

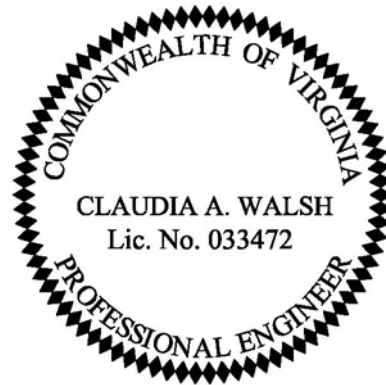


Traffic Impact Study

Conditional Use Permit and
Conditional Rezoning Application

SPSA Regional Landfill

Suffolk, Virginia
June 2016



HDR Engineering, Inc.
Virginia Beach, VA
TRANSPORTATION ENGINEER

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1 Introduction

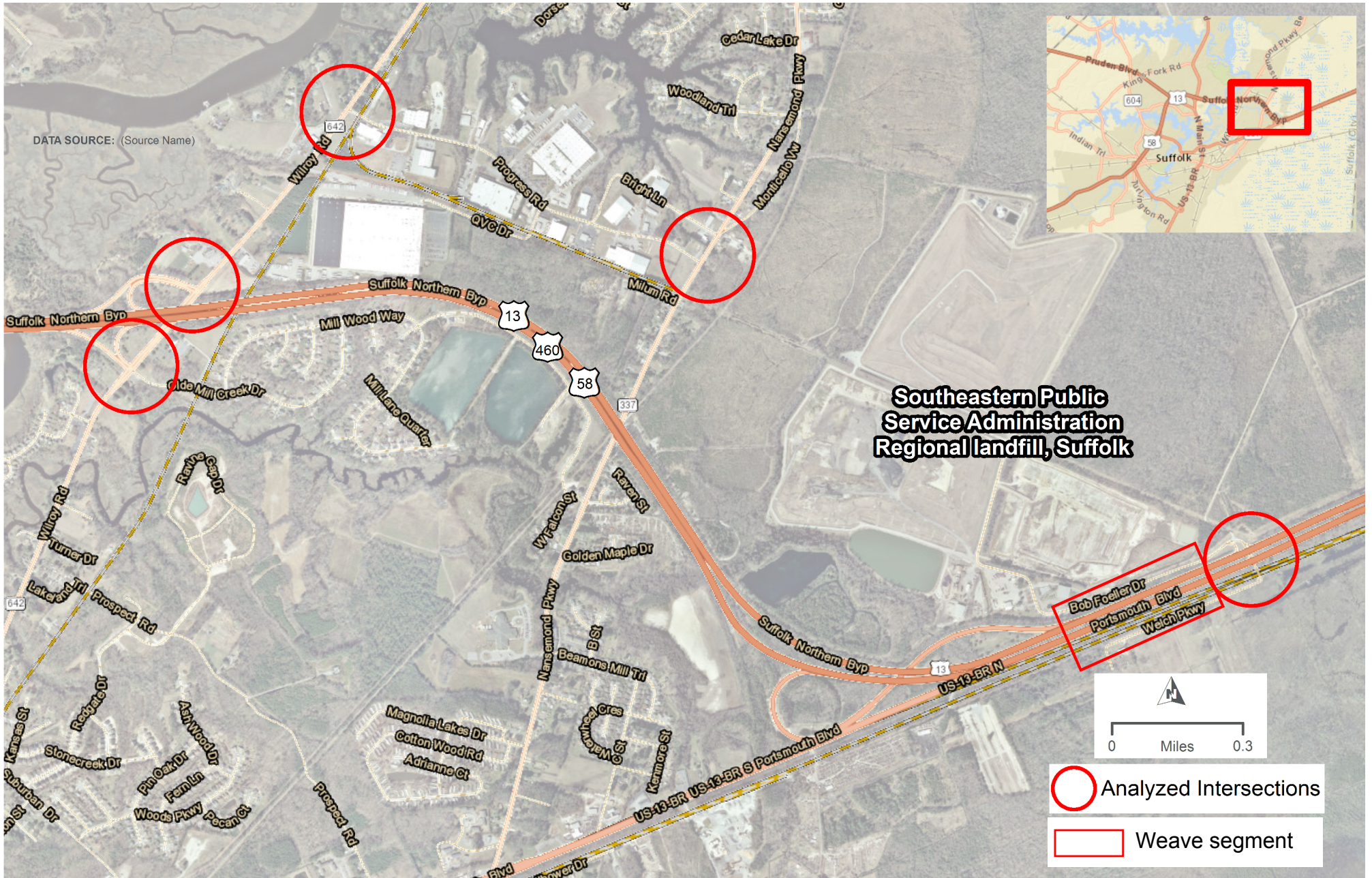
The Southeastern Public Service Authority (SPSA) is submitting applications for a Conditional Use Permit and Conditional Rezoning for modification to its Regional Landfill, located at #1 Bob Foeller Drive in the City of Suffolk. The modification includes the proposed construction of a new landfill cell, Cell VII, on the existing landfill site, and development of a soil borrow area or vegetative waste composting system on the existing property north of Cell VII. The property is located north of the West Military Highway (Route 13/58/460), Bob Foeller Drive, and Welch Parkway intersection. Figure 1 displays a study area map.

It is anticipated that construction of Cell VII will take place one to two years prior to the completion of waste filling operations in Cells V and VI. Cell V and VII operations are anticipated to continue through at least 2024, based on current and anticipated disposal rates, and could possibly extend up to 2040 depending on the success of planned alternative waste disposal strategies. For purposes of this study, HDR has assumed that Cell VII and the compost operations would begin in 2030, and that Cell VII would have a projected life span of 25 years.

The new Cell VII and compost operations will be accessed using the existing facility entrance roadway, Bob Foeller Drive. The proposed access on Route 13/58/460 is an existing partial access with an existing median crossing. The landfill eastbound traffic on Route 13/58/460 must make a right onto westbound Route 13/58/460 and use the loop ramp that is located approximately 3000 feet to the west of the Bob Foeller Drive and Welch Parkway intersection.

HDR understands that the Virginia Department of Transportation (VDOT) is planning to complete a study and conceptual design for a flyover or interchange between westbound and eastbound Routes 13/58/460 east of the facility, which would provide an alternative for the median crossing traffic entrance to the facility. VDOT funding for this regional study and construction of the flyover is not assured and the actual timing for the implementation of this regional traffic improvements is not known. This study and its second alternative has assumed that the flyover is not available for traffic flow at the time Cell VII is operational.

The purpose of this report is to document the impacts of the existing entrance and exit and access requirements for the proposed site. Analysis of existing conditions is presented in the Section 2. Section 3 contains the analysis of future conditions without development. Trips and forecasted traffic volumes is presented in the Section 4 of this report. The capacity analysis for the proposed facility with development is documented in Section 5. The signal warrants analysis is presented in Section 6. Finally, Sections 7 & 8 summarize the study findings and present the recommendations and conclusions.



2 Existing Conditions

This section presents the existing traffic operational analysis for the peak hour traffic volumes for the analyzed intersections and weaving segment.

As shown in the study area map, the study area includes five intersections plus a weave segment of Route 13/58/460 that are being analyzed for this project:

- Route 13/58/460, Bob Foeller Drive, and Welch Parkway
- Bob Foeller Drive Merge Ramp onto Route 13/58/460 Westbound
- Nanesmond Parkway and Progress Road
- Wilroy Road and Progress Road
- Wilroy Road and Route 13/58/460 West Bound Ramps
- Wilroy Road and Route 13/58/460 East Bound Ramps

The current entrance to the SPSA landfill site can only be accessed via Bob Foeller Drive located at the south of the site. Bob Foeller Drive intersects with Route 13/58/460 to the southeast of the SPSA landfill facility. Bob Foeller Drive is named as Welch Parkway to the south of Route 13/58/460. Presently, a locked gate controls access to Welch Parkway. Route 13/58/460 is a divided six-lane highway with a grass median and Bob Foeller Drive and Welch Parkway are both two-lane local roadways. There is an exclusive left turn lane and free flow lane to the SPSA landfill site on the westbound approach and an exclusive left turn lane on the eastbound approach. The storage bay for the westbound right turn lane and for the eastbound left turn is approximately 300 feet. All the movements to and from Bob Foeller Drive are stop controlled except the free flowing right turn movement to Bob Foeller Drive from Route 13/58/460 and the free flowing right turn movement from Bob Foeller Drive to Route 13/58/460.

Progress Road is an east-west two-lane local roadway facility with a continuous two-way center left-turning lane. Progress Road intersects with Nansemond Parkway at the east end and Wilroy Road at the west end. The Wilroy Road intersection with Progress Road is a signalized intersection. However, the intersection of Progress Road and Nansemond Road is an unsignalized intersection with a stop sign on Progress Road. Nansemond Parkway is a north-south two-lane local roadway with a double yellow centerline to the east of the intersection with Progress Road and a skipped yellow center line to the west. Wilroy Road is also a two-lane local roadway with double yellow center line.

There is an existing interchange between Wilroy Road and Route 13/58/460 to the south of the signalized intersection of Wilroy Road and Progress Road. Wilroy Road goes under Route 13/58/460 with access ramps for both eastbound and westbound traffic to/from Route 13/58/460. The eastbound access ramps to/from Route 13/58/460 are located to the north of the interchange, whereas the westbound access ramps are to the south. Both the access ramps are signalized intersections at Wilroy Road. Additionally, Wilroy Road becomes a four-lane local roadway with a raised grass median within the interchange limits with Route 13/58/460.

To determine the existing conditions, Intermodal Engineering, P.C. conducted a peak hour volume and turning movement count during the a.m. peak period from 7:00- 9:00 a.m. and the p.m. peak period from 2:00 -4:30 p.m. The counts were conducted on the following days:

- Intersection of Bob Foeller Drive and West Military Highway (Route 13/58/460) - Wednesday, April 13, 2016.
- Bob Foeller Drive Merge Ramp onto Route 13/58/460 Westbound – Wednesday, April 13, 2016.
- Intersection of Nanesmond Parkway and Progress Road – Thursday, June 2, 2016
- Intersection of Wilroy Road and Progress Road – Tuesday, June 14, 2016
- Intersection of Wilroy Road and East Bound/West Bound Ramps - Thursday, June 2, 2016

Level of service (LOS) is a qualitative measure used to describe the condition of traffic flow, ranging from excellent free-flow conditions at LOS A to overloaded stop-and-go conditions at LOS F. LOS C is typically considered to be the minimum acceptable level of service in rural areas. LOS at all five intersections were analyzed using Synchro 8.0. LOS for the weaving segment was analyzed using the FHWA's Highway Capacity Software.

2.1 Existing LOS Summaries

2.1.1 Intersection of Route 13/58/460, Bob Foeller Drive, and Welch Parkway

The intersection functions at an unacceptable level of service in the a.m. and p.m. peak hour. This is due to the heavy volumes on the Route 13/58/460 approaches as shown on Figure 2A. For analysis results summary see Table 1 and full reports in Appendix C.

2.1.2 Bob Foeller Drive Merge Ramp on to Route 13/58/460 Westbound

The weave segment functions at an acceptable level of service in the a.m. and p.m. peak hour. This is due to the low volumes making the ramp to freeway movement. For analysis results summary, see Table 2 and full reports in Appendix C.

2.1.3 Intersection of Nanesmond Parkway and Progress Road

The intersection functions at an acceptable level of service in the a.m. and p.m. peak hour. Existing conditions volumes are displayed on Figure 2B. For analysis results summary, see Table 3 and full reports in Appendix C.

2.1.4 Intersection of Wilroy Road and Progress Road

The intersection functions at an acceptable level of service in the a.m. and p.m. peak hour. Existing conditions volumes are displayed on Figure 2C. For analysis results summary, see Table 4 and full reports in Appendix C.

2.1.5 Intersection of Wilroy Road and Route 13/58/460 WB off/on Ramps

The intersection functions at an acceptable level of service in the a.m. and an unacceptable level of service in the p.m. peak hour. This is due to the intersection being unsignalized and the heavy volumes on the Wilroy Road approaches as show on Figure 2D. For analysis results summary, see Table 5 and full reports in Appendix C.



2.1.6 Intersection of Wilroy Road and Route 13/58/460 EB off/on Ramps

The intersection functions at an acceptable level of service in the a.m. and p.m. peak hour. Existing conditions volumes are displayed on Figure 2E. For analysis results summary, see Table 6 and full reports in Appendix C.

