

# Bayview Ridge Subarea Traffic Analysis



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## Introduction

Skagit County asked Skagit Council of Governments (SCOG) to perform a transportation analysis for the Bayview Ridge Subarea. The County expects substantial growth in the area, including over 2,500 new homes. With this new growth, the County is concerned that the increased demand on the existing road network will overwhelm the capacity and cause failures in the level of service at key intersections in the subarea.

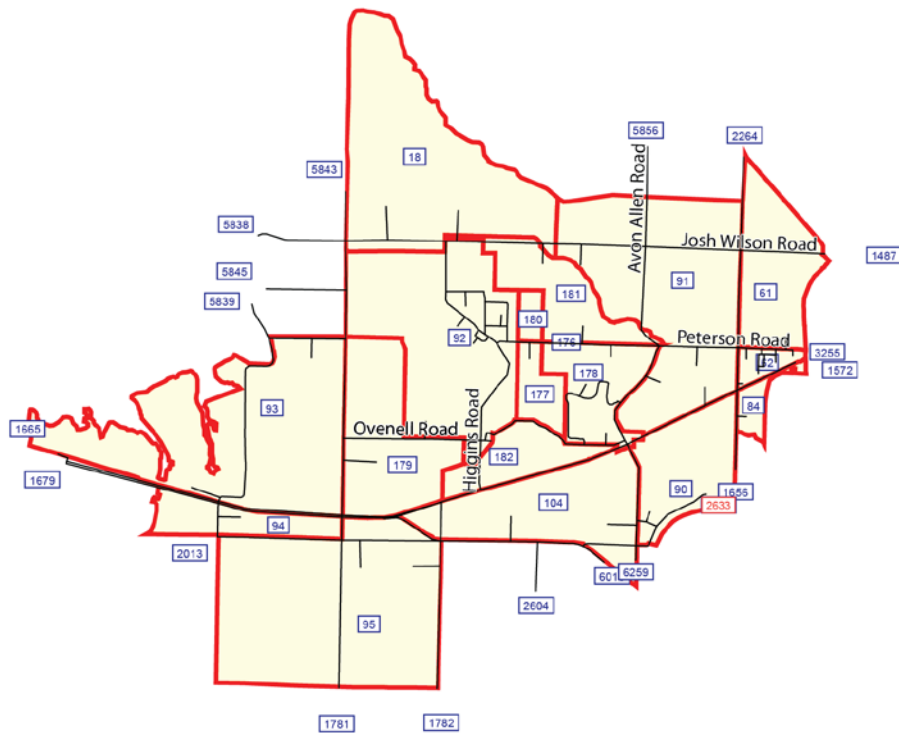
This report analyzes the traffic conditions with the expected growth and predicts at what percentage of the build-out traffic problems will arise. Solutions to these potential problems will also be provided.

## Methodology

In the summer of 2010, SCOG updated the regional travel demand model. The existing network (2008) was calibrated against existing counts for the entire region and found to be a reasonably accurate depiction of existing traffic patterns for Skagit and Island Counties. Also, model scenarios were created for the horizon year 2035. Multiple 2035 scenarios were created, including No Build (existing network with no improvements), Baseline TIP (existing network plus improvements indicated in local jurisdictions' TIPs), Full Build MTP (existing network plus every improvement listed in the SCOG MTP/RTP), and Build MRTP (existing network plus the "most likely" improvements as agreed upon by the Technical Advisory Committee). It was decided to use the Build MRTP model scenario as the 2035 model for the Bayview Ridge analysis.

Because the area of focus was a much smaller scale than the regional model, some network changes were made to the Existing and 2035 models. The area of study is illustrated in **Figure 1** below. After discussion with County staff, it was decided that the centroid connector (where zones load trips onto and off of the network) from zone 180 to access on Josh Wilson Road be replaced with access to Peterson Road. Also, a centroid connector from zone 181 to access on Josh Wilson Road was removed. Finally, a centroid connector was added giving access from zone 179 to Ovenell Road.

**Figure 1 – Study Zones for Bayview Ridge Subarea**



With these corrections, the model was rerun to produce more accurate results for the study area. The new model numbers matched observed traffic counts reasonably well.

The outputs from the model were then post-processed to produce future expected turning movements used for intersection analysis. An analysis was done to find the difference in volumes between the 2035 model scenario and the Existing model scenario. This difference was then applied to existing turning movement counts to produce future year turning movements. This information was then used to determine expected level of service (LOS) given the expected land use growth (as determined in the regional model). Intersection level of analysis was performed using Synchro 7, which is an accepted practice in the engineering community.

Intersections are graded on a scale of A-F based on the delay experienced by motorists wishing to pass through the intersection. For stop-controlled intersection analysis, the approach with the longest delay is reported. The County's LOS standard is LOS D; therefore, any intersection with LOS E or F will need mitigation to bring it to an acceptable level. Also of note, one should not mistakenly correlate this A through F scale with that of the better-known school grading system. In traffic level of service calculations, LOS D is perfectly acceptable and functions well.

## Existing Conditions

For the existing scenario, PM peak hour counts were performed and used to analyze the existing conditions. Counts were entered into Synchro 7 to establish the LOS of the six study intersections. All intersections currently operate at an acceptable level of service as can be seen in **Table 1** below:

Table 1 Existing Intersection Level of Service (LOS)						
Number	Intersection	Approach	Delay	LOS	95th Percentile Queue	
					Approach	Length
1	Josh Wilson & Higgins	NB	11.1	B	NB	14
2	Josh Wilson & Avon Allen	NB	21.3	C	SB	31
3	Peterson & Higgins	WB	10.5	B	WB	10
4	Peterson & Avon Allen	EB	11.1	B	-	-
5	Ovenell & Higgins	EB	11.6	B	EB	19
6	Ovenell & Avon Allen	EB	9.6	A	EB	9

A more detailed representation of the intersection analysis for the existing conditions can be found in **Figure 2** in Appendix A.

