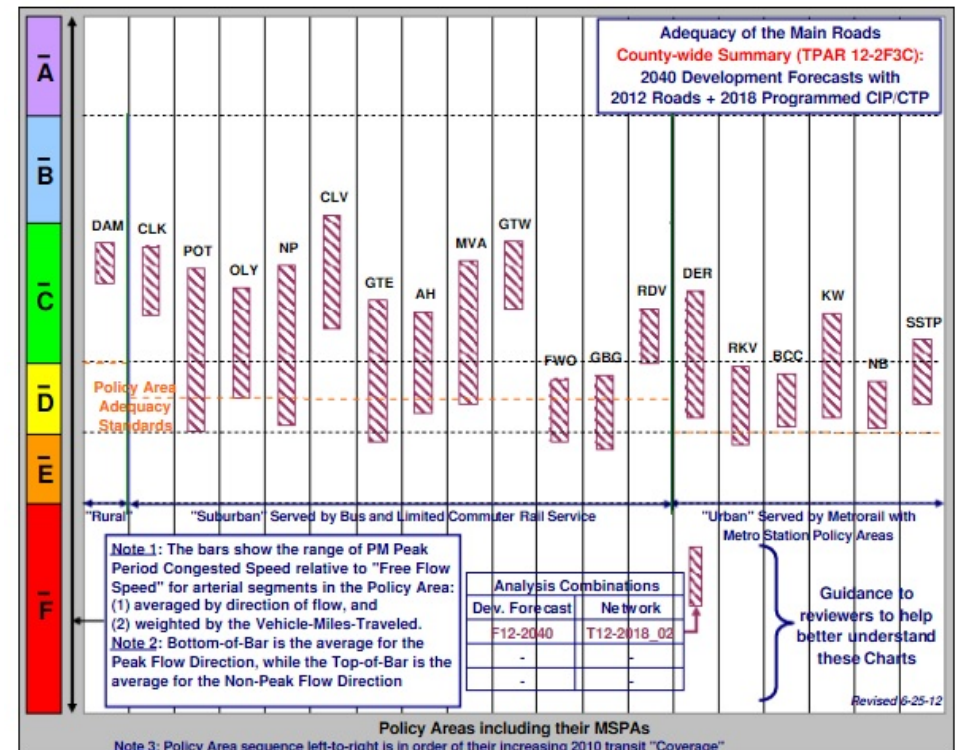


that at a high level the anticipated year 2040 transportation network, in combination with numerous intersections improvements, new roadway links, and road widenings (many of which are anticipated to be obtained through the regulatory/development review process) can adequately support the zoning recommendations and increased densities in Montgomery Village.

### Policy Area Roadway Network Adequacy Test

In support of the 2012 Subdivision Staging Policy (SSP), a Transportation Policy Area Review (TPAR) analysis was performed for each policy area in the county to test the roadway network's adequacy in 2040 (see chart below). The year 2040 TPAR analysis took into account buildout of all the adopted master plans by the year 2040 in combination with the implementation of all the unbuilt master planned projects anticipated to be constructed by 2040. It should be noted that this analysis differs from TPAR analysis for year 2024 that is currently used in the context of the regulatory review process. It should also be noted that, unlike the local area traffic analysis performed in support of this Master Plan, the segment of Midcounty Highway (M-83) between Middlebrook Road and Montgomery Village Avenue was not included in the year 2040 TPAR analysis. This resulted in the Montgomery Village/Airpark Policy Area (labeled 'MVA' in the chart below) marginally failing the roadway adequacy test during the evening peak hour. If the unbuilt segment of Midcounty Highway (M-83) or the Planning Department's preferred transit and MD 355 BRT alternatives had been assumed in the 2012 SSP year 2040 TPAR analysis, the Montgomery

Village/Airpark Policy Area would likely have shown roadway adequacy for the currently adopted Plan in year 2040. Given that the Montgomery Village Master Plan area is a small subset of a much larger policy area and the magnitude of planned growth in Montgomery Village is anticipated to be relatively minor, the transportation network is considered to be in balance with the land use and densities proposed by the Montgomery Village Master Plan.



## Montgomery County Planning Department Montgomery Village Master Plan Transportation Evaluation White Paper<sup>1</sup>

This White Paper describes the transportation systems analyses performed by Renaissance Planning Group and Parsons Transportation Group in support of the Montgomery Village Sector Plan under a task-order on-call contract. The primary purpose of the on-call contract is to assess intersection system performance for the master plan vision, using the regional MDCOG travel demand model, NCHRP 765 post-processing assessments, and CLV/Highway Capacity Manual techniques as generally used to implement the County's Adequate Public Facilities Ordinance (APFO) as described in the Planning Board's *Local Area Transportation Review / Transportation Policy Area Review Guidelines*.

### Executive Summary

The Montgomery Village Sector Plan is addressing the planned obsolescence of the Town Sector Zone, established in 1965 for development of one of the earliest master-planned communities in Montgomery County, as well as other community needs. From a transportation system perspective, Montgomery Village is located on the east side of I-270 between the City of Gaithersburg and the agricultural reserve. Traffic volumes and intersection congestion near the agricultural reserve are fairly low, and both traffic volumes and congestion are greater closer to I-270. The Midcounty Highway Extended project (M-83) is the most significant master planned improvement remaining to be built in the

vicinity of the Plan area and will change travel patterns to and through Montgomery Village.