Table 1 LOS: Route 13/58/460 and Bob Foeller Drive, and Welch Parkway

		Route 13/58/460 Eastbound			Route 13/58/460 Westbound			Welch Parkway Northbound			Bob Foeller Drive Southbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Existing	A.M. Peak	F	-	-	-	-	-	-	-	-	-	-	-
	P.M. Peak	F	-	-	-	-	-	-	-	-	-	-	-
No-Built	A.M. Peak	F	-	-	-	-	-	-	-	-	-	-	-
	P.M. Peak	F	-	-	-	-	-	-	-	-	-	-	-
Alternative 1	A.M. Peak	F	-	-	-	-	-	-	-	-	-	-	-
	P.M. Peak	F	-	-	-	-	-	-	-	-	-	-	-
Alternative 2	A.M. Peak	F	-	-	-	-	-	-	-	-	-	-	-
	P.M. Peak	F	-	-	-	-	-	-	-	-	-	-	-

Table 2 LOS: Bob Foeller Drive Ramp onto Route 13/58/460 WB

		Bob Foeller Drive Ramp onto Route 13/58/460 WB	
		Merge Segment	
Existing	A.M. Peak	B	
	P.M. Peak	B	
No-Built	A.M. Peak	B	
	P.M. Peak	C	
Alternative 1	A.M. Peak	B	
	P.M. Peak	C	
Alternative 2	A.M. Peak	B	
	P.M. Peak	C	



Table 3 LOS: Nansemond Parkway and Progress Road

		Progress Road Eastbound			Progress Road Westbound			Wilroy Road Northbound			Wilroy Road Southbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Existing	A.M. Peak	B	-	A	-	-	-	A	A	-	-	-	-
	P.M. Peak	C	-	B	-	-	-	A	A	-	-	-	-
No-Built	A.M. Peak	C	-	B	-	-	-	A	A	-	-	-	-
	P.M. Peak	D	-	B	-	-	-	A	A	-	-	-	-
Alternative 1	A.M. Peak	-	-	-	-	-	-	-	-	-	-	-	-
	P.M. Peak	-	-	-	-	-	-	-	-	-	-	-	-
Alternative 2	A.M. Peak	C	-	B	-	-	-	A	A	-	-	-	-
	P.M. Peak	E	-	B	-	-	-	A	A	-	-	-	-

Table 4 LOS: Wilroy Road and Progress Road

		Progress Road Westbound		Wilroy Road Northbound		Wilroy Road Southbound	
		Left	Right	Thru	Right	Left	Thru
Existing	A.M. Peak	B	B	A	A	A	-
	P.M. Peak	B	A	B	A	B	-
No-Built	A.M. Peak	B	B	B	A	B	-
	P.M. Peak	B	B	B	A	B	-
Alternative 1	A.M. Peak	-	-	-	-	-	-
	P.M. Peak	-	-	-	-	-	-
Alternative 2	A.M. Peak	B	B	B	A	B	-
	P.M. Peak	C	B	B	B	B	-

Table 5 LOS: Wilroy Road and Route 13/58/460 EB off Ramp

		Route 13/58/460 EB off Ramp		Olde Mill Creek Drive Westbound		Wilroy Road Northbound			Wilroy Road Southbound		
		Left	Thru/Right	Left/Thru	Right	Left	Thru	Right	Left	Thru	Right
Existing	A.M. Peak	C	A	-	C	B	C	B	B	C	C
	P.M. Peak	C	B	-	C	B	C	B	B	C	C
No-Built	A.M. Peak	D	A	-	C	B	C	B	B	C	C
	P.M. Peak	D	B	-	C	B	C	C	B	C	C
Alternative 1	A.M. Peak	-	-	-	-	-	-	-	-	-	-
	P.M. Peak	-	-	-	-	-	-	-	-	-	-
Alternative 2	A.M. Peak	D	A	-	C	C	C	C	B	C	C
	P.M. Peak	D	B	-	C	B	C	C	C	C	C



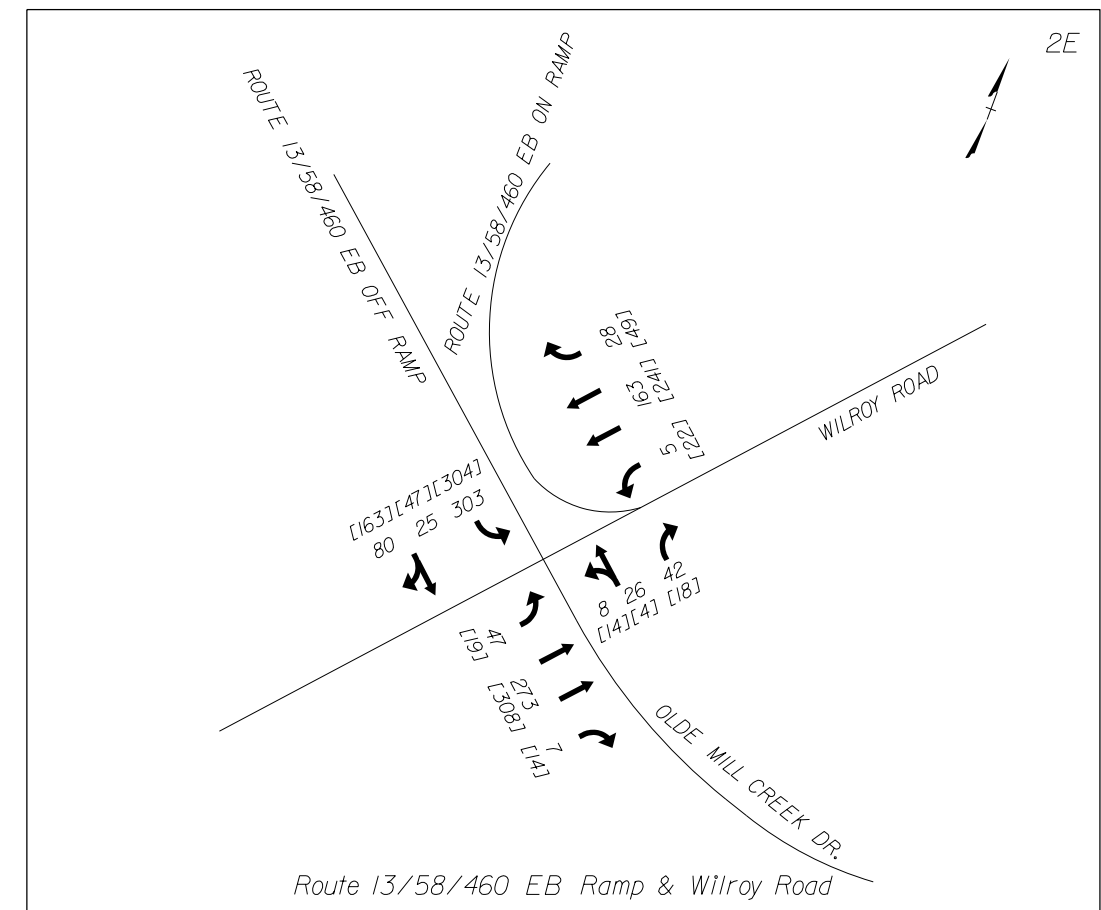
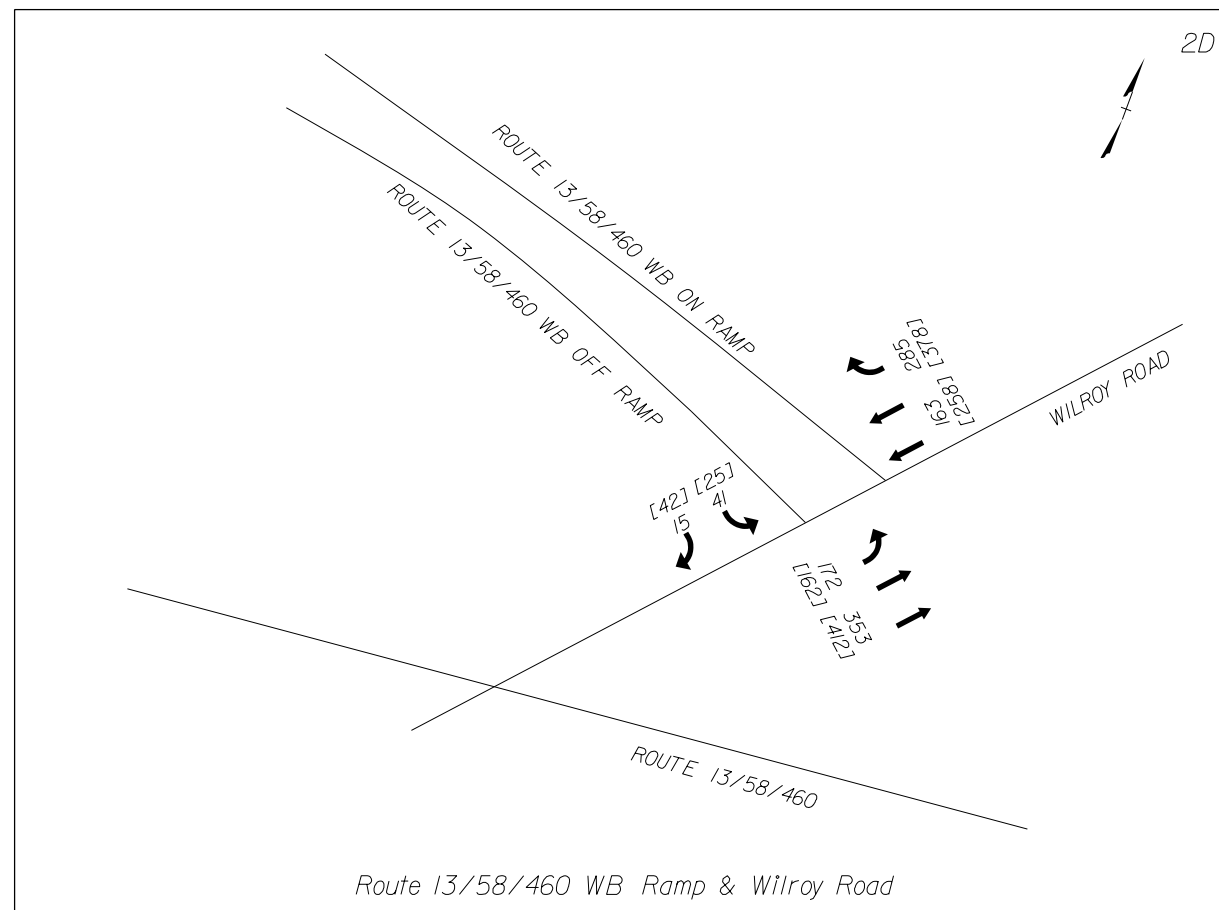
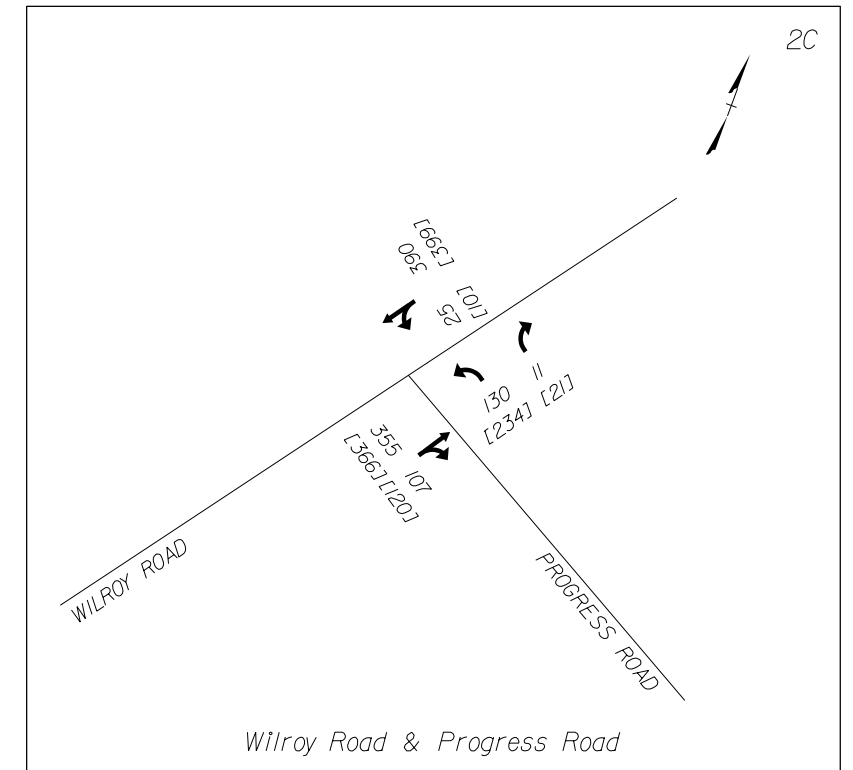
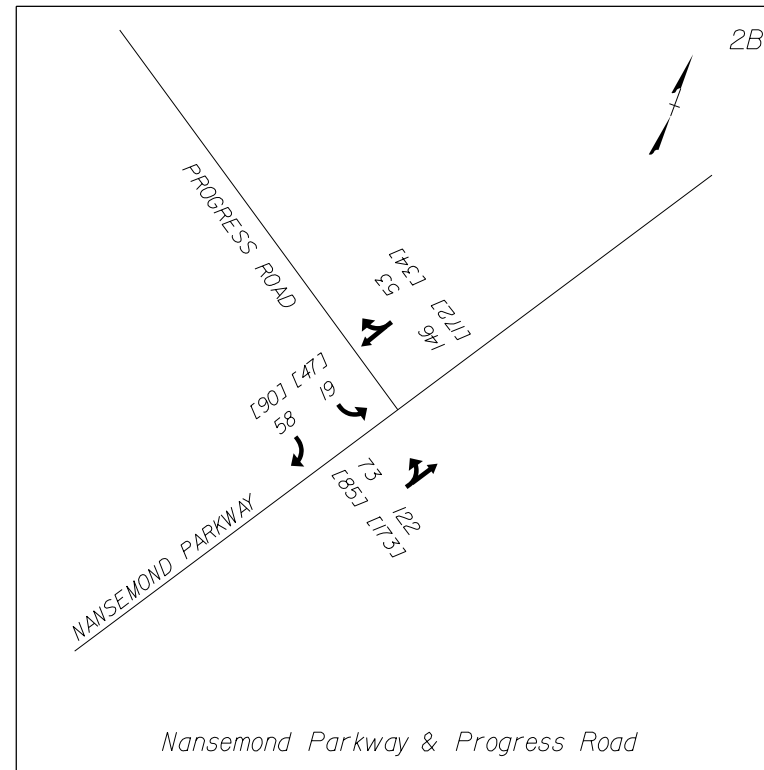
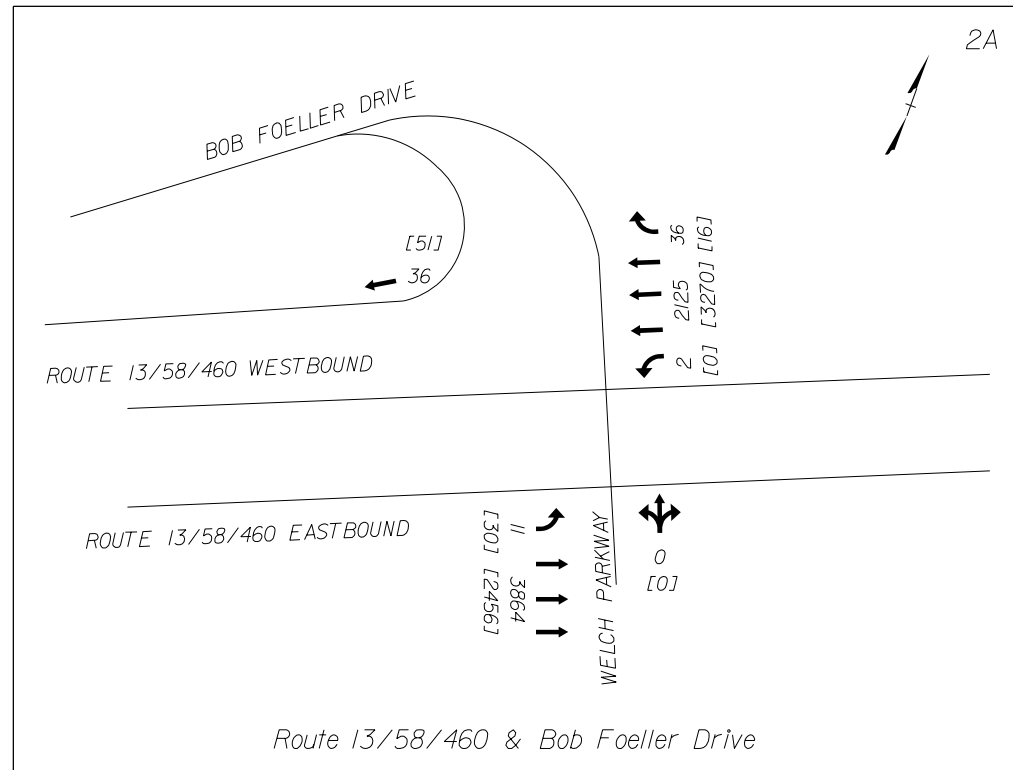
Table 6 LOS: Wilroy Road and Route 13/58/460 WB Ramps