## Future Scenarios

### Methodology

With the expected growth for the Bayview Ridge area, the County would like to determine when traffic problems could arise so that traffic impacts can be mitigated by developers. First, the 2035 regional model network was updated with the same changes as the Existing model. This was done so that comparisons can be made between the Existing scenario and a baseline scenario in which no improvements are made to the transportation system.

Land use in the 2035 regional model was reviewed by the County and found to be an accurate depiction of the anticipated growth in the study area. However, trip generation rates for a large, two-county model are generally low, especially when considered with the rural nature of much of Skagit and Island Counties. Therefore, the County felt it was appropriate to adjust the trip generation rates for the zones within the study area to match rates generally used in development analysis. The Institute of Transportation

Engineers (ITE) has established accepted PM peak hour trip generation rates commonly used in site and subarea level of analysis. While they are generally higher than those found in the SCOG regional model, it is acceptable to use these rates for this study. Because the rates are generally higher, it provides a more conservative estimate of when traffic problems would occur. The trip generation rates used for the Bayview Ridge Subarea Study are found in **Table 2** below:

Table 2 PM Peak Hour Trip Generation Rates Used for 2035 Model			
Land Use	Unit	Trips In	Trips Out
Single Family Residential	Dwelling Unit	0.64	0.37
Multi-Family Residential	Dwelling Unit	0.40	0.22
Retirement Residential	Dwelling Unit	0.14	0.15
Seasonal Recreation Residential	Dwelling Unit	0.11	0.15
Agricultural Employment	Employee	0.14	0.18
Forestry Employment	Employee	0.14	0.18
Mining Employment	Employee	0.14	0.18
Construction Employment	Employee	0.30	0.74
Manufacturing Employment	Employee	0.06	0.34
Total Persons Unemployed	Employee	0.32	0.39
Wholesale Employment	Employee	0.35	0.23
Retail Employment	Employee	0.94	0.87
Financial and Insurance Employment	Employee	0.35	0.35
School Employment	Employee	0.13	0.15
Healthcare Employment	Employee	0.66	0.66
Other Services Employment	Employee	0.21	0.25
Public Administration Employment	Employee	0.38	0.83

The ITE trip rates were applied to the land use in the 2035 regional model. This calculation was only applied to the zones within the study area, so impacts associated with development in the study area could clearly be analyzed and addressed.

While traffic information is readily available for existing analysis, we do not have the luxury of statistics such as peak hour factor and heavy vehicle percentages. The default values for these statistics in Synchro 7 are .92 and 2%, respectively. The default peak hour factor was used for analysis in the future scenarios because there was no consistent trend, either higher or lower, for the peak hour factors in the existing counts. However, the heavy vehicle percentage was consistently higher than the default values, and in some cases, much higher. This is likely due to the proximity of the Port of Skagit and other industrial land uses. For this reason, it was decided that a standard rate of 5% would be used for heavy vehicle percentage across all of the study intersections. This rate suits the nature of the land use in the Bayview Ridge area but also considers the increased residential growth in the County's plans.

## 2035 Baseline

Analysis was performed on the existing network using the 2035 land use and ITE trip rates to establish a Baseline scenario to determine the effects of unchecked growth. Two intersections do not meet the County’s LOS standards in the Baseline scenario. First, the two-way stop-controlled intersection at Josh Wilson Road and Avon Allen Road will experience excessive delay and queues at both stop-controlled approaches, but primarily in the NB direction. This is because vehicles planning to turn left or continue traveling north have considerable cross-traffic that is uncontrolled. With this many vehicles it is difficult to find a gap large enough to cross both directions of travel. Second, the four-way stop at Peterson Road and Avon Allen Road will also experience excessive delay. At this intersection it is the eastbound movement that has the longest delay but the current design of the intersection is not adequate to allow vehicles to travel through at a reasonable rate.

The LOS and queues for all of the study intersections for the Baseline scenario can be found in **Table 3** below or in **Figure 3** in Appendix A.

Table 3 2035 Baseline Intersection Level of Service (LOS)						
Number	Intersection	Approach	Delay	LOS	95th Percentile Queue	
					Approach	Length
1	Josh Wilson & Higgins	NB	12.1	B	NB	22
2	Josh Wilson & Avon Allen	NB	Er	F	NB	Er
3	Peterson & Higgins	WB	12.8	B	WB	25
4	Peterson & Avon Allen	EB	296.8	F	-	-
5	Ovenell & Higgins	EB	18.9	C	EB	73
6	Ovenell & Avon Allen	EB	11.1	B	EB	22

Analysis was then done to determine at what percentage of the total build-out of the expected growth the intersections begin to drop below LOS standards. This was done by applying a factor to the demand matrices in the model to scale down the difference between the Existing scenario and the 2035 Baseline scenario. The matrices were scaled down in 10% increments until the post-processed volumes no longer created unacceptable levels of service for any intersection in the study area. Forty percent of the expected growth is the last 10% increment before any intersection reaches an unacceptable LOS. In this scenario, the worst intersection is the intersection at Peterson

Road and Avon Allen Road which has a delay of 25.9 seconds, just over the standard of LOS D.

The LOS and queues for all intersections in the study area for the 40% Build-out scenario can be found in **Table 4** below:

Table 4 40% Build-out Intersection Level of Service (LOS)						
Number	Intersection	Approach	Delay	LOS	95th Percentile Queue	
					Approach	Length
1	Josh Wilson & Higgins	NB	10.4	B	NB	11
2	Josh Wilson & Avon Allen	NB	16.3	C	SB	19
3	Peterson & Higgins	WB	10.9	B	WB	14
4	Peterson & Avon Allen	WB	25.9	D	-	-
5	Ovenell & Higgins	EB	11.3	B	EB	22
6	Ovenell & Avon Allen	EB	9.8	A	EB	9

With the demand matrices scaled to 50% the intersection at Peterson Road and Avon Allen Road, delay slips to 39.5 seconds, which classifies it as LOS E and fails to meet the County's LOS standards. Therefore, it can be reasonably concluded that sometime between 40% and 50% of the anticipated growth in the Bayview Ridge Subarea, at least one intersection will fall below the County's LOS standard.