The primary points of forecast congestion at analyzed intersections are along MD 355, which is fully within the City of Gaithersburg, and along parallel Midcounty Highway where it borders the City of Gaithersburg. The analysis considered conditions both under the currently adopted 1985 *Gaithersburg Vicinity Master Plan* (described as the Current Plan) and under the staff's proposed changes (described as the Vision Plan). Increased development under the Vision Plan is focused in the Lost Knife Corridor, and intersection capacity improvements would be warranted at the Montgomery Village Avenue with Lost Knife/Christopher Road intersection to accommodate that growth. Otherwise, the level of forecast congestion, and alleviation of congestion under potential intersection capacity enhancements, are fairly similar under both the Current Plan and Vision Plan scenarios.

### Travel Demand Forecasting Analysis Process

The following steps were undertaken to develop peak hour forecasts and conduct operational analysis of plan area intersections. The first section describes the travel demand modeling conducted to generate 2040 daily forecasts, and the second outlines the process used to gather existing intersection counts and develop 2040 peak hour forecasts.

#### Travel Demand Modeling

- Obtained 2015 and 2040 models from M-NCPPC
- Regional travel demand model version: MDCOG Version 2.3.52
  - Baseline model incorporates land use from the Round 8.2 Cooperative Forecasts

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<sup>1</sup> White Paper prepared by Renaissance Planning Group with Parsons Transportation Group: July 27, 2015



- The 2015 Existing year existing model was modified to include the land use inputs for the zones representing Montgomery Village as shown in Table 1. This revised land use data was provided by Montgomery County planning staff in order to correct the underlying land use assumed in the Round 8.2 Cooperative Forecasts for this Sector Plan.

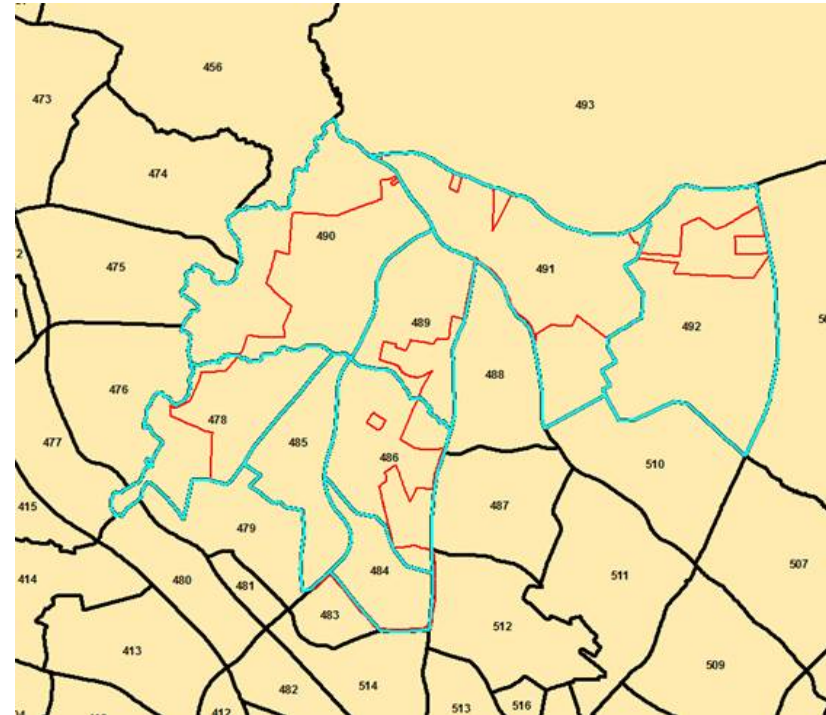


Table 1: Land Use Inputs for 2015 Existing

TAZ	Households	Population			Employment				
		Household	Group Quarters	Total	Industrial	Retail	Office	Other	Total
478	1,023	2,562	8	2,570	0	0	0	123	123
484	2,009	4,518	21	4,539	0	687	0	116	803
485	2,094	4,478	187	4,665	10	688	987	342	2,027
486	1,818	4,327	27	4,354	0	0	303	118	421
489	1,559	4,660	13	4,673	220	316	80	0	616
490	1,635	5,438	13	5,451	0	0	0	209	209
491	2,287	6,021	16	6,037	0	158	38	24	220
492	1,612	5,455	0	5,455	1,910	0	364	175	2,449
Total	14,037	37,459	285	37,744	2,140	1,849	1,772	1,107	6,868