		Route 13/58/460 WB off Ramp		Wilroy Road Northbound		Wilroy Road Southbound	
		Left	Right	Left	Thru	Thru	Right
Existing	A.M. Peak	D	B	A	-	-	-
	P.M. Peak	F	B	B	-	-	-
No-Built	A.M. Peak	F	B	B	-	-	-
	P.M. Peak	F	B	C	-	-	-
Alternative 1	A.M. Peak	-	-	-	-	-	-
	P.M. Peak	-	-	-	-	-	-
Alternative 2	A.M. Peak	F	B	B	-	-	-
	P.M. Peak	F	B	C	-	-	-



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EXISTING CONDITIONS



LEGEND
 AM Peak Hour Volume
 [PM] Peak Hour Volume

Figure 2

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3 Analysis of Future Conditions without Development

The volumes used for the analysis of the existing conditions were used as the background volumes for the No-Build conditions. To analyze the No-Build conditions, the background traffic was forecast using the growth rates found in the next section. The a.m. and p.m. peak hour levels of service for study area intersections and ramp were computed by utilizing the Synchro 8.0 and HCM 2010.

3.1 No-Build LOS Summaries

3.1.1 Intersection of Route 13/58/460, Bob Foeller Drive, and Welch Parkway

The intersection functions at an unacceptable level of service in the a.m. and p.m. peak hour. This is due to the heavy volumes on the Route 13/58/460 approaches as shown on Figure 3A. For analysis results summary, see Table 1 and full reports in Appendix C.

3.1.2 Bob Foeller Drive Merge Ramp on to Route 13/58/460 Westbound

The weave segment functions at an acceptable level of service in the a.m. and p.m. peak hour. This is due to the low volumes making the ramp to freeway movement. For analysis results summary, see Table 2 and full reports in Appendix C.

3.1.3 Intersection of Nansemond Parkway and Progress Road

The intersection functions at an acceptable level of service in the a.m. and p.m. peak hour. No-Build conditions volumes are displayed on Figure 3B. For analysis results summary, see Table 3 and full reports in Appendix C.

3.1.4 Intersection of Wilroy Road and Progress Road

The intersection functions at an acceptable level of service in the a.m. and p.m. peak hour. No-Build conditions volumes are displayed on Figure 3C. For analysis results summary, see Table 4 and full reports in Appendix C.