The LOS and queues for all intersections in the study area for the 50% Build-out scenario can be found in **Table 5** below and **Figure 4** in Appendix A.

Table 5 50% Build-out Intersection Level of Service (LOS)						
Number	Intersection	Approach	Delay	LOS	95th Percentile Queue	
					Approach	Length
1	Josh Wilson & Higgins	NB	10.7	B	NB	11
2	Josh Wilson & Avon Allen	SB	18.4	C	SB	34
3	Peterson & Higgins	WB	11.2	B	WB	15
4	Peterson & Avon Allen	EB	39.5	E	-	-
5	Ovenell & Higgins	EB	11.8	B	EB	25
6	Ovenell & Avon Allen	EB	10.1	B	EB	10

### Build Scenario

The County identified in the Bayview Ridge Subarea Plan (2008) a need for a new north-south connection segment between Josh Wilson Road and Peterson Road as well as another segment continuing from Peterson Road south to Ovenell Road. These connections were built into the regional model to see if they alleviate the problems caused by the expected growth.

With this new network connection in the model, it was assumed that half of the trips to and from zones 176 and 181 would have access directly to the new connection instead of Peterson Road. Because of the new connection in the network and changes to the loading points, the model was completely rerun as the Build scenario (with ITE trip generation rates applied to the 2035 land use, just like in the Baseline scenario).

Throughout the analysis, it was found that the southern portion of the new connection (Peterson Road to Ovenell Road) did not improve intersection level of service in the study area in any significant way. For the remainder of the Build scenario analysis, only the portion between Josh Wilson Road and Peterson Road will be addressed. As development occurs in the Bayview Ridge Subarea and the traffic problems already addressed start to become realized, it is suggested that further analysis be done to determine if the southern portion of the new connection will benefit the overall traffic flow of the area.

The volumes from the 2035 Build scenario were post-processed for analysis in Synchro 7. Because the intersections at both ends of the proposed connection do not currently exist, there are no existing counts to apply the growth between to the two models to. For



these two intersections, volumes were taken directly from the model without being applied to existing turning movements. While they are turning movement volumes that can be used for analysis, it should be noted that they are directly from the model (models are never fully correct) and not applied to any real life travel behavior and should be used with greater caution.

The 2035 Build scenario has two intersections that do not meet the County’s LOS standards despite the new connection between Josh Wilson Road and Peterson Road. Much like in the 2035 Baseline scenario, the intersections at Josh Wilson Road and Avon Allen Road as well as Peterson Road and Avon Allen Road experience excessive delays.

The LOS and queues for all intersections in the study area for the 2035 Build scenario can be found in **Table 6** below and **Figure 5** in Appendix A.

Table 6 2035 Build Intersection Level of Service (LOS)						
Number	Intersection	Approach	Delay	LOS	95th Percentile Queue	
					Approach	Length
1	Josh Wilson & Higgins	NB	11.3	B	NB	13
2	Josh Wilson & Avon Allen	NB	Er	F	NB	Er
3	Peterson & Higgins	WB	13.1	B	WB	28
4	Peterson & Avon Allen	EB	164.4	F	-	-
5	Ovenell & Higgins	EB	18.6	C	EB	72
6	Ovenell & Avon Allen	EB	11.1	B	EB	23
7	Josh Wilson & New Connection	NB	10.6	B	NB	22
8	Peterson & New Connection	SB	11.7	B	SB	14

The County wanted to know at what percentage of the total build-out would additional mitigation measures—in addition to the proposed new connection—be necessary to maintain an acceptable LOS for all of the study intersections. This analysis was done by applying a factor to the demand matrices in the model to scale down the difference between the Existing scenario and the 2035 Build scenario. The matrices were scaled down in 10% increments until the post-processed volumes no longer created unacceptable levels of service for any intersection in the study area. Fifty percent of the

growth is the last 10% increment in which all study intersections have an acceptable LOS.

The LOS and queues for all intersections in the study area for the 50% Build scenario can be found in **Table 7** below:

Table 7 50% Build Intersection Level of Service (LOS)						
Number	Intersection	Approach	Delay	LOS	95th Percentile Queue	
					Approach	Length
1	Josh Wilson & Higgins	NB	10.5	B	NB	11
2	Josh Wilson & Avon Allen	NB	19.7	C	SB	31
3	Peterson & Higgins	WB	11.2	B	WB	16
4	Peterson & Avon Allen	WB	26.3	D	-	-
5	Ovenell & Higgins	EB	11.8	B	EB	25
6	Ovenell & Avon Allen	EB	10	B	EB	10
7	Josh Wilson & New Connection	NB	9.5	A	NB	8
8	Peterson & New Connection	SB	10.5	B	SB	9

With the Build scenario demand matrices scaled to 60% the intersection at Peterson Road and Avon Allen Road the delay slips to 36.9 seconds, which classifies it as LOS E and fails to meet the County's LOS standards. Therefore, it can be reasonably concluded that sometime between 50% and 60% of the anticipated growth in the Bayview Ridge Subarea, with the proposed new connection, at least one intersection will fall below the County's LOS standard.

The LOS and queues for all intersections in the study area for the 60% Build scenario can be found in **Table 8** below and **Figure 6** in Appendix A.