- Model Assumptions
  - A number of modifications were made to the model network in the Montgomery Village vicinity to more accurately reflect existing and future conditions
    - The existing model network was modified to include East Village Avenue and Stewartown Road, correct the number of lanes on Goshen Road and also closing of Watkins Mill Road across I-270
    - The future model scenarios were modified to include East Village Avenue and Stewartown Road and correcting the alignment of the extension of the Midcounty Highway
      - The future Vision Plan scenario additionally included the extension of Stewartown Road to Watkins Mill Road
  - The model structure was used as-is, including the year 2020 transit constraint and two-step assignment for HOT lanes
    - The 2020 constraint year utilized baseline land use; not an interim Vision land use plan
    - The multistep distributed processing was deactivated for the model run due to licensing constraints
- Intrastep distributed processing was included in the model run with four subnodes
- Montgomery Village 2040 Current Plan and Vision Plan Model Runs
  - Two land use plans were considered for the year 2040 resulting in two separate model runs
    - The 2040 Current Plan represents maintaining the current plan for development within Montgomery Village
      - The model run for the 2040 Current Plan included the land use inputs as shown in Table 2 for the TAZs representing Montgomery Village
    - The 2040 Vision Plan is a departure from the Current Plan representing higher household, population and employment expectations
      - The model run for the 2040 Vision Plan included the land use inputs as shown in Table 3 for the TAZs representing Montgomery Village
  - Daily traffic was extracted from the model Using daily volumes from the model – as opposed to peak period volumes – makes for a simpler comparison to available AADT data.



Table 2: Land Use Inputs for 2040 Current Plan

TAZ	Households	Population			Employment				
		Household	Group Quarters	Total	Industrial	Retail	Office	Other	Total
478	1,023	2,664	12	2,676	0	0	0	123	123
484	2,265	5,225	40	5,265	0	909	0	116	1,025
485	2,094	4,564	276	4,840	10	691	987	342	2,030
486	1,818	4,471	50	4,521	0	0	303	118	421
489	1,559	4,835	24	4,859	220	316	80	0	616
490	1,635	5,648	24	5,672	0	0	0	209	209
491	2,287	6,254	33	6,287	418	188	38	24	668
492	1,612	5,668	0	5,668	1,910	0	364	175	2,449
Total	14,293	39,329	459	39,788	2,558	2,104	1,772	1,107	7,541

Table 3: Land Use Inputs for 2040 Vision Plan

TAZ	Households	Population			Employment				
		Household	Group Quarters	Total	Industrial	Retail	Office	Other	Total
478	1,023	2,664	12	2,676	0	0	0	123	123
484	3,288	7,586	40	7,626	0	1,334	0	116	1,450
485	2,924	6,373	276	6,649	0	618	1,319	342	2,279
486	1,908	4,693	50	4,743	0	78	160	118	356
489	1,730	5,366	24	5,390	220	316	169	0	705
490	1,725	5,959	24	5,983	0	0	72	209	281
491	2,287	6,254	33	6,287	418	188	38	24	668
492	1,612	5,668	0	5,668	1,910	0	364	175	2,449
Total	16,497	44,563	459	45,022	2,548	2,534	2,122	1,107	8,311



- Daily traffic forecasts were estimated utilizing procedures from the *NCHRP 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design*
  - The forecasts were developed individually for each intersection in isolation
    - Forecasts were not balanced between intersections
    - The 2013 Average Annual Daily Traffic (AADT ) was used as the existing count data (see below for source of the counts)
    - The 2015 model results (using Round 8.2 land use with Montgomery Village corrections) were used as the base year traffic assignment
    - The 2040 Current and Vision Plan model results (using Round 8.2 land use with the exception of Current and Vision Plan data, respectively, within Montgomery Village) were used as the future year traffic assignment
    - No interim year model results were used for the post-processing
  - The daily forecasts resulting from the NCHRP 765 post-processing were taken as-is with minimal manual adjustments
    - For new or extended facilities, such as new legs of the Midcounty Highway, the post-processed forecasts of adjacent segments were used to scale raw model

data of the new segments as the processing does not work as well with “new” links

- Another example includes adjusting daily forecasts for MD 355 as the model appeared to underestimate volume on MD 355 and overestimate volume on I-270

#### Existing and 2040 Intersection Analysis

- Acquired count data from Montgomery County’s Intersection Analysis website (<http://www.mcatlas.org/Intersections/>)
  - Used most recent counts only
  - Counts for a number of locations were unavailable from the website; these locations were supplemented with data obtained from traffic counts provided by M-NCPPC on 3/12/15
  - AM and PM peak hour traffic volumes were extracted for each location based on the peak hour as indicated in count file
    - The peak hour did not necessarily align with a clock hour, e.g., it could be 7:45-8:45 AM
    - The peak hour listed in the count file generally aligned with the highest total traffic hour (i.e., the hour with the highest number of total turn movements)
  - While existing traffic data was available for a range of years, the traffic counts were all assumed to be consistent with existing