3.1.5 Intersection of Wilroy Road and Route 13/58/460 WB off/on Ramps

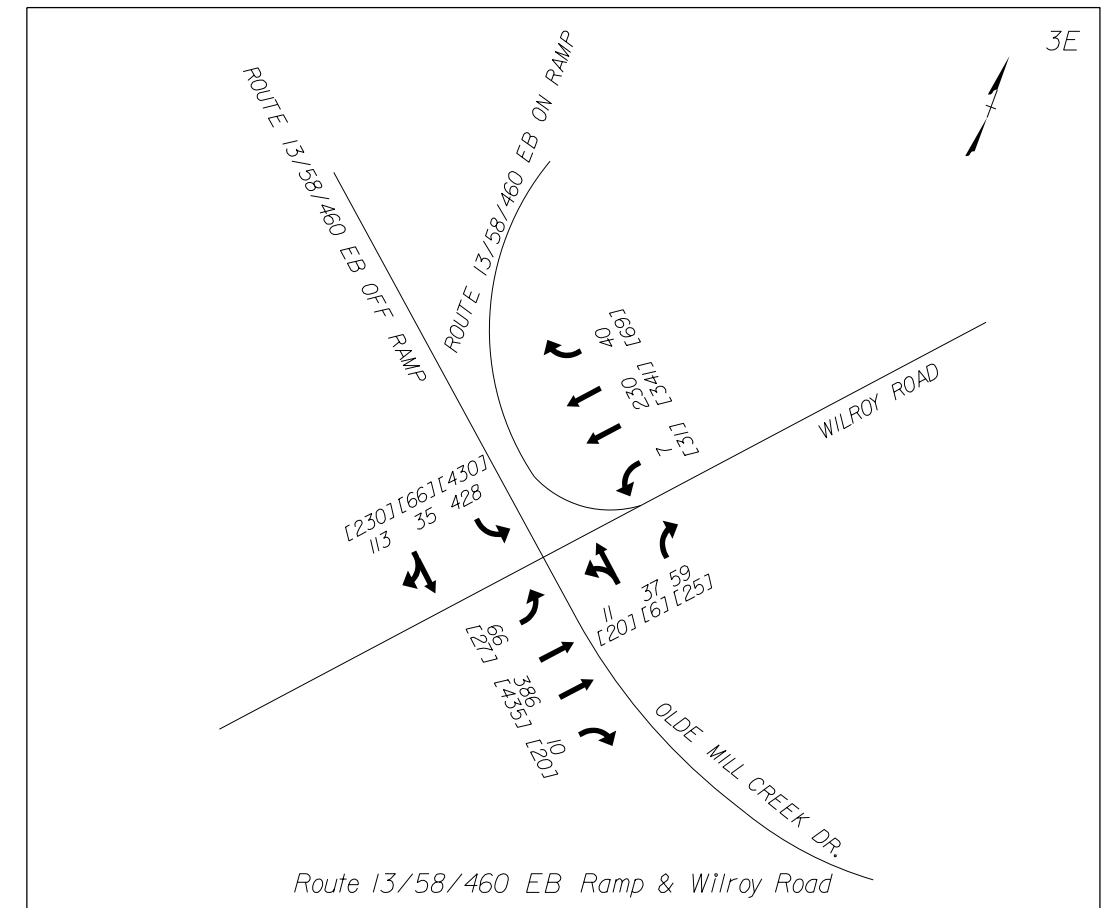
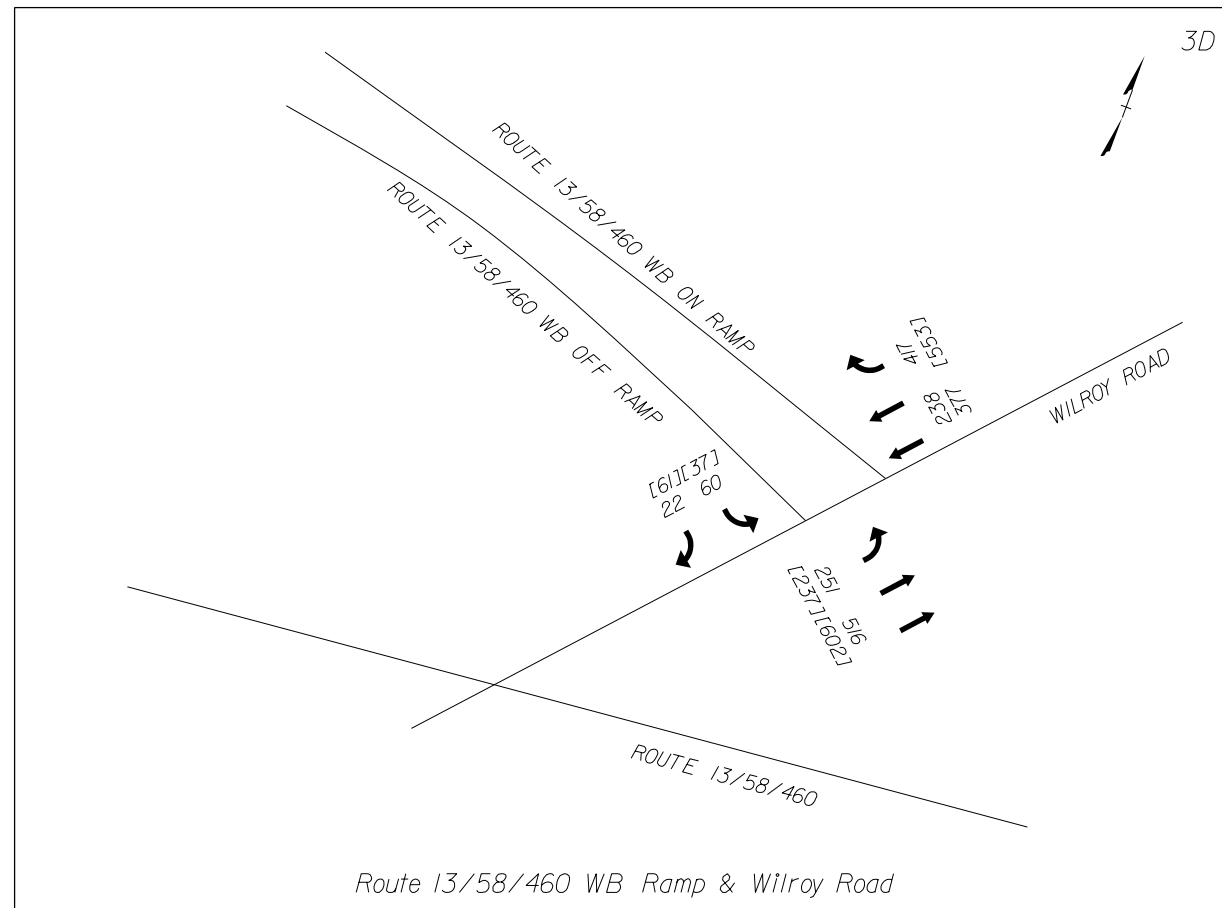
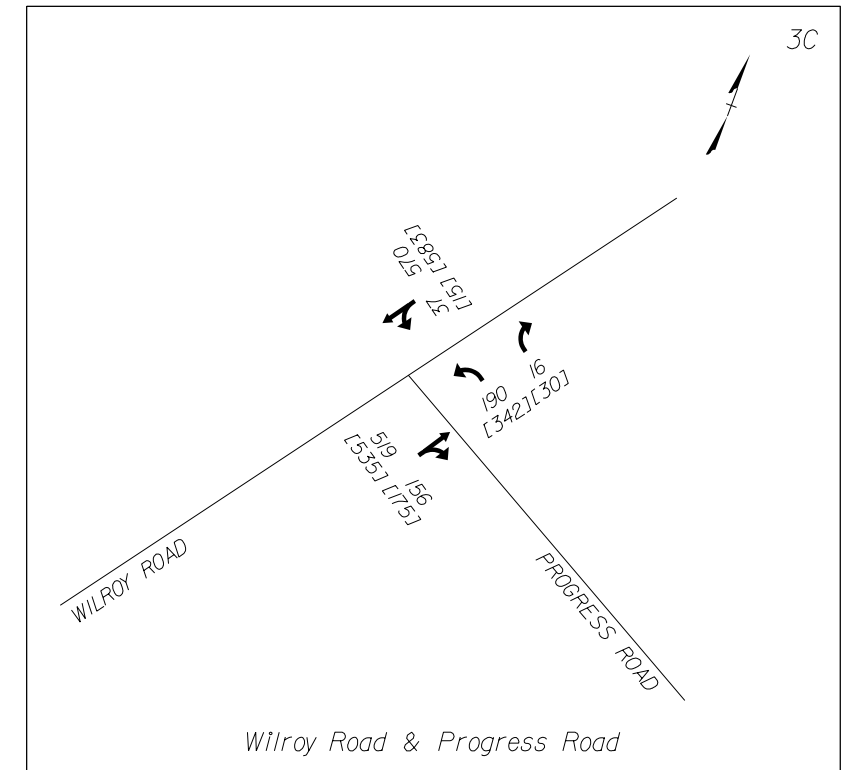
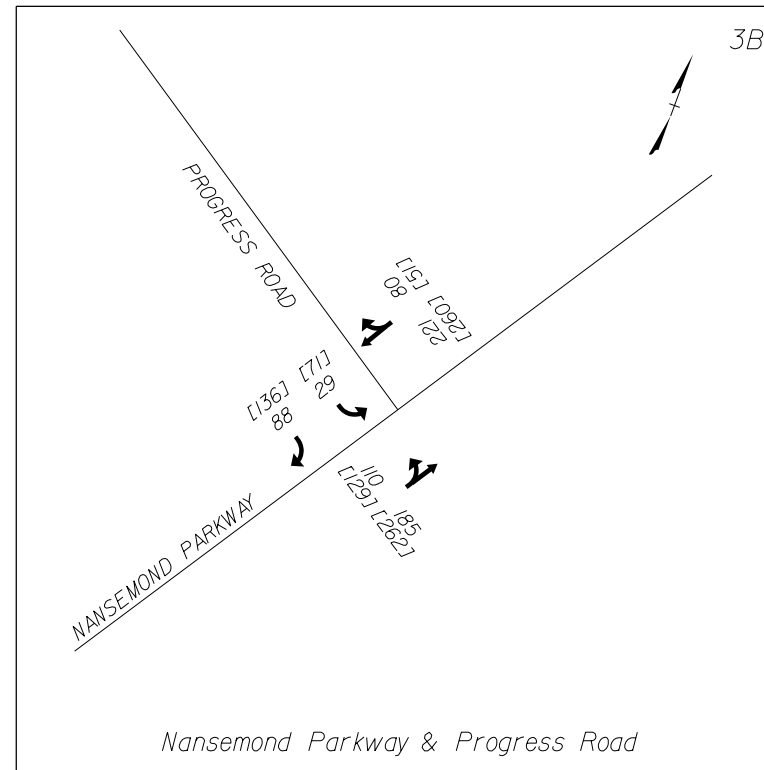
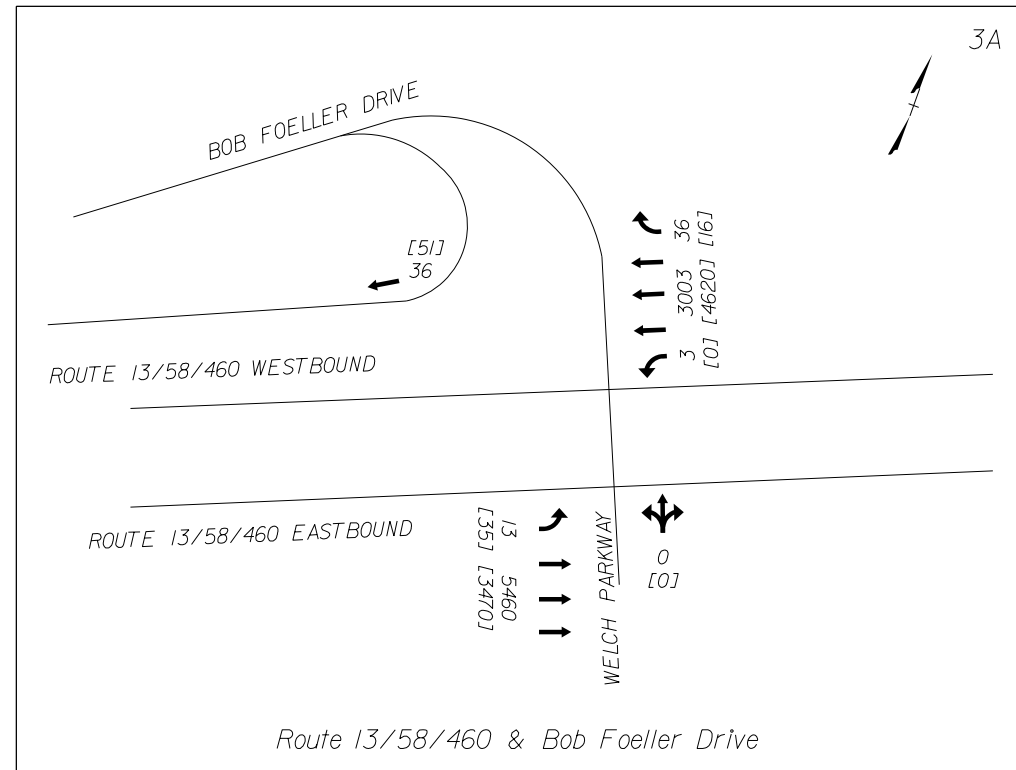
The intersection functions at an unacceptable level of service in the a.m. and p.m. peak hour. This is due to the intersection being unsignalized and the heavy volumes on the Wilroy Road approaches as shown on Figure 3D. For analysis results summary, see Table 5 and full reports in Appendix C.

3.1.6 Intersection of Wilroy Road and Route 13/58/460 EB off/on Ramps

The intersection functions at an acceptable level of service in the a.m. and p.m. peak hour. No-Build conditions volumes are displayed on Figure 3E. For analysis results summary, see Table 6 and full reports in Appendix C.

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NO-BUILD



LEGEND
 AM Peak Hour Volume
 [PM] Peak Hour Volume

Figure 3

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4 Trip and Forecasted Volumes

The property is currently zoned M-2 (heavy manufacturing) which only permits a limited number of uses and conditional uses. Based on information provided by SPSA, HDR included an increase in traffic volume assuming a 1% growth in waste volume per year. The operation of Cell VII, in itself, does not increase the traffic to the facility, it just provides additional disposal capacity. The operation of the Regional Landfill will change in 2018 based on the success of a new beneficial waste facility in Chesapeake where SPSA plans to send most of their waste for processing. If the new facility in Chesapeake is successful, SPSA would receive the residue from this process for disposal at the Regional Landfill. If it is not successful, SPSA would like operate the Regional Landfill as primarily as a municipal solid waste (MSW) landfill, which would have higher traffic volumes. For purposes of this study HDR has projected future traffic conditions based on the worst case operations as an MSW landfill receiving 375,000 tons per year. For the compost facility operations, HDR assumed the facility would operate at approximately 20,000 tons per year and generate an average of 35 trips per day at 2 tons per trip, and the Suffolk yard waste delivery would be 10% of the total trip volume.

The trips to the Regional Landfill from 2014 to 2015 totaled 85,491. A complete table of the Regional Landfill trips from Month Year to Month Year is located in Appendix A. The traffic growth to and from the SPSA facility were forecast to the proposed opening of Cell VII and compost facility in 2030 and at the projected life span of Cell VII in 2054.

The forecasting of general traffic for a.m. and p.m. periods was based on a 2016 traffic count performed by Intermodal Engineering, P.C. for the intersection of Route 13/58/460, Bob Foeller Drive, and Welch Parkway, Nansemond Parkway, Wilroy Road and Progress Road, Wilroy Road & Route 13/58/460 WB off Ramp, and Wilroy Road & Route 13/58/460 EB off Ramp and VDOT's annual traffic count for City of Suffolk at the study area. The traffic counts are located in Appendix B; projected growth rates are shown in Tables 7-11.



Table 7 Growth Rate: Rt 13/58/460, Bob Foeller Drive, and Welch Parkway

Annual Average Daily Traffic

Route 13/58/460, Bob Foeller Drive, and Welch Parkway

Year	Eastbound	Westbound	Growth Rate (%)
2006	70000	70000	1.43
2007	71000	71000	-2.82
2008	69000	69000	1.45
2009	70000	70000	4.29
2010	73000	73000	-12.33
2011	64000	64000	3.13
2012	66000	66000	4.55
2013	69000	69000	-1.45
2014	68000	68000	4.41
2015	71000	71000	
Total			19.26

Growth Rate Calculation

- Average Daily traffic for initial year (ADTi)
- Average Daily traffic for future year (ADTf)
- Initial year for ADT (I)
- Future year for ADT (F)

$$GR = \left[\left(\frac{ADTf}{ADTi} \right)^{\frac{1}{(F-I)}} - 1 \right] \times 100$$

Growth Rate (%) = 2.14%

* For annual traffic volume growth percentage, use **2.5%**



Table 8 Growth Rate: Nansemond Parkway & Progress Road

Annual Average Daily Traffic

Nansemond Parkway & Progress Road

Year	Northbound	Southbound	Growth Rate (%)
2006	4600	4600	
			2.17
2007	4700	4700	
			-12.77
2008	4100	4100	
			2.44
2009	4200	4200	
			4.76
2010	4400	4400	
			-2.27
2011	4300	4300	
			-2.33
2012	4200	4200	
			0.00
2013	4200	4200	
			-7.14
2014	3900	3900	
			2.56
2015	4000	4000	
			11.93

Growth Rate Calculation

- Average Daily traffic for initial year (ADTi)
- Average Daily traffic for future year (ADTf)
- Initial year for ADT (I)
- Future year for ADT (F)

$$GR = \left[\left(\frac{ADTf}{ADTi} \right)^{\frac{1}{(F-I)}} - 1 \right] \times 100$$

Growth Rate (%) = 2.98%

* For annual peak hour growth percentage, use 3.0%



Table 9 Growth Rate: Wilroy Road & Progress Road

Annual Average Daily Traffic

Wilroy Road & Progress Road

Year	Northbound	Southbound	Growth Rate (%)
2006	8100	8100	3.70
2007	8400	8400	-5.95
2008	7900	7900	2.53
2009	8100	8100	4.94
2010	8500	8500	-4.71
2011	8100	8100	-2.47
2012	7900	7900	1.27
2013	8000	8000	1.25
2014	8100	8100	2.47
2015	8300	8300	
Total			16.16