Table 8 60% Build Intersection Level of Service (LOS)						
Number	Intersection	Approach	Delay	LOS	95th Percentile Queue	
					Approach	Length
1	Josh Wilson & Higgins	NB	10.6	B	NB	11
2	Josh Wilson & Avon Allen	NB	22	C	SB	56
3	Peterson & Higgins	WB	11.6	B	WB	18
4	Peterson & Avon Allen	WB	36.9	E	-	-
5	Ovenell & Higgins	EB	12.4	B	EB	30
6	Ovenell & Avon Allen	EB	10.3	B	EB	11
7	Josh Wilson & New Connection	NB	9.6	A	NB	11
8	Peterson & New Connection	SB	10.6	B	SB	9

Because the new connection between Josh Wilson Road and Peterson Road is not sufficient to prevent LOS failures in the 2035 Build scenario, additional mitigation measures should be addressed.

The intersection at Josh Wilson Road and Avon Allen Road experiences excessive delay for the stop-controlled approaches. A potential low-cost solution to this problem is to provide receiving lanes for the left turn movements at the stop-controlled approaches. This will allow the left turns to only have to wait for a gap in one direction, pull safely into the receiving lane, and then wait for another gap in the desired direction of travel. If this mitigation measure is implemented, the expected delay for this intersection in the 2035 Build scenario is 31.3, which represents an LOS D. Though simply adding receiving lanes would return the LOS to acceptable levels, Skagit County reserves the right to research and evaluate other intersection improvements at this location – up to and including reconstruction,

The four way stop-controlled intersection at Peterson Road and Avon Allen Road also fails to meet County LOS standards in the 2035 Build scenario. The eastbound approach will experience 164.4 seconds of delay. Due to the large volumes at this intersection, stop-controlled approaches will likely be unable to provide an acceptable level of service. Given the geometry and existing pavement footprint, the County wanted to analyze this intersection as a roundabout. The volumes expected at this intersection are similar to other locations where roundabouts have worked, and the size of the

existing intersection is sufficient for the space needed for a single-lane roundabout. Synchro 7 is not capable of producing delays or queues for roundabout analysis but does provide a LOS rating based on volume to capacity ratios. With a roundabout at this location, the intersection will operate at LOS D in the 2035 Build scenario.

The LOS and queues for all intersections in the study area for the 2035 Build with Mitigation scenario can be found in **Table 9** below and **Figure 7** in appendix A:

Table 9 2035 Build with Mitigation Intersection Level of Service (LOS)							
#	Intersection	Improvement	Approach	Delay	LOS	95th Percentile Queue	
						Approach	Length
1	Josh Wilson & Higgins		NB	11.3	B	NB	13
2	Josh Wilson & Avon Allen	Add receiving lane	SB	31.3	D	NB	113
3	Peterson & Higgins		WB	13.1	B	WB	28
4	Peterson & Avon Allen	Create single lane roundabout*	-	-	D	-	-
5	Ovenell & Higgins		EB	18.6	C	EB	72
6	Ovenell & Avon Allen		EB	11.1	B	EB	23
7	Josh Wilson & New Connection		NB	10.6	B	NB	22
8	Peterson & New Connection		SB	11.7	B	SB	14

\*Synchro 7 does not calculate delay or queues for roundabouts. In this instance ICU level of service is used, which is based primarily on the volume to capacity ratio

## Conclusions

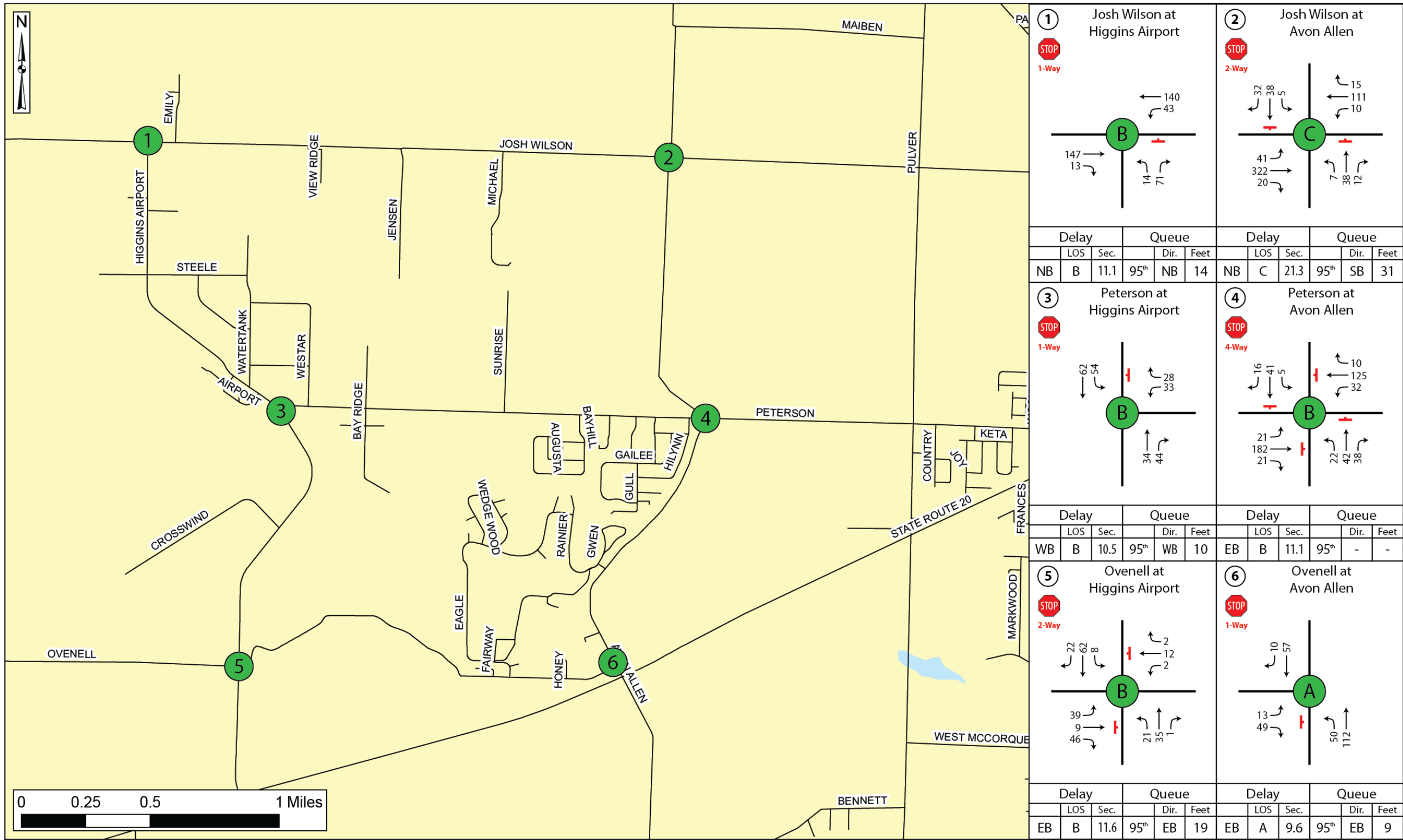
With the addition of over 2,500 homes in the Bayview Ridge Subarea, traffic congestion would continue to increase and become more of a problem. As development occurs, it is recommended that the County ensure that accommodations are made to alleviate LOS issues as they begin to arise.