- conditions; therefore, no growth factors were applied to the data
- Acquired daily roadway volume data from the Maryland State Highway Administration
  - Traffic data was extracted from shapefiles provided at the SHA website: <http://www.roads.maryland.gov/pages/GIS.aspx?PageId=838>
  - The data used for this study was AADT from the year 2013
- Development of peak hour forecasts
  - K-factors were calculated for each approach of the analysis intersections based on the existing intersection turning movement counts (TMCs) and AADT data, where available
  - The K-factors were applied to the post-processed daily traffic volume on each approach of each intersection to calculate an initial estimate of peak hour traffic
    - Where a K-factor was unavailable due to incomplete AADT data, such as on lower functional class roadways, a 10% growth rate was assumed if existing traffic count data was available.
    - When existing traffic data was not available for approaches, the peak hour traffic was developed by averaging peak and daily volume ratios of the other legs at the intersection.
    - No interim year model results were used for the post-processing

- The daily forecasts resulting from the NCHRP 765 post-processing were taken as-is with minimal manual adjustments
  - For new or extended facilities, such as new legs of the Midcounty Highway, the post-processed forecasts of adjacent segments were used to scale raw model data of the new segments as the processing does not work as well with “new” links
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rate was assumed if existing traffic count data was available.

When existing traffic data was not available for approaches, the peak hour traffic was developed by averaging peak and daily volume ratios of the other legs at the intersection.

- The intersection traffic was balanced. The initial estimates of traffic on inbound links to the intersection were summed, as were the estimates of the outbound traffic. These two sums were averaged, and the individual inbound and outbound approaches were scaled proportionally based on this total. This was done because each approach link has its own K-factor and growth rate from the traffic forecasts which will often lead to unbalanced traffic coming into and out of the intersection.
- Forecast turning movements were estimated based on the existing TMCs and the approach link volumes calculated above
  - Utilized a Fratar (iterative balancing) technique
  - The existing TMCs act as a seed value for the balancing
  - The 2040 forecast link volumes are the target values for the balancing
  - No manual adjustments were made to the resulting balanced turning movement volumes; some link volume totals differed slightly from those forecasted due to rounding of numbers during the balancing process



### Intersection Analysis

Tables 4a and 4b summarize the Critical Lane Volume (CLV) and Synchro analysis for the existing conditions, future 2040 Current Plan and future 2040 Vision Plan. Locations with a CLV value greater than 1600 are colored in yellow to denote levels of notable congestion.

The study area intersections outside the City of Gaithersburg are located in the Montgomery Village/Airpark Policy Area which has a CLV standard of 1425. Intersections within the City of Gaithersburg are subject to the City's plans and policies. Currently, the City has a CLV standard of 1450 CLV, although the 2009 Transportation Plan Element of the city's Comprehensive Plan suggests revisiting it to allow higher levels of congestion. For each intersection with a substandard 2040 Vision Plan scenario CLV, potential improvement scenarios are identified on subsequent lines, with the rightmost column indicating the number of lanes on each intersection approach for that scenario. Given the high levels of traffic volume at the MD 355 analysis intersections and the City's intent to rethink their 1450 CLV standard, improvements to intersections within the City only are identified to the extent needed to reach a 1600 CLV.



Table 4a. Intersection Analysis Results

Location				CLV Results						Configuration (if different than existing)
ID	E-W Road	N-S Road	Conditions	Existing		2040 Current Plan		2040 Vision Plan*		
				AM	PM	AM	PM	AM	PM	
1	MD 355	Montgomery Village Avenue	Existing	1,421	1,712	1,393	1,679	1,422	1,700	
			Synchro Analysis	-	-	E (63.7)	F (100.8)	E (67.2)	F (103.6)	
			Test improvements	-	-	1,317	1,509	1,344	1,526	NB: 2L   4T   R / SB: 4T   R / EB: 2L   4T   R / WB: 2L   4T   2R
			Synchro Analysis	-	-	E (55.0)	E (77.2)	E (57.4)	F (80.2)	
2	Russell Avenue	Montgomery Village Avenue	Existing	861	1,124	907	1,189	955	1,243	
3	Lost Knife Road	Montgomery Village Avenue	Existing	923	1,308	946	1,526	993	1,656	
			Synchro Analysis	-	-	D (42.5)	F (124.7)	D (45.5)	F (148.8)	
			Test improvements	-	-	946	1,270	993	1,379	NB: L   3T   R / SB: 2L   3T   R / EB: 2L   2T   R / WB: 2L   2T   2R
			Synchro Analysis	-	-	D (40.9)	F (81.0)	D (43.0)	F (98.0)	
4	Midcounty Hwy	Montgomery Village Avenue	Existing	783	1,482	1,213	1,643	1,283	1,795	Future: NB: L   2T   R / SB: 2L   2T   T+R / EB: L   2T   R / WB: 3L   2T   2R
			Synchro Analysis	-	-	F (121.7)	F (163.6)	F (155.1)	F (206.4)	
			Test improvements	-	-	1,213	1,305	1,283	1,439	NB: L   3T   2R / SB: 2L   2T   T+R / EB: L   2T   R / WB: 3L   2T   2R
			Synchro Analysis	-	-	F (120.3)	E (61.8)	F (153.4)	F (81.6)	
5	Stedwick Road	Montgomery Village Avenue	Existing	998	987	1,026	1,172	1,026	1,176	
6	Centerway Road	Montgomery Village Avenue	Existing	699	887	663	837	681	744	
7	Stewartown Rd	Montgomery Village Ave	Existing	549	611	478	550	504	538	Future (Vision plan only): NB: L   T   T+R / SB: L   2T   R / EB: L+T+R / WB: L+T+R
8	Apple Ridge Rd	Montgomery Village Ave	Existing	788	660	774	679	764	675	
9	Wightman Road	Montgomery Village Avenue	Existing	726	744	835	682	820	670	Future: NB: L   T   R / SB: L   T   R / EB: L   T   T+R / WB: L   T   T+R
10	Centerway Road	Snouffer School Road	Existing	1,816	1,466	1,362	1,159	1,354	1,140	Future: NB: L   2T / SB: T   T+R / EB: L   R