Growth Rate Calculation

- Average Daily traffic for initial year (ADTi)
- Average Daily traffic for future year (ADTf)
- Initial year for ADT (I)
- Future year for ADT (F)

$$GR = \left[\left(\frac{ADTf}{ADTi} \right)^{\frac{1}{(F-I)}} - 1 \right] \times 100$$

Growth Rate (%) = 2.69%

* For annual peak hour growth percentage, use **2.75%**



Table 10 Growth Rate: Wilroy Road & Routh 13/58/460 WB off Ramp

Annual Average Daily Traffic

Wilroy Road & Route 13/58/460 WB off Ramp

Year	Northbound	Southbound	Growth Rate (%)
2006	8100	8100	3.70
2007	8400	8400	-5.95
2008	7900	7900	2.53
2009	8100	8100	4.94
2010	8500	8500	-4.71
2011	8100	8100	-2.47
2012	7900	7900	1.27
2013	8000	8000	1.25
2014	8100	8100	2.47
2015	8300	8300	16.16

Growth Rate Calculation

- Average Daily traffic for initial year (ADTi)
- Average Daily traffic for future year (ADTf)
- Initial year for ADT (I)
- Future year for ADT (F)

$$GR = \left[\left(\frac{ADTf}{ADTi} \right)^{\frac{1}{(F-I)}} - 1 \right] \times 100$$

Growth Rate (%) = 2.69%

* For annual traffic volume growth percentage, use **2.75%**



Table 11 Growth Rate: Wilroy Road & Route 13/58/460 EB off Ramp

Annual Average Daily Traffic

Wilroy Road & Route 13/58/460 EB off Ramp

Year	Northbound	Southbound	Growth Rate (%)
2006	7600	7600	2.63
2007	7800	7800	-32.05
2008	5300	5300	1.89
2009	5400	5400	3.70
2010	5600	5600	-8.93
2011	5100	5100	-1.96
2012	5000	5000	0.00
2013	5000	5000	2.00
2014	5100	5100	1.96
2015	5200	5200	12.18

Growth Rate Calculation

- Average Daily traffic for initial year (ADTi)
- Average Daily traffic for future year (ADTf)
- Initial year for ADT (I)
- Future year for ADT (F)

$$GR = \left[\left(\frac{ADTf}{ADTi} \right)^{\frac{1}{(F-I)}} - 1 \right] \times 100$$

Growth Rate (%) = 2.44%

* For annual traffic volume growth percentage, use **2.5%**

5 Analysis of Future Conditions with Development

5.1 Alternative 1: VDOT Funded Flyover

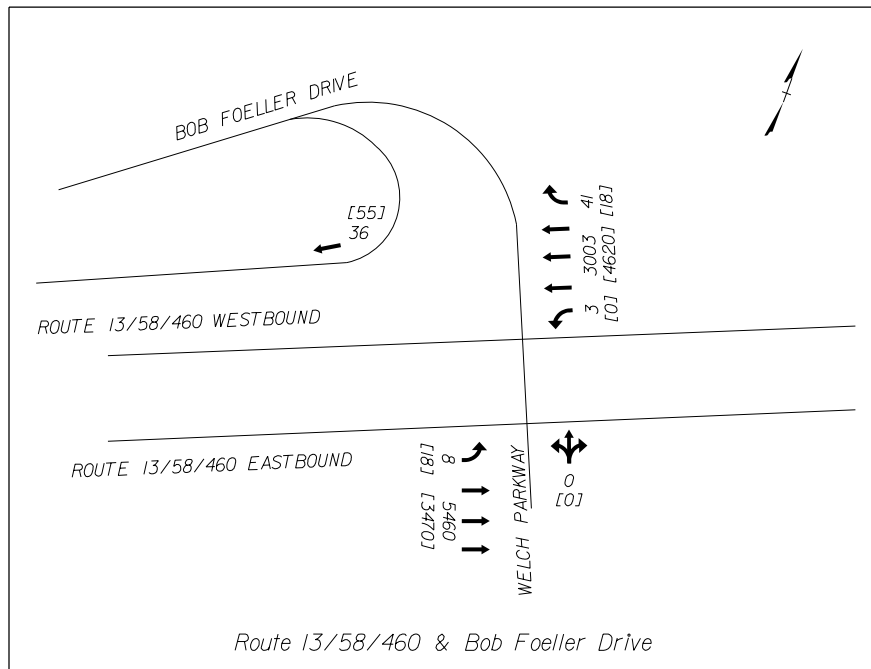
Alternative 1 consists of a new proposed VDOT funded flyover roadway in the vicinity of the Intersection at Route 13/58/460, Bob Foeller Drive, and Welch Parkway. Alternative 1 would connect the eastbound and westbound routes of Routes 13/58/460 and provide eastbound traffic with the ability to reverse direction and enter the facility through Bob Foeller Drive.

Alternative 1 would be used by the City of Suffolk refuse and yard waste trucks and residential traffic to enter the facility and by other traffic wishing to reverse their direction. Motorists would have to use the existing route to exit the SPSA facility to get on Route 13/58/460 WB. To analyze the Alternative 1 conditions, the background traffic was forecast using the growth rates found in the previous section. The a.m. and p.m. peak hour levels of service for study area intersection and ramp were computed by utilizing the Synchro 8.0 and HCM 2010.

5.1.1 Bob Foeller Drive Merge Ramp on to Route 13/58/460 Westbound

The weave segment functions at an acceptable level of service in the a.m. and p.m. peak hour. This is due to the low volumes making the ramp to freeway movement. For analysis results summary, see Table 2 and full reports in Appendix C.

ALTERNATIVE 1



LEGEND

AM Peak Hour Volume

[PM] Peak Hour Volume

Figure 4

5.2 Alternative 2: Rear Access Road to SPSA Facility

Alternative 2 consists of a new access roadway originating at western side of the SPSA property. Alternative 2 would connect to an intersection of Nansemond Parkway and Progress Road. Alternative 2 would only allow one-way thru movement to the SPSA facility for the City of Suffolk refuse and yard waste trucks and residential traffic. Motorists would have to use the existing route to exit the SPSA facility, which is the Bob Foeller Drive ramp to get on Route 13/58/460 WB. Alternative 2 would consist of a one-lane urban local road with a design speed of 30 miles per hour.

To analyze the Alternative 2 conditions, the background traffic was forecast using the growth rates found in the previous section. Unlike Alternative 1 conditions, SPSA projected traffic volumes for the City of Suffolk vehicles accessing the facility were only applied to the turning movements that lead into the facility. The volumes for the City of Suffolk vehicles leaving the facility were added to the Bob Foeller Drive Ramp volumes for analysis of the weave segment of the Route 13/58/460 WB. The a.m. and p.m. peak hour levels of service for study area intersections and ramp were computed by utilizing the Synchro 8.0 and HCM 2010.

5.2.1 Intersection of Route 13/58/460, Bob Foeller Drive, and Welch Parkway

Like Alternative 1 conditions, reducing the amount of vehicles making a left turn movement at this intersection did not improve the level of service. It still functions at unacceptable level of service in the a.m. and p.m. peak hour. This is due to the heavy volumes on the Route 13/58/460 approaches as shown on Figure 6A. For analysis results summary, see Table 1 and full reports in Appendix C.

5.2.2 Bob Foeller Drive Merge Ramp on to Route 13/58/460 Westbound

The weave segment functions at an acceptable level of service in the a.m. and p.m. peak hour. This is due to the low volumes making the ramp to freeway movement. For analysis results summary, see Table 2 and full reports in Appendix C.

5.2.3 Intersection of Nansemond Parkway and Progress Road

The intersection functions at an acceptable level of service in the a.m. peak hour and an unacceptable level of service in the p.m. peak hour. This is due to heavy volumes on Nansemond Parkway approaches as shown on Figure 6B. For analysis results summary, see Table 3 and full reports in Appendix C.

5.2.4 Intersection of Wilroy Road and Progress Road

The intersection functions at an acceptable level of service in the a.m. and p.m. peak hour. Alternative 2 conditions volumes are displayed on Figure 6C. For analysis results summary, see Table 4 and full reports in Appendix C.

5.2.5 Intersection of Wilroy Road and Route 13/58/460 WB off/on Ramps

The intersection functions at an unacceptable level of service in the a.m. and p.m. peak hour. This is due to the intersection being unsignalized and the heavy volume on the Wilroy Road approaches as shown on Figure 6D. For analysis results summary, see Table 5 and full reports in Appendix C.

5.2.6 Intersection of Wilroy Road and Route 13/58/460 EB off/on Ramps: Signalized Intersection

The intersection functions at an acceptable level of service in the a.m. and p.m. peak hour. Alternative 2 conditions volumes are displayed on Figure 6E. For analysis results summary, see Table 6 and full reports in Appendix C.

PROJECT MANAGER _____
SURVEYED BY, DATE _____
DESIGN BY _____
SUBSURFACE UTILITY BY, DATE _____

REVISED	STATE	ROUTE	STATE PROJECT	SHEET NO.
	VA.			



DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

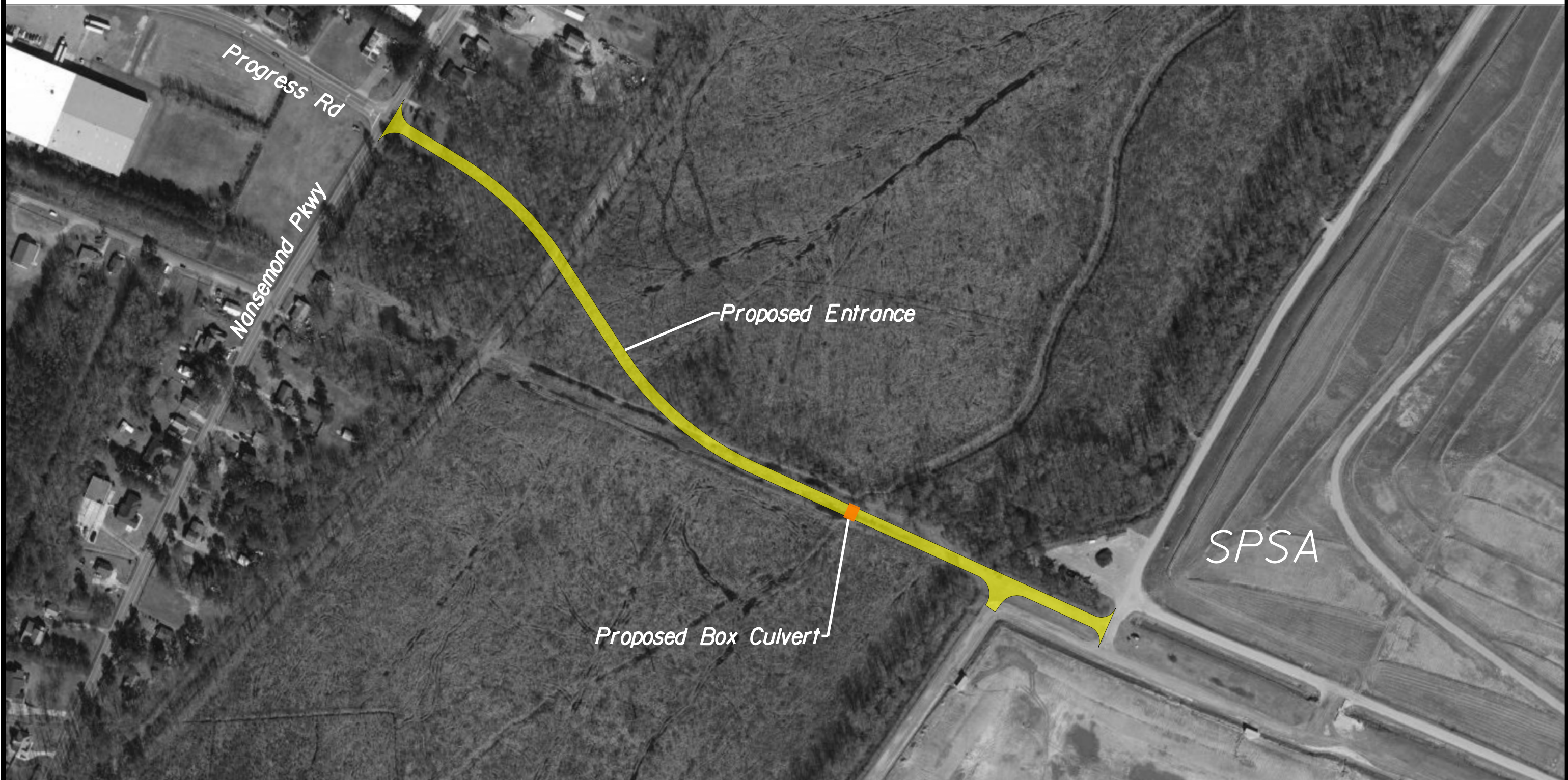
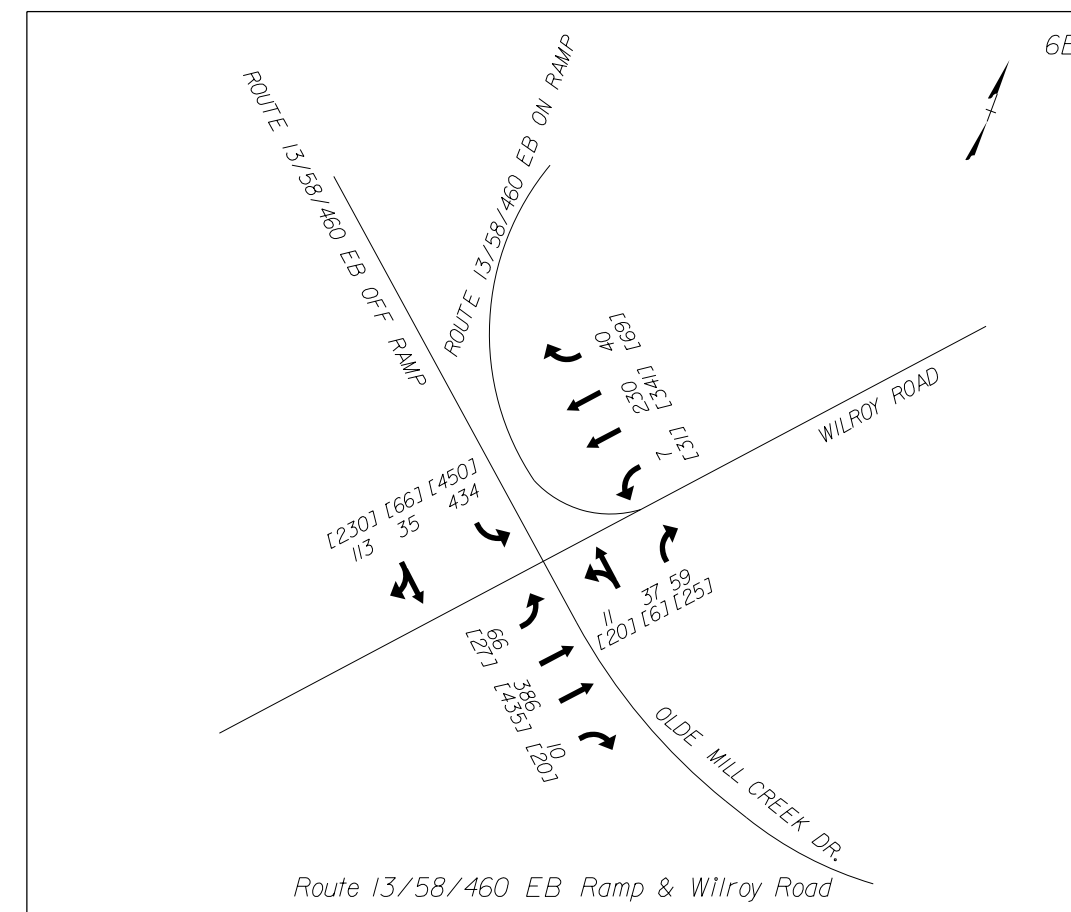
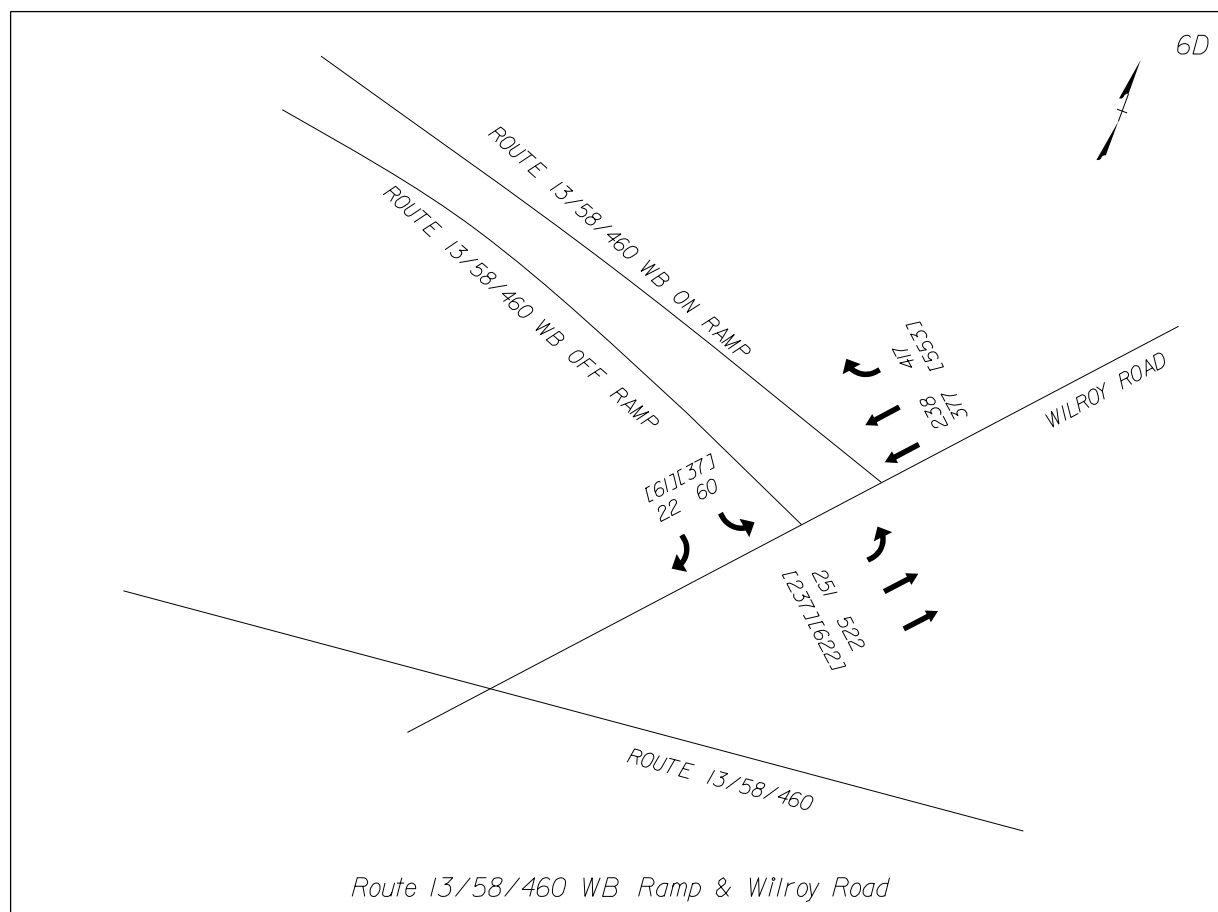
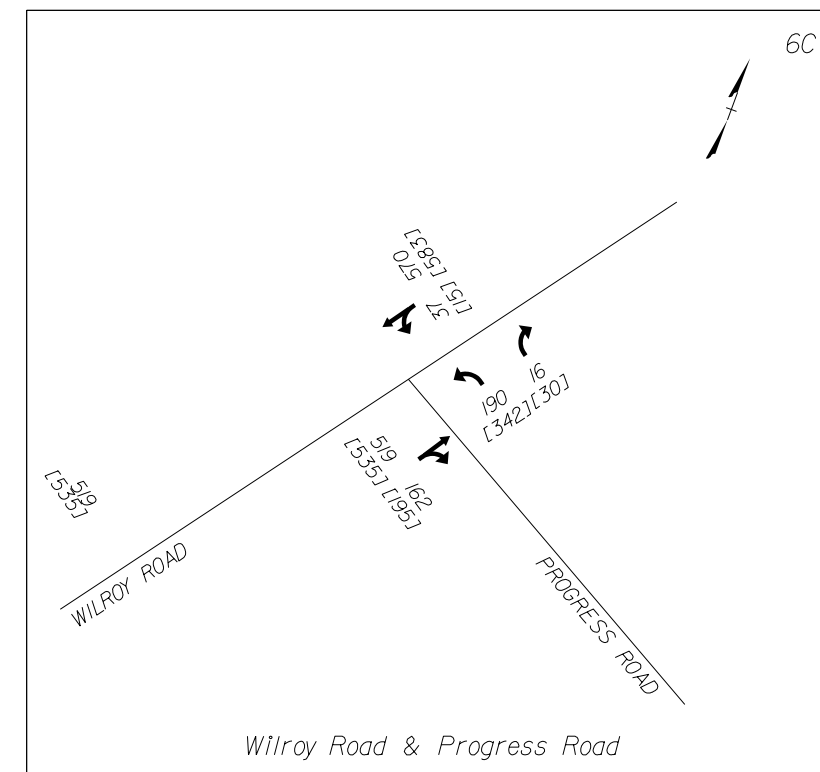
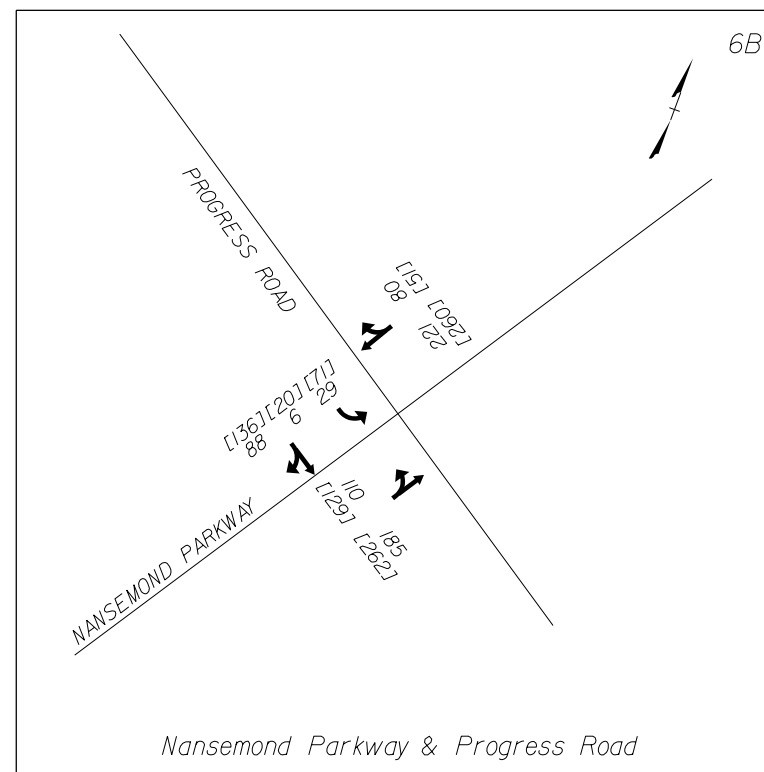
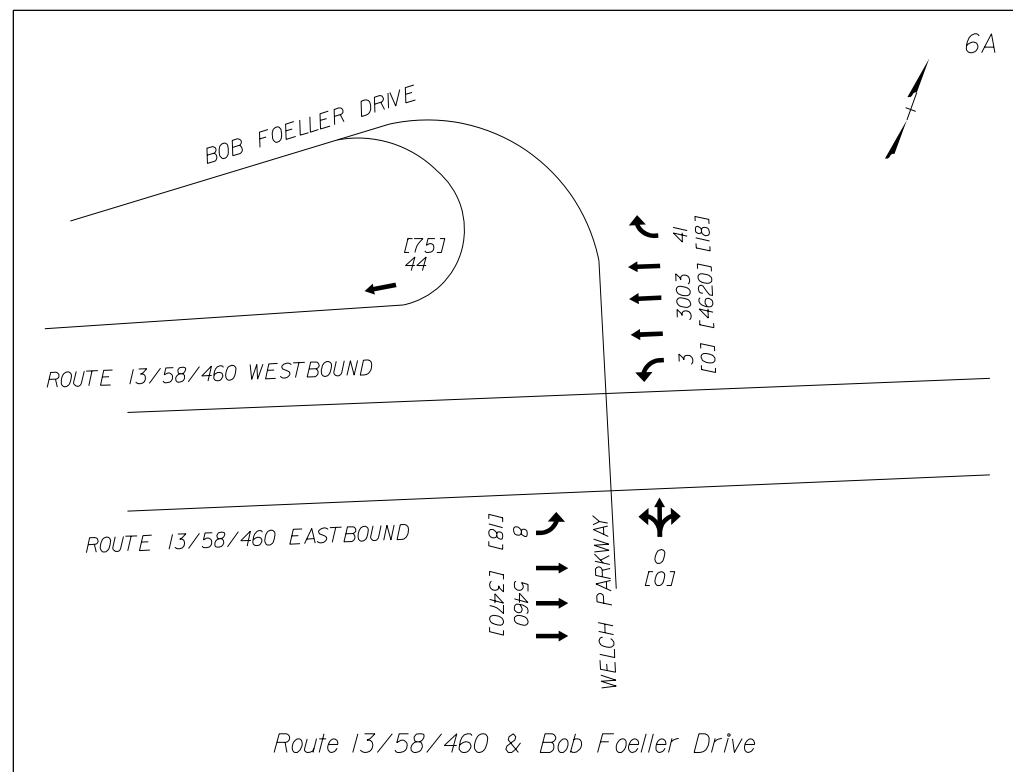


Figure 5 - Proposed Rear Access Road

	PROJECT	SHEET NO.