From this analysis, it is determined that with the existing road network, intersections will begin to fall below the County's LOS standards somewhere between 40% and 50% of the expected build-out. At this time, a new connection between Josh Wilson Road and Peterson Road is recommended to alleviate traffic pressure, primarily at the intersection

of Peterson Road and Avon Allen Road. Further analysis should be conducted to determine the need for and effectiveness of this recommendation as the development threshold is approached.

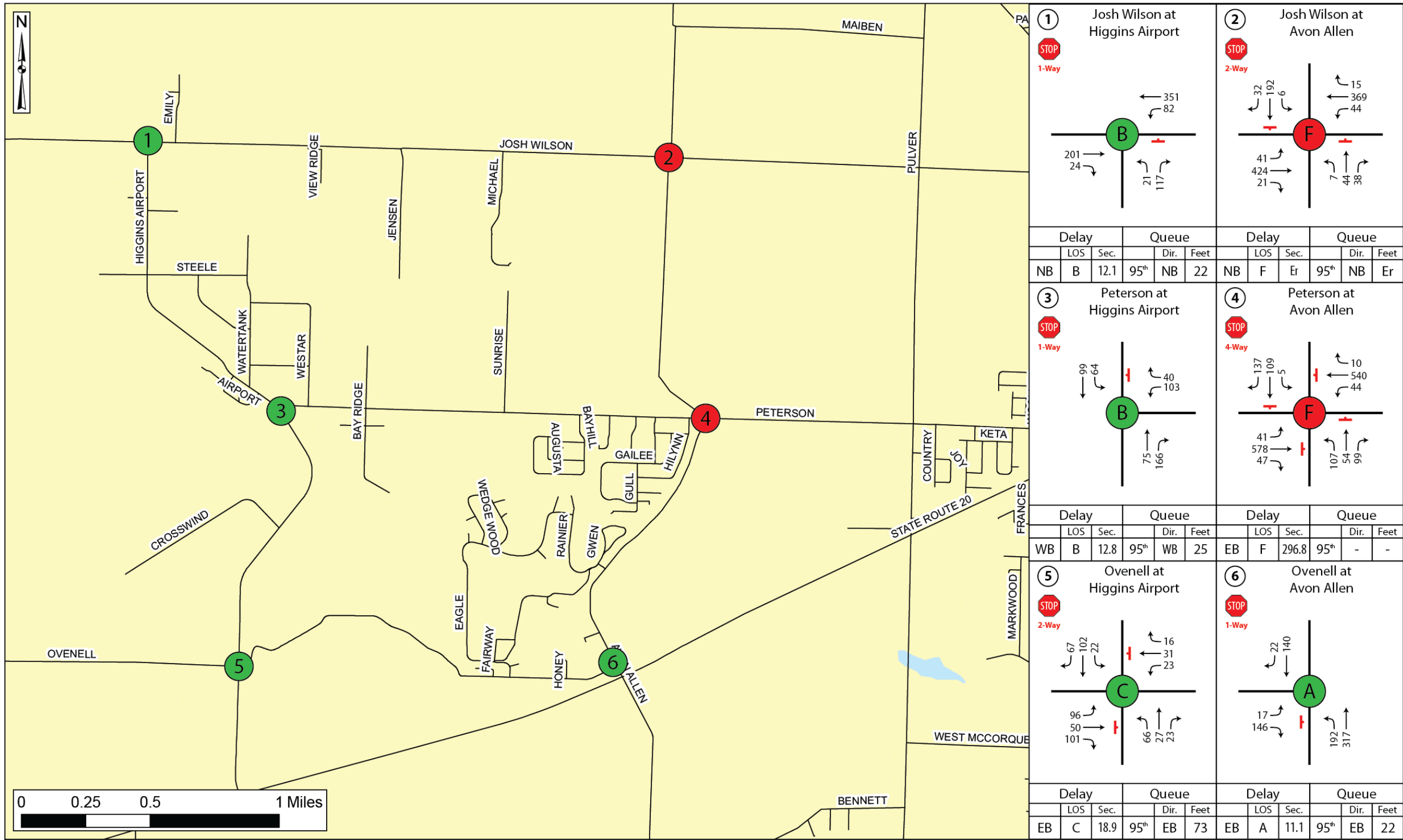
Also, with the recommended connection between Josh Wilson Road and Peterson Road, intersections would still fall below the County's LOS standards sometime between 50% and 60% of the expected build-out. To remedy this problem, the addition of a receiving lane for southbound and northbound left turn movements onto Josh Wilson Road from Avon Allen Road, as well as the installation of a single lane roundabout at the intersection of Peterson Road and Avon Allen Road, is recommended. Likewise, further analysis on the need for and effectiveness of these recommendations should be conducted as development approaches the thresholds identified.