Table 4b. Intersection Analysis Results

Location				CLV Results						Configuration (if different than existing)
				Existing		2040 Current Plan		2040 Vision Plan*		
ID	E-W Road	N-S Road	Conditions	AM	PM	AM	PM	AM	PM	
11	MD 355	Watkins Mill Road	Existing	1,045	1,136	2,292	2,173	2,319	2,212	
			Synchro Analysis	-	-	F (232.8)	F (248.2)	F (240.8)	F (259.6)	
			Test improvements	-	-	1,575	1,523	1,591	1,547	NB: 3L   2T   R / SB: 2L   2T   R / EB: L   3T   2R / WB: 2L   3T   T+R
			Synchro Analysis	-	-	F (87.7)	E (73.5)	F (90.4)	E (77.0)	
12	M83 (Mid-County Highway)	Watkins Mill Road	Existing	0	0	727	911	725	903	Future: NB: L   2T   R / SB: L   2T   R / EB: L   2T   R / WB: L   2T   R
13	Stedwick Rd	Watkins Mill Rd	Existing	655	854	919	1,112	909	1,107	
14	Club House Dr	Watkins Mill Rd	Existing	699	1,045	777	1,199	780	1,189	
15	Crested Iris Dr	Watkins Mill Rd	Existing	635	575	740	671	795	868	Future (Vision plan only): NB: L   T   R / SB: L   T+R / EB: L+T+R / WB: L+T+R
16	Apple Ridge Rd	Watkins Mill Rd	Existing	914	841	1,043	985	1,098	1,041	
17	East Village Ave	Goshen Rd	Existing	683	666	576	550	584	558	Future: NB: 2T   R / SB: L+T   T / WB: L   R
18	Wightman Rd/Snouffer Scho	Goshen Rd	Existing	963	1,325	1,050	1,417	1,046	1,435	Future: NB: L   T   T+R / SB: L   T   T+R / EB: L   T   T+R / WB: L   T   T+R
19	Stewartown Rd/Trams Way	Goshen Rd	Existing	694	706	564	566	647	625	Future: NB: L+T   T+R / SB: L+T   T+R / EB: L+T+R / WB: L+T+R
20	Centerway Road	Goshen Road	Existing	958	1,027	840	859	810	905	Future: NB: L   T   T+R / SB: L   T   T+R / EB: L   T   R / WB: L   T   T+R
21	Midcounty Hwy	Goshen Road	Existing	1,349	1,485	1,392	1,761	1,451	1,806	Future: NB: L   2T   R / SB: 2L   2T   R / EB: 2L   2T   R / WB: L   2T   R
			Synchro Analysis	-	-	E (76.9)	F (140.7)	F (84.0)	F (149.1)	
			Test improvements	-	-	1,073	1,545	1,138	1,587	NB: L   2T   R / SB: 2L   2T   R / EB: 2L   3T   R / WB: 2L   3T   R
			Synchro Analysis	-	-	D (53.5)	F (87.8)	E (56.6)	F (96.2)	
22	Midcounty Hwy	Saybrooke Blvd/Woodfield R	Existing	976	1,090	1,199	1,360	1,232	1,316	
23	Snouffer School Road/Munca	Woodfield Road	Existing	850	1,108	947	1,176	955	1,190	
24	Airpark Road	Woodfield Road	Existing	732	841	887	1,093	886	1,095	
* - Montgomery Village intersections analyzed using only Montgomery Village Current Plan or Vision Plan land use				CLV > 1,600						
				Synchro analysis presented as: LOS (control delay in seconds)						





Tables 4a and 4b demonstrate that the majority of intersections are expected to operate at acceptable CLV levels with the following exceptions:

- Two locations, MD 355 at Montgomery Village Ave (Location 1) and Centerway Rd at Snouffer School Rd (Location 10) operate at substandard levels under existing conditions.
  - Location 1 (within the City of Gaithersburg) maintains substandard operation under the future scenarios and as such may require additional improvements
    - Reconfiguring the intersection to bring the CLV to an acceptable level would require adding a fourth eastbound through lane as well as converting one westbound left-turn lane into a through lane and adding an additional through lane (for a total of two left and four through lanes).
  - Location 10 (in unincorporated Montgomery County east of the Plan area boundary) is expected to operate sufficiently well in the future scenarios as a result of the widening of Snouffer School Rd
- Only one location, Lost Knife Rd at Montgomery Village Ave (Location 3), is expected to operate above the acceptable threshold in the Vision Plan scenario but within the acceptable limit under the Current Plan scenario. This location is bounded by the City of Gaithersburg to the west and the Lost Knife Corridor to

the east, where most of the additional development in the Vision Plan is focused.