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ALTERNATIVE 2



LEGEND
 AM Peak Hour Volume
 [PM] Peak Hour Volume

Figure 6

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6 Signal Warrant Analysis

There are three unsignalized intersections within the study area:

- Route 13/58/460 and Bob Foeller Drive
- Nansemond Parkway and Progress Road
- Wilroy Road and Route 13/58/460 WB Ramp

A traffic signal may be justified if one or more of the warrants are met based on the 2009 MUTCD Signal Warrant Analysis methodology. The eight warrants are:

1. Warrant 1, Eight-Hour Vehicular Volume
2. Warrant 2, Four-Hour Vehicular Volume
3. Warrant 3, Peak Hour
4. Warrant 4, Pedestrian Volume
5. Warrant 5, School Crossing
6. Warrant 6, Coordinated Signal System
7. Warrant 7, Crash Experience
8. Warrant 8, Roadway Network
9. Warrant 9, Intersection Near a Grade Crossing

Only Warrant 2 and Warrant 3 apply to this study.

Warrant 2 – This warrant is intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic signal.

Warrant 2 is satisfied when, for each of any four hours of an average day, the plotted points that represent the vehicles per hour on both approaches of the major street and the vehicles per hour on the higher volume minor street approach (same hour), all fall above the curve provided on Figure 4C-1 of the 2009 MUTCD.

Warrant 3 – This warrant is intended to be applied where minor street traffic suffers undue delay when entering or crossing the major street. Warrant 3 is met under two conditions.

Condition A: This condition is met when all three of the following statements are true for the same one hour period of an average day.

1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and
2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and
3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.



Condition B: This condition is met when the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve on Figure 4C-3 of 2009 MUTCD, for the existing combination of approach lanes.

The intersections were analyzed for each of the two warrants for both existing and future scenarios – No-Build, Alternative 1, and Alternative 2.

Table 12 shows the results of the traffic signal warrant analysis for the existing 2016 hourly traffic volumes for the three unsignalized intersections within the study area and Table 13 shows the results based on the future scenarios. Appendix D contains summary worksheets of the traffic volumes, volume thresholds, and analysis results.

Table 12 Signal Warrant Analysis 2016

Intersection	Warrant 2 – Four-Hour Vehicular Volume	Warrant 3 – Peak Hour Vehicular Volume
Route 13/58/460 and Bob Foeller Drive	N/A*	N/A*
Nansemond Parkway & Progress Road	N	N
Wilroy Road and Route 13/58/460 WB Ramp	N	N

Table 13 Warrant 3 Analysis for Proposed Conditions

Intersection	No-Action	Alternative 1	Alternative 2
Route 13/58/460 and Bob Foeller Drive	N/A*	N/A*	N/A*
Nansemond Parkway & Progress Road	N	N	N
Wilroy Road and Route 13/58/460 WB Ramp	N	N	N

* N/A because the minimum threshold limit for minor street is not met.

As presented in Table 12 and Table 13, none of the unsignalized intersection meets Warrant 2 or Warrant 3. Hence, all the current unsignalized intersections are recommended to remain unsignalized based on the MUTCD Signal Warrant Analysis.

7 Recommendation

The poor operational level of service of the unsignalized at the entrance to the Regional Landfill intersection is due to heavy through movements found on Route 13/58/460. Signalization would improve the intersection’s overall level of service of the turning movements; however, this intersection does not meet the MUTCD warrants for signalization. Also, signalizing this divided highway intersection increases the potential for traffic accidents, and is not a viable alternative.

Alternative 1 is the preferred alternative by SPSA to remedy the level of service of the existing entrance to the Regional Landfill for facility traffic originating from the City of Suffolk. Should the flyover not be constructed by the time Cell VII is planned for operation, SPSA would propose for consideration, implementation of Alternative 2. The proposed rear entrance road to the SPSA facility would improve the delay of the turning movements and functionality of the intersection at

Route 13/58/460, Bob Foeller Drive, and Welch Parkway. Alternative 2 would only allow one-way thru movement to the SPSA facility for the Suffolk traffic. With the City of Suffolk vehicles using the Alternative 1 to access the facility, the left turn movement at the intersection of Route 13/58/460 would be minimized. However, even without the vehicles making a left turn to enter SPSA facility, there are enough motorists making a U-turn movement at the intersection that it functions at unacceptable level of service. HDR recommends the entrance to Bob Foeller Drive from the median be removed following completion of a rear access road, in order to restrict vehicles from using the median to enter the facility. Facility signage on eastbound Route 13/58/460 would also be removed.

The proposed alternatives also provide a benefit to the City of Suffolk by eliminating the need for its refuse trucks to make the left hand turn onto Bob Foeller Drive. Potential crashes that may be caused by crossing and turning movements at the intersection of Route 13/58/460 would be minimized by either alternative. The alternatives may also reduce on the road travel time for the collection vehicles and would eliminate the difficult and dangerous crossing of westbound Route 13/58/460 especially during peak traffic times. Alternative 1 would not require any changes to the existing solid waste collection routing for the City as it would be just a more efficient and safe manner to access the facility than the current entrance. Alternative 1 would also maintain the current controlled access into the facility, and not require routing of refuse traffic through the industrial park and residential area to enter the facility through the alternate location.

8 Conclusion

SPSA is proposing to develop Cell VII at the Regional Landfill site and possibly construct and operate a vegetative waste compost facility on the existing property. This Traffic Impact Study analyzed the effect of the No-Build and Alternative 2 conditions at the following intersections and weave segment.

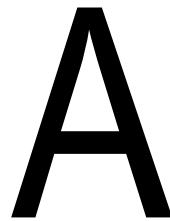
- Route 13/58/460, Bob Foeller Drive, and Welch Parkway
- Bob Foeller Drive Merge Ramp onto Route 13/58/460 WB
- Nanesmond Parkway and Progress Road
- Wilroy Road and Progress Road
- Wilroy Road and East Bound/West Bound Ramps

A capacity analysis was performed on all five locations listed for existing, No-Build and Alternative 2 conditions. For existing conditions, service levels are adequate for both peak periods at the following locations: Bob Foeller Drive Ramp on to Route 13/58/460 WB, Nanesmond Parkway and Progress Road, Wilroy Road and Progress Road, Wilroy Road and East Bound Ramps. Service level is adequate for a.m. peak at Wilroy Road and West Bound Ramps. Service level is inadequate for p.m. peak at Wilroy Road and West Bound Ramps. Service levels are inadequate for both peak periods for Bob Foeller Drive/Welch Parkway and West Military Highway (Route 13/58/460).

Under No-Build conditions, service levels are adequate for both peak periods at the following locations: Bob Foeller Drive Ramp on to Route 13/58/460 WB, Nanesmond Pkwy and Progress Road, Wilroy Road and Progress Road, Wilroy Road and East Bound Ramps. Service levels are inadequate for both peak periods at the following locations: Wilroy Road and West Bound Ramps and Bob Foeller Drive/Welch Parkway and West Military Highway (Route 13/58/460).

For Alternative 1 conditions, service levels for the Bob Foeller Drive ramp onto Route 13/58/460 WB would be adequate for both peak periods since the conflicting turn movements would be removed. Under Alternative 2 conditions, service levels are adequate for both peak periods at the following locations: Bob Foeller Drive Ramp onto Route 13/58/460 WB, Wilroy Road and Progress Road, Wilroy Road and East Bound Ramps. Service level is adequate for a.m. peak at Nansmond Parkway and Progress Road. Service level is inadequate for p.m. peak at Nansmond Parkway and Progress Road. Service levels are inadequate for both peak periods at the following locations: Wilroy Road and West Bound Ramps and Bob Foeller Drive/Welch Parkway and West Military Highway (Route 13/58/460).

Since the proposed conditions for the SPSA site will not cause further measurable deterioration at the intersection of Route 13/58/460, Bob Foeller Drive, and Welch Parkway, it is the preferred option to further the VDOT funded flyover option and eliminate the turning median traffic once an alternative access is provided for City of Suffolk refuse and yard waste vehicles and residents wishing to utilize the facility.

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Appendix A – Annual
Tonnage and Daily Traffic
Projections



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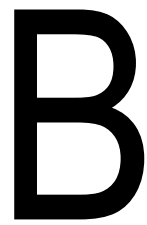
Southeastern Public Service Authority
Regional Landfill
Material and Traffic Summary

Annual Waste Growth 1.0%

	2015 Conditions			2018	MSW Landfill	2018	Residue Landfill	2030	MSW Landfill	2030	Residue Landfill
	Total Yearly Count	Total Tons	Estimated Trips/Day	Estimated Annual Tons ³	Estimated Trips/Day	Estimated Annual Tons ⁴	Estimated Trips/Day	Estimated Annual Tons	Estimated Trips/Day	Estimated Annual Tons	Estimated Trips/Day
SPSA Employees/Visitors	6240		20	0	20	0	20	0	20	0	20
Transfer Station											
Residential Vehicles ⁵	28722	2872	100.4	2959	103.5	2959	103.5	3335	116.6	3335	116.6
Suffolk Commercial Packers ⁵	6080	36054	29.2	37147	30.1	37147	30.1	41858	33.9	41858	33.9
Landfill and Processing Facilities⁵											
Ash Roll Offs	8658	186135	41.6	0	0	0	0	0	0	0	0
RePower Residue	0		0.0	0	0	105000	18.4	0	0	121902	21.3
CDD Roll Offs	3491	10390	16.8	10705	12.6	10705	12.6	12063	14.2	12063	14.2
100 CY Non Processible Trailers	1932	14683	9.3	15128	7.0	15128	7.0	17047	7.8	17047	7.8
100 CY MSW Trailers ¹				334894	58.5	0	0.0	390171	68.2	0	0.0
Daily Cover Dump Trucks/Trailers ²	13345	163450	64.2	252604	72.1	168403	48.1	284640	81.3	189760	54.2
Compost Facility Trucks/Trailers ⁶								20000	35.0	20000	35.0
Other Roll-off/Dump Truck Waste	17023	156418	81.8	161157	61.3	161157	61.3	181596	69.1	181596	69.1
TOTAL	85491	570002	363	814595	365	500499	301	950710	446	587560	372

1. Assumes 20 ton/100 CY trailer on average
2. Assumes worst case conditions. All cover soil procured from off site and 50% more daily cover required over existing conditions for 375,000 MSW landfill, and similar daily cover is required for RePower residue landfill as existing conditions.
3. 2018 MSW Landfill assumes 375,000 tons MSW/yr and similar disposal quantities of other waste and soil materials. Includes waste from Isle of Wight and Franklin Counties that are currently disposed of at alternate location.
4. 2018 Residue Landfill assumed max 105,000 tons residue/yr and similar disposal quantities of other waste and soil materials.
5. Landfill and Transfer Station Open to public 5.5 days per week, Suffolk curbside collection is 4 days per week. SPSA transfer trailers can deliver 7 days per week, but typically deliver 5.5 days per week.
6. Compost Facility assumes maximum of 20,000 tons per year processed, with an average of 2 tons per truck/trailer delivery, operated 5.5 days per week. Yard Waste assumed 500 lb/CY, average truck size 8 CY. 10% of traffic attributed to City of Suffolk.

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Appendix B – Traffic Count
Data



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INTERMODAL ENGINEERING, P.C.