## Appendix A



**Figure 2**

Bayview Ridge Subarea Study  
 PM Peak Hour Intersection Level of Service (LOS) and Volumes Existing Conditions

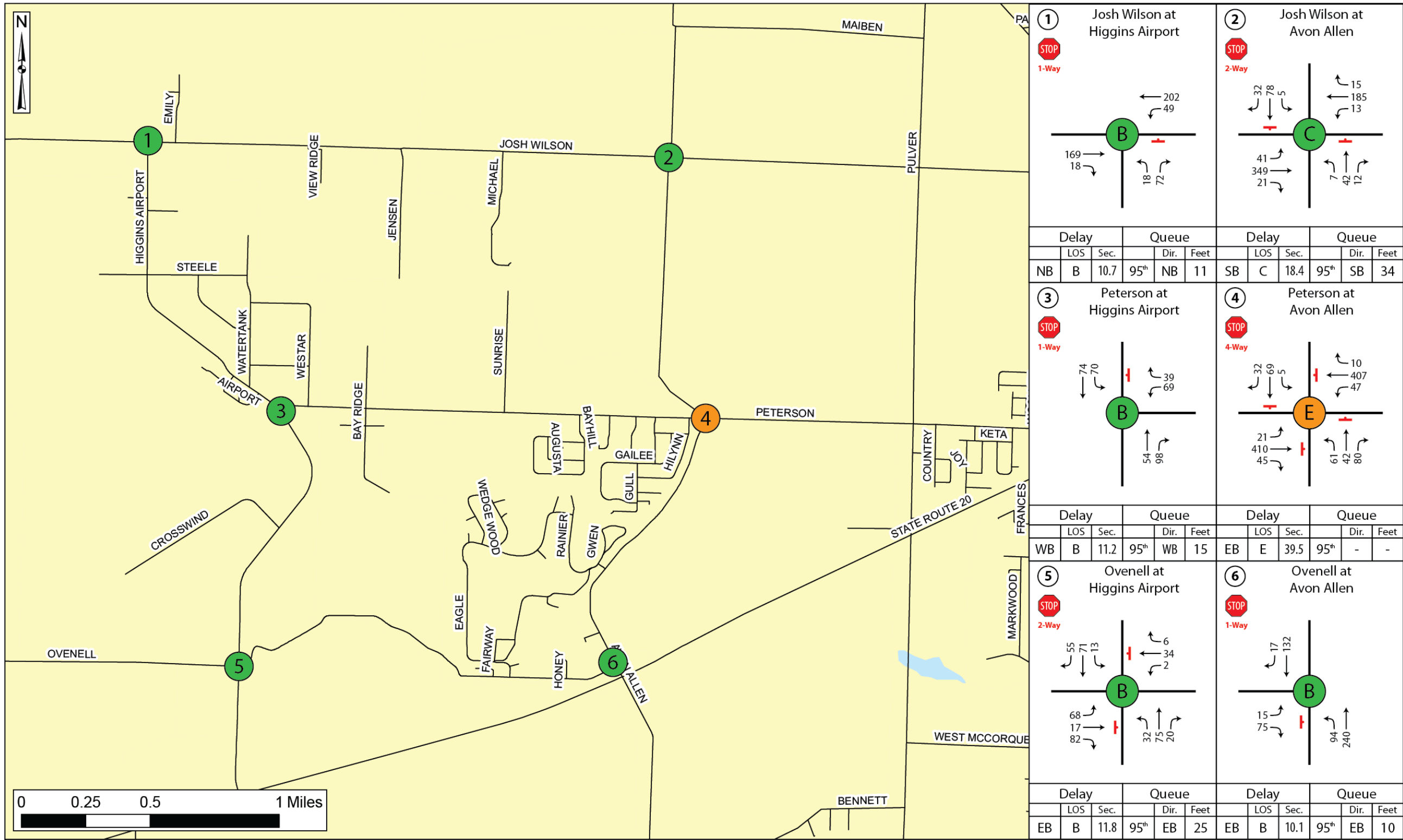


Delay		Queue		Delay		Queue					
LOS	Sec.	Dir.	Feet	LOS	Sec.	Dir.	Feet				
<b>1</b> Josh Wilson at Higgins Airport 				<b>2</b> Josh Wilson at Avon Allen 							
NB	B	12.1	95 <sup>h</sup>	NB	22	NB	F	Er	95 <sup>h</sup>	NB	Er
<b>3</b> Peterson at Higgins Airport 				<b>4</b> Peterson at Avon Allen 							
WB	B	12.8	95 <sup>h</sup>	WB	25	EB	F	296.8	95 <sup>h</sup>	-	-
<b>5</b> Ovenell at Higgins Airport 				<b>6</b> Ovenell at Avon Allen 							
EB	C	18.9	95 <sup>h</sup>	EB	73	EB	A	11.1	95 <sup>h</sup>	EB	22

Bayview Ridge Subarea Study  
 PM Peak Hour Intersection Level of Service (LOS) and Volumes 2035 (ITE) Baseline