- An additional southbound left turn lane and a westbound right turn lane could provide sufficient capacity to bring the intersection to an acceptable operational level
- Four locations, (Locations 1, 4, 11, and 21), are shown to have unacceptable CLV levels under both the Current and Vision plans
  - Two of the four are located on MD 355, at Montgomery Village Ave (Location 1) and at Watkins Mill Rd (Location 11), and the other two on Midcounty Hwy, at Montgomery Village Ave (Location 4), and at Goshen Rd (Location 21)
    - Location 1 can be improved as described above
    - Location 4 shows an unacceptable CLV with an assumed configuration of one left and right turn lanes each and two through lanes on the new eastbound approach of Midcounty Hwy, two through lanes of westbound Midcounty Hwy, a new northbound left turn lane and a shared southbound left and through lane. To get the intersection to an acceptable CLV level, the assumed condition would need to be augmented with a third northbound through lane.
    - Location 11 will see an increase in traffic in future scenarios due to the land use



changes, but also due to the bridging of Watkins Mill Rd across I-270. To bring the intersection to an acceptable CLV level, an additional northbound left and a through lane would need to be added, the southbound leg of Watkins Mill would need to be reconfigured to allow for two left and two through lanes, an additional eastbound right turn lane and an additional westbound left and a through lane would need to be added.

- Location 21 assumes an additional southbound through lane as a result of the widening of Goshen Rd. To bring the intersection to an acceptable CLV, an additional eastbound and westbound through lane would need to be added.

As noted above, Locations 1 and 11 along MD 355 are located fully within the City of Gaithersburg, but are along key roadways that connect Montgomery Village to I-270.

Locations 4 and 21 along Midcounty Highway are located at the edge of the Montgomery Village Master Plan area, and are bounded by the City of Gaithersburg. Forecast traffic and congestion levels are influenced primarily by levels of increased development throughout the I-270 corridor, not by the increased development in the Montgomery Village Master Plan area. Improvements to any of these four locations would require coordination with the City and the identification of potential capacity additions, particularly along MD 355 within the City at Locations 1 and 11, are for informational purposes. The City of Gaithersburg is currently coordinating with state,

regional, and local agencies to examine potential designs for Bus Rapid Transit (BRT) along MD 355. The Transportation Element of the City's Comprehensive Plan also contemplates increasing the City's CLV standards to allow greater levels of congestion.

### **Sensitivity Tests**

The primary sensitivity test within this sector plan is the comparison of the Current Plan and Vision Plan. Though the Vision Plan shows increases in land utilization compared to the Current Plan, traffic does not necessarily increase uniformly in proportion to the land use. The Vision Plan has additional growth of about 2,200 households (corresponding to an increase of 5,200 residents based on the average residents per household factor of the zones within the plan area) and 800 jobs compared to the Current Plan. The residential growth is focused in the Montgomery Village Center, former golf course site, and the Lost Knife Corridor. The commercial growth is more distributed throughout the existing neighborhood centers, providing additional retail opportunities within walking distance of the predominantly residential environment. It should be noted that much of the projected growth in study area TAZs will occur just outside the borders of the Montgomery Village Master Plan area in the City of Gaithersburg and around the airport.

The number of trips as modeled would increase with increased land use, but the distribution of trips will shift to account for shifting activity locations, and therefore traffic on individual roads may increase or, in some cases, even decrease with increases in population or employment. As an example, an increase in employment in one location may lead



to a decrease in traffic away from the location if the home to work ratio becomes more balanced, therefore meaning shorter trips are necessary to get from home to work. This is reflected in the forecast volumes, and consequent CLV results increasing at a number of locations under the Vision Plan scenario, but decreasing in others. At all locations, the differences between the Current and Vision Plans are low enough that operations are expected to be similar under both plans; that is, with only one exception (Montgomery Village Ave and Lost Knife Rd) there are no locations where intersections are expected to have congestion in one plan and not the other.



## Bicycle Level of Traffic Stress

# WHAT IS LEVEL OF TRAFFIC STRESS?

Level of Traffic Stress is an approach that quantifies the level of stress that bicyclists feel when they ride close to traffic. The methodology was developed in 2012 by the Mineta Transportation Institute and San Jose State University.\*

When cyclists travel on roadways, they face varying levels of stress from traffic. A quiet residential street with a 25-mile-per-hour speed limit is considered a very low-stress environment for cyclists. But a six-lane suburban highway with a 40-mile-per-hour speed limit represents a high-stress environment for cyclists who must share the roadway with traffic. As a result, fewer people are likely to cycle on the highway.

The LTS methodology assigns a numeric stress level to streets (and other places where people can bicycle, like trails), based on attributes like traffic speed, traffic volume, number of lanes, frequency of parking turnover, ease of intersection crossings and other characteristics.

Quiet streets and separated bike facilities, like trails and paths, are considered to be very low stress (Level 1). As traffic speeds and volume increase, the stress level rises. It's important to note that while LTS 1 is a very low-stress level and is appropriate for many children, LTS 2 is also a low-stress environment that most adults would feel comfortable riding in.

When a street has an LTS 3 or LTS 4 ranking, it may be a sign that bicycle infrastructure, like separated bike lanes or shared use paths, is needed to make it a place where more people will feel comfortable riding.

An analysis of Montgomery County shows that while 80-percent of the roadway network qualifies as a low-stress environment, these low stress areas form "islands of connectivity" separated by major highways and other high-speed roads. Most people are uncomfortable biking on high-speed roads in such environments. These low stress-tolerant groups, accounting for about 60 percent of the County's population, would be unlikely to bicycle to many of the County's job centers and transit facilities without a network of separated bikeways and other enhancements connecting the "islands," so planners are looking into ways of creating a connected bikeway system that will appeal to a wider range of riders.

\*Mekuria, Maaza, Peter G. Furth, and Hilary Nixon, *Low-Stress Bicycling and Network Connectivity*, San Jose, CA: Mineta Transportation Institute, 2012.



## STRESS LEVEL 1



- Very low stress, requires little attention
- Equivalent to neighborhood roads, cycle tracks, trails

## STRESS LEVEL 2



- Low stress, suitable for 60 percent of the population
- Equivalent to low-volume / low-speed roads

## STRESS LEVEL 3



- Moderate stress, suitable for 10 percent of the population
- Equivalent to bicycling on four-lane roads with bike lanes

## STRESS LEVEL 4



- High stress, suitable for 1 percent of the population
- Equivalent to bicycling in traffic on 40+ mph roads

Figure 5: What is Level of Traffic Stress?

This plan explores the usage of the Level of Traffic Stress (LTS) method which is currently being used in the update to the Bicycle Master Plan to identify roadway stress on bicyclists. LTS analysis measures the amount of stress that bicyclists feel when riding on a roadway alongside vehicular traffic. Figure 7 below is a depiction of the existing LTS in Montgomery Village.

With the Plan recommendations, it is estimated that the LTS will improve significantly, should improvements to existing infrastructure and additions to missing links occur over time.