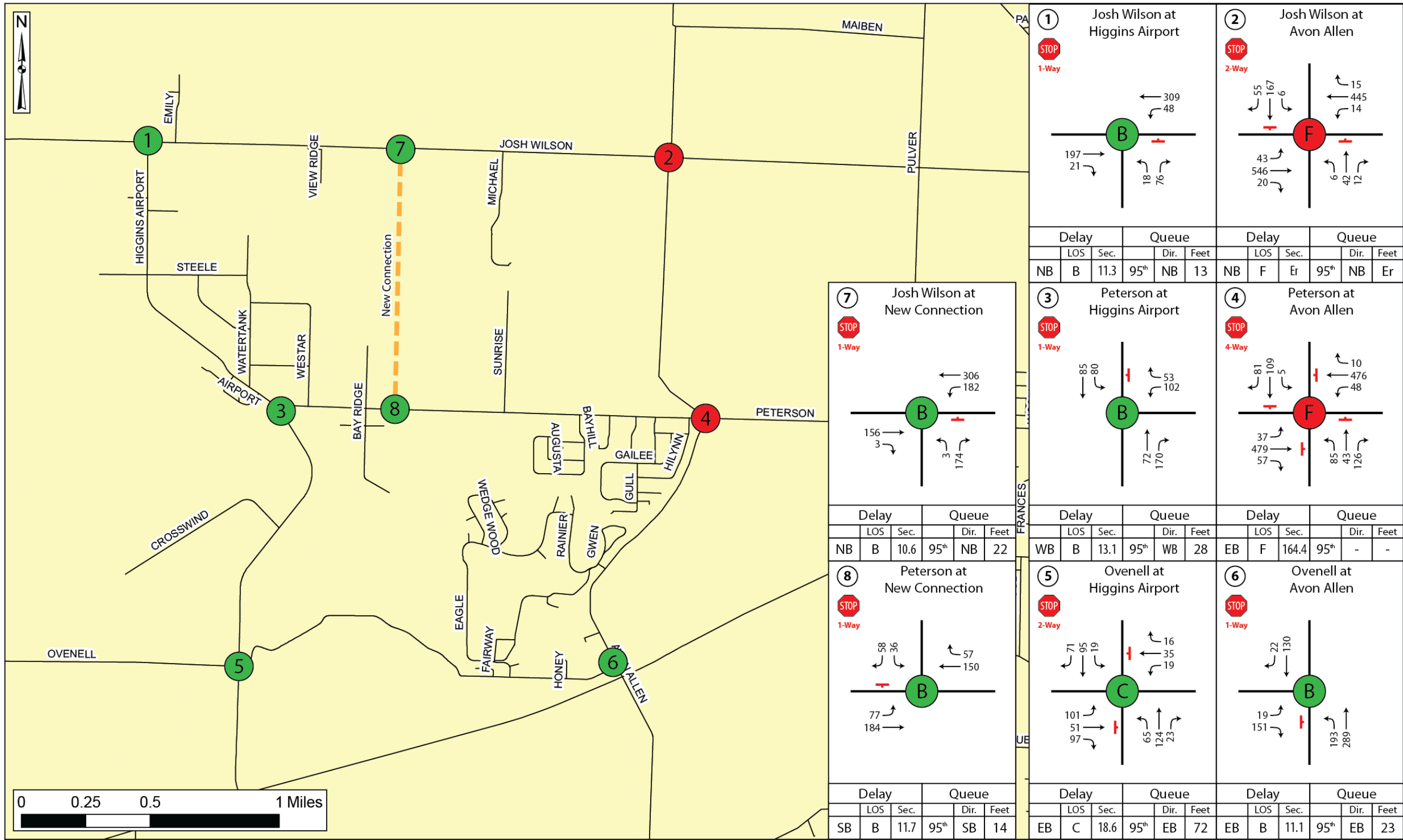
Figure 3





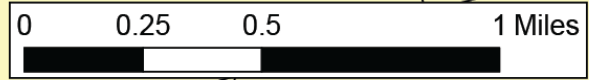
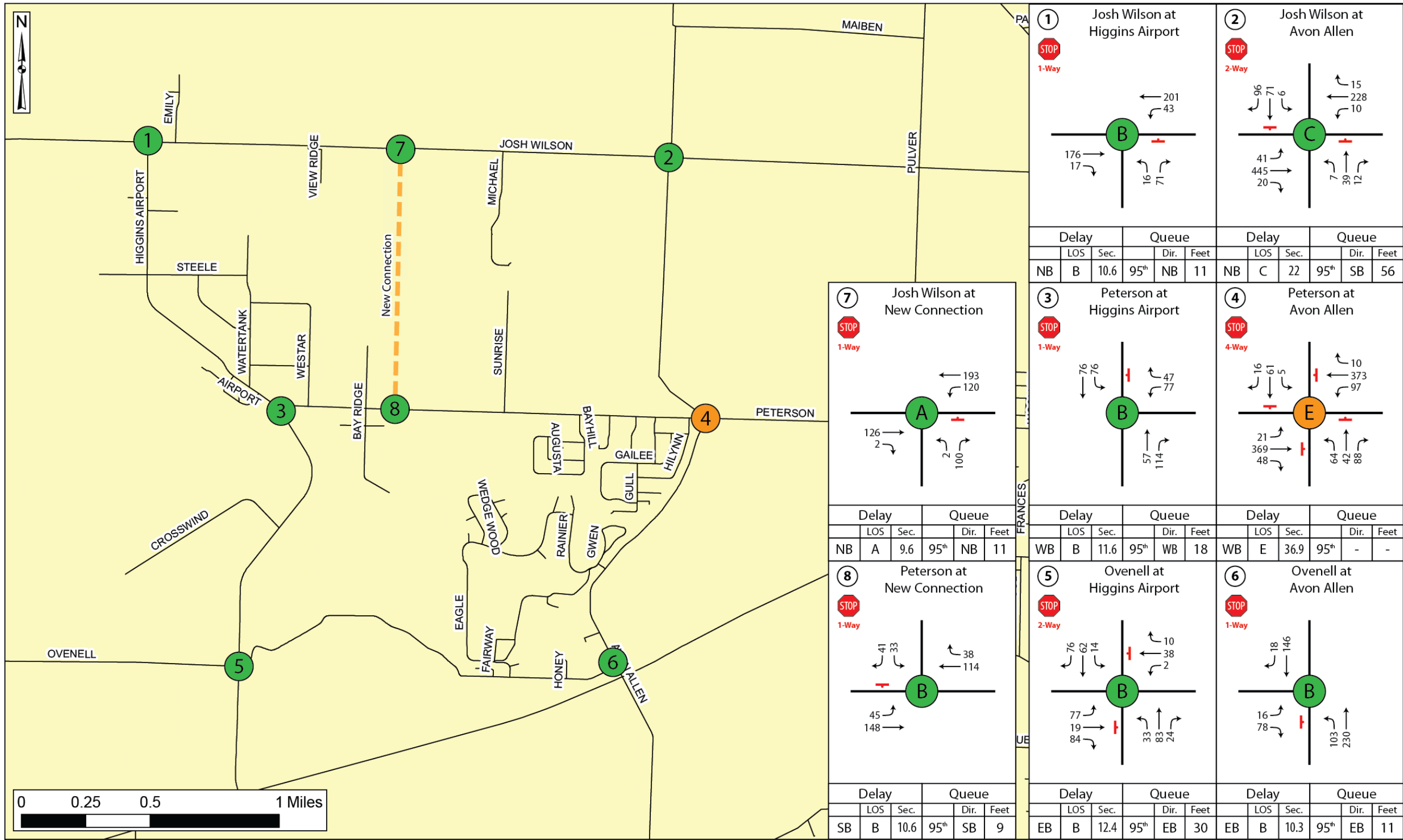
**Figure 4**

Bayview Ridge Subarea Study  
 PM Peak Hour Intersection Level of  
 Service (LOS) and Volumes  
 50% Build-out



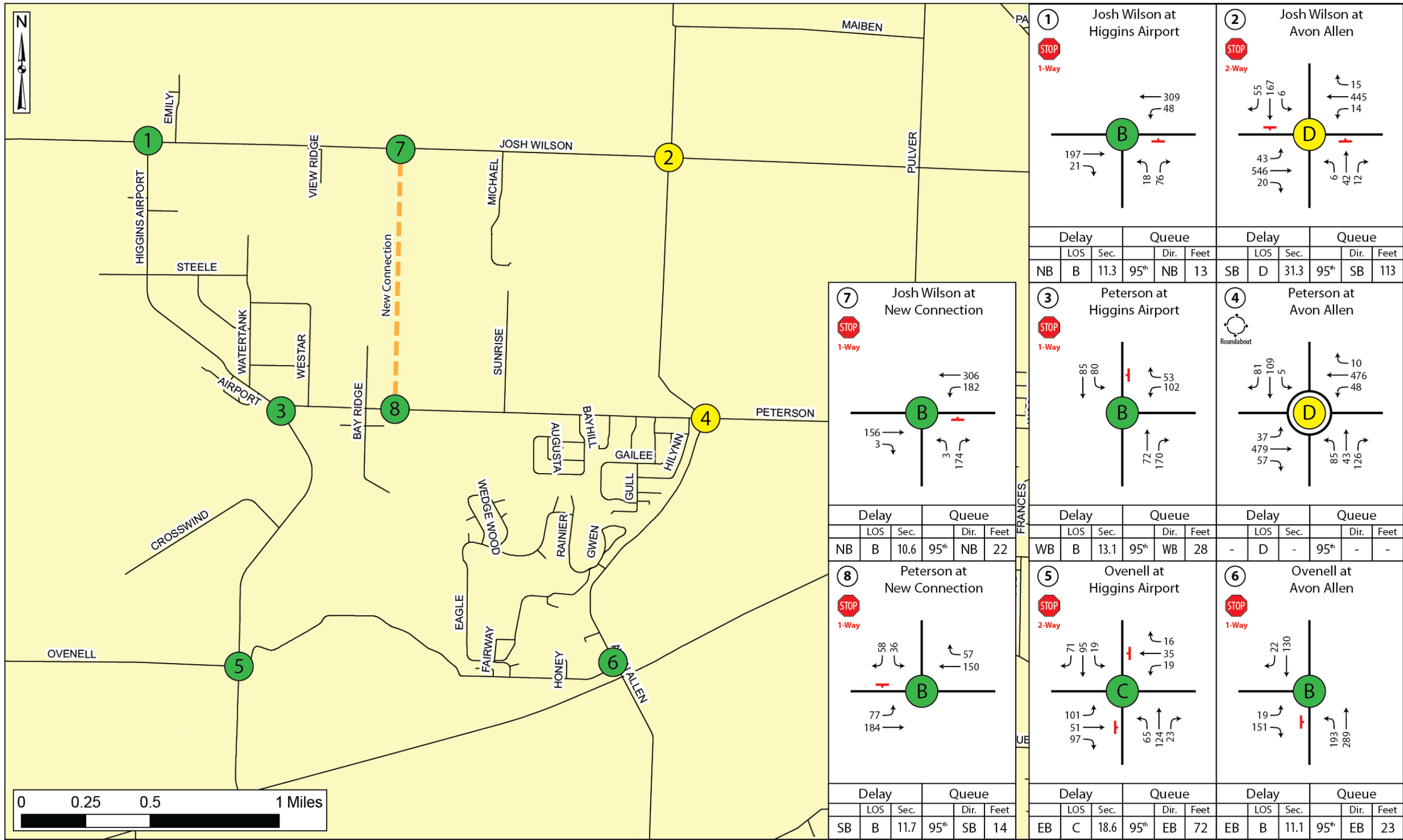
**Figure 5**

Bayview Ridge Subarea Study  
PM Peak Hour Intersection Level of Service (LOS) and Volumes 2035 (ITE) Build



**Figure 6**

Bayview Ridge Subarea Study  
 PM Peak Hour Intersection Level of Service (LOS) and Volumes  
 60% Build-out with New Connection



**Figure 7**

Bayview Ridge Subarea Study  
 PM Peak Hour Intersection Level of Service (LOS) and Volumes 2035 (ITE) Build with Mitigation