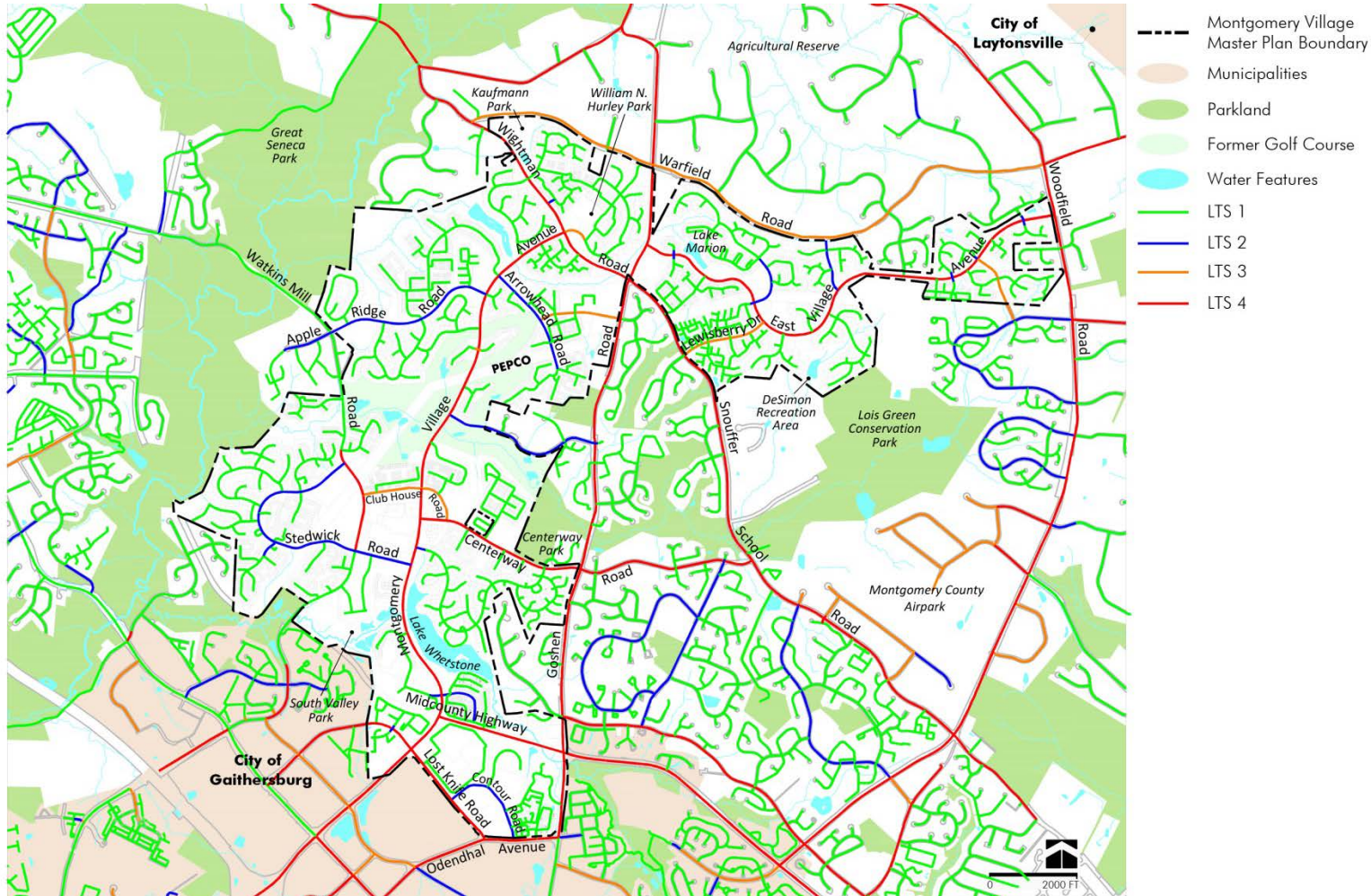


Figure 6: Existing Level of Traffic Stress



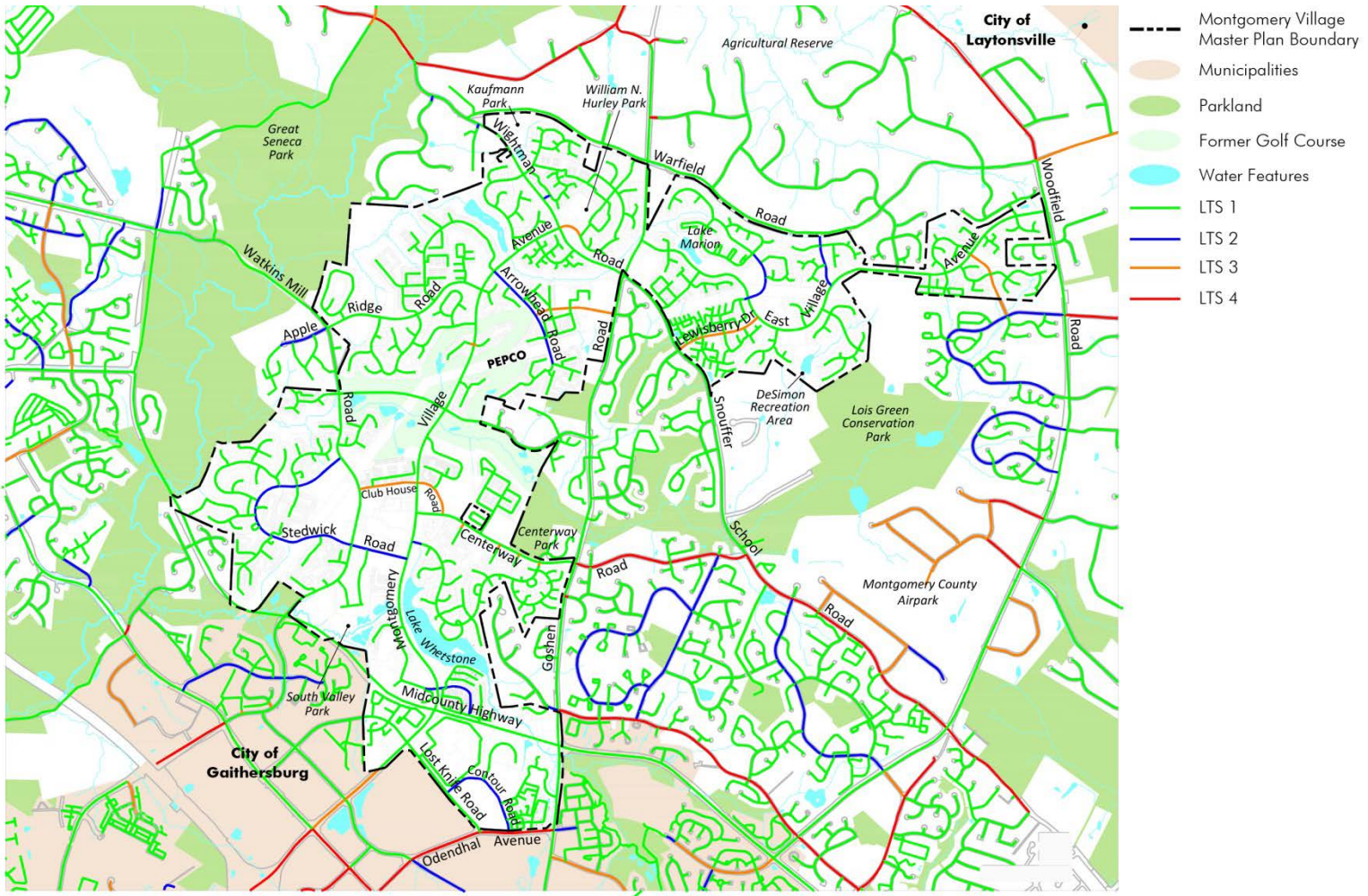


Figure 9: Future Level of Traffic Stress