3656 E. Stratford Road
Virginia Beach, VA 23455
intermodalengr@aol.com

SPSA Count

File Name : SPSA41601
Site Code : 00041601
Start Date : 4/13/2016
Page No : 1

Groups Printed- Cars - + Trucks

Start Time	SPSA Southbound			US 58 Westbound			Northbound			US 58 Eastbound				Int. Total
	Left	Thru	Right	U-turn	Thru	Right	Left	Thru	Right	U-turn	Left	Thru	Right	
07:00 AM	0	0	12	2	432	15	0	0	0	3	2	1000	0	1466
07:15 AM	0	0	13	0	482	5	0	0	0	1	1	1042	0	1544
07:30 AM	0	0	6	0	584	4	0	0	0	0	2	1056	0	1652
07:45 AM	0	0	5	0	627	12	0	0	0	2	0	766	0	1412
Total	0	0	36	2	2125	36	0	0	0	6	5	3864	0	6074
08:00 AM	0	0	9	0	544	13	0	0	0	1	8	720	0	1295
08:15 AM	0	0	12	0	521	4	0	0	0	3	1	674	0	1215
08:30 AM	0	0	13	1	565	2	0	0	0	4	12	671	0	1268
08:45 AM	0	0	6	2	504	6	0	0	0	7	4	618	0	1147
Total	0	0	40	3	2134	25	0	0	0	15	25	2683	0	4925
02:00 PM	0	0	10	0	660	18	0	0	0	2	2	552	0	1244
02:15 PM	0	0	12	0	628	7	0	0	0	3	6	598	0	1254
02:30 PM	0	0	15	1	613	15	0	0	0	1	2	631	0	1278
02:45 PM	0	0	11	1	777	14	0	0	0	4	4	566	0	1377
Total	0	0	48	2	2678	54	0	0	0	10	14	2347	0	5153
03:00 PM	0	0	12	2	798	14	0	0	0	1	6	581	0	1414
03:15 PM	0	0	10	0	770	13	0	0	0	5	12	683	0	1493
03:30 PM	0	0	11	0	731	6	0	0	0	1	9	600	0	1358
03:45 PM	0	0	14	0	813	6	0	0	0	3	5	571	0	1412
Total	0	0	47	2	3112	39	0	0	0	10	32	2435	0	5677
04:00 PM	0	0	17	0	844	4	0	0	0	5	2	672	0	1544
04:15 PM	0	0	9	0	882	0	0	0	0	4	1	613	0	1509
Grand Total	0	0	197	9	11775	158	0	0	0	50	79	12614	0	24882
Apprch %	0	0	100	0.1	98.6	1.3	0	0	0	0.4	0.6	99	0	0
Total %	0	0	0.8	0	47.3	0.6	0	0	0	0.2	0.3	50.7	0	0
Cars	0	0	127	9	10955	104	0	0	0	50	56	11771	0	23072
% Cars	0	0	64.5	100	93	65.8	0	0	0	100	70.9	93.3	0	92.7
+ Trucks	0	0	70	0	820	54	0	0	0	0	23	843	0	1810
% + Trucks	0	0	35.5	0	7	34.2	0	0	0	0	29.1	6.7	0	7.3

Start Time	SPSA Southbound				US 58 Westbound				Northbound				US 58 Eastbound					Int. Total
	Left	Thru	Right	App. Total	U-turn	Thru	Right	App. Total	Left	Thru	Right	App. Total	U-turn	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 07:00 AM																		
07:00 AM	0	0	12	12	2	432	15	449	0	0	0	0	3	2	1000	0	1005	1466
07:15 AM	0	0	13	13	0	482	5	487	0	0	0	0	1	1	1042	0	1044	1544
07:30 AM	0	0	6	6	0	584	4	588	0	0	0	0	0	2	1056	0	1058	1652
07:45 AM	0	0	5	5	0	627	12	639	0	0	0	0	2	0	766	0	768	1412
Total Volume	0	0	36	36	2	2125	36	2163	0	0	0	0	6	5	3864	0	3875	6074
% App. Total	0	0	100		0.1	98.2	1.7		0	0	0		0.2	0.1	99.7	0		
PHF	.000	.000	.692	.692	.250	.847	.600	.846	.000	.000	.000	.000	.500	.625	.915	.000	.916	.919

INTERMODAL ENGINEERING, P.C.

3656 E. Stratford Road
Virginia Beach, VA 23455
intermodalengr@aol.com

SPSA Count

File Name : SPSA41601
Site Code : 00041601
Start Date : 4/13/2016
Page No : 2

Start Time	SPSA Southbound				US 58 Westbound				Northbound				US 58 Eastbound				Int. Total	
	Left	Thru	Right	App. Total	U-turn	Thru	Right	App. Total	Left	Thru	Right	App. Total	U-turn	Left	Thru	Right		App. Total
Peak Hour Analysis From 12:00 PM to 04:15 PM - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 03:30 PM																		
03:30 PM	0	0	11	11	0	731	6	737	0	0	0	0	1	9	600	0	610	1358
03:45 PM	0	0	14	14	0	813	6	819	0	0	0	0	3	5	571	0	579	1412
04:00 PM	0	0	17	17	0	844	4	848	0	0	0	0	5	2	672	0	679	1544
04:15 PM	0	0	9	9	0	882	0	882	0	0	0	0	4	1	613	0	618	1509
Total Volume	0	0	51	51	0	3270	16	3286	0	0	0	0	13	17	2456	0	2486	5823
% App. Total	0	0	100		0	99.5	0.5		0	0	0		0.5	0.7	98.8	0		
PHF	.000	.000	.750	.750	.000	.927	.667	.931	.000	.000	.000	.000	.650	.472	.914	.000	.915	.943

INTERMODAL ENGINEERING, P.C.

3656 E. Stratford Road
Virginia Beach, VA 23455
intermodalengr@aol.com

SPSA Count
City of Suffolk Counts

File Name : SPSA41602 segregated
Site Code : 00041602
Start Date : 4/13/2016
Page No : 1

Groups Printed- City of Suffolk Trucks - Bank 1

Start Time	SPSA Southbound		US 58 Eastbound		Int. Total
	Right	Left	Right	Left	
07:00 AM	3			1	4
Total	3			1	4
08:00 AM	0			2	2
08:15 AM	2			0	2
08:30 AM	1			1	2
Total	3			3	6
02:00 PM	1			0	1
02:15 PM	3			2	5
02:30 PM	2			0	2
02:45 PM	0			1	1
Total	6			3	9
03:00 PM	3			2	5
03:30 PM	0			1	1
Total	3			3	6
Grand Total	15			10	25
Aprch %	100			100	
Total %	60			40	
City of Suffolk Trucks	15			10	25
% City of Suffolk Trucks	100			100	100
Bank 1	0			0	0
% Bank 1	0			0	0

SPSA Counts: Wilroy Road Area

File Name : SPSA61604 Nansemond & Progress

Site Code : 61604

AM Counted: 6/2/2016

Start Date : 6/2/2016

PM Counted: 6/2/2016

Page No : 1

Groups Printed- All Vehicles -

Start Time	Nansemond Pkwy Southbound			Progress Rd Westbound			Nansemond Pkwy Northbound			Progress Rd Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	37	19	0	0	0	15	36	0	2	0	10	119
07:15 AM	0	37	4	0	0	0	12	32	1	5	0	18	109
07:30 AM	0	39	10	0	0	0	24	26	0	3	0	19	121
07:45 AM	0	33	20	0	0	0	22	27	0	9	0	11	122
Total	0	146	53	0	0	0	73	121	1	19	0	58	471
08:00 AM	0	39	9	0	0	0	27	25	0	5	2	11	118
08:15 AM	0	34	12	0	0	0	17	29	0	3	0	8	103
08:30 AM	0	29	10	0	0	0	22	36	0	1	0	13	111
08:45 AM	1	30	13	0	0	0	21	17	0	3	0	4	89
Total	1	132	44	0	0	0	87	107	0	12	2	36	421
02:00 PM	0	32	8	0	0	0	16	32	0	11	2	21	122
02:15 PM	0	28	13	0	0	0	20	34	0	11	0	9	115
02:30 PM	0	24	7	0	0	0	20	27	0	12	0	15	105
02:45 PM	0	35	10	0	0	0	17	33	0	12	0	9	116
Total	0	119	38	0	0	0	73	126	0	46	2	54	458
03:00 PM	0	33	10	0	0	0	14	37	0	8	2	25	129
03:15 PM	0	27	9	0	0	0	25	23	0	3	2	18	107
03:30 PM	0	38	10	0	0	0	24	52	0	13	0	42	179
03:45 PM	0	48	8	0	0	0	27	42	0	10	0	16	151
Total	0	146	37	0	0	0	90	154	0	34	4	101	566
04:00 PM	0	41	9	0	0	0	13	48	0	15	0	20	146
04:15 PM	0	45	7	0	0	0	21	31	0	9	0	12	125
Grand Total	1	629	188	0	0	0	357	587	1	135	8	281	2187
Apprch %	0.1	76.9	23	0	0	0	37.8	62.1	0.1	31.8	1.9	66.3	
Total %	0	28.8	8.6	0	0	0	16.3	26.8	0	6.2	0.4	12.8	
All Vehicles	0	622	185	0	0	0	336	573	1	133	8	267	2125
% All Vehicles	0	98.9	98.4	0	0	0	94.1	97.6	100	98.5	100	95	97.2
	1	7	3	0	0	0	21	14	0	2	0	14	62
%	100	1.1	1.6	0	0	0	5.9	2.4	0	1.5	0	5	2.8

Start Time	Nansemond Pkwy Southbound				Progress Rd Westbound				Nansemond Pkwy Northbound				Progress Rd Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	37	19	56	0	0	0	0	15	36	0	51	2	0	10	12	119
07:15 AM	0	37	4	41	0	0	0	0	12	32	1	45	5	0	18	23	109
07:30 AM	0	39	10	49	0	0	0	0	24	26	0	50	3	0	19	22	121
07:45 AM	0	33	20	53	0	0	0	0	22	27	0	49	9	0	11	20	122
Total Volume	0	146	53	199	0	0	0	0	73	121	1	195	19	0	58	77	471
% App. Total	0	73.4	26.6		0	0	0		37.4	62.1	0.5		24.7	0	75.3		
PHF	.000	.936	.663	.888	.000	.000	.000	.000	.760	.840	.250	.956	.528	.000	.763	.837	.965

Peak Hour Analysis From 12:00 PM to 04:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:30 PM																	
03:30 PM	0	38	10	48	0	0	0	0	24	52	0	76	13	0	42	55	179
03:45 PM	0	48	8	56	0	0	0	0	27	42	0	69	10	0	16	26	151
04:00 PM	0	41	9	50	0	0	0	0	13	48	0	61	15	0	20	35	146
04:15 PM	0	45	7	52	0	0	0	0	21	31	0	52	9	0	12	21	125
Total Volume	0	172	34	206	0	0	0	0	85	173	0	258	47	0	90	137	601
% App. Total	0	83.5	16.5		0	0	0		32.9	67.1	0		34.3	0	65.7		
PHF	.000	.896	.850	.920	.000	.000	.000	.000	.787	.832	.000	.849	.783	.000	.536	.623	.839

SPSA Counts: Wilroy Road Area

File Name : SPSA61604 Nansemond & Progress

Site Code : 61604

AM Counted: 6/2/2016

Start Date : 6/2/2016

PM Counted: 6/2/2016

Page No : 1

Groups Printed- Trucks

Start Time	Nansemond Pkwy Southbound			Progress Rd Westbound			Nansemond Pkwy Northbound			Progress Rd Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	1	0	0	0	1	4	0	0	0	0	6
07:15 AM	0	0	0	0	0	0	0	4	0	0	0	4	8
07:30 AM	0	0	0	0	0	0	1	1	0	0	0	1	3
07:45 AM	0	0	0	0	0	0	1	0	0	1	0	2	4
Total	0	0	1	0	0	0	3	9	0	1	0	7	21
08:00 AM	0	0	0	0	0	0	3	0	0	0	0	0	3
08:15 AM	0	1	0	0	0	0	0	1	0	0	0	0	2
08:30 AM	0	0	0	0	0	0	1	1	0	0	0	1	3
08:45 AM	1	0	0	0	0	0	2	0	0	0	0	0	3
Total	1	1	0	0	0	0	6	2	0	0	0	1	11
02:00 PM	0	1	0	0	0	0	0	1	0	0	0	1	3
02:15 PM	0	1	1	0	0	0	2	0	0	0	0	1	5
02:30 PM	0	0	0	0	0	0	0	0	0	1	0	0	1
02:45 PM	0	0	0	0	0	0	2	1	0	0	0	0	3
Total	0	2	1	0	0	0	4	2	0	1	0	2	12
03:00 PM	0	1	0	0	0	0	1	0	0	0	0	1	3
03:15 PM	0	0	1	0	0	0	1	0	0	0	0	0	2
03:30 PM	0	0	0	0	0	0	2	1	0	0	0	1	4
03:45 PM	0	1	0	0	0	0	1	0	0	0	0	1	3
Total	0	2	1	0	0	0	5	1	0	0	0	3	12
04:00 PM	0	1	0	0	0	0	1	0	0	0	0	0	2
04:15 PM	0	1	0	0	0	0	2	0	0	0	0	1	4
Grand Total	1	7	3	0	0	0	21	14	0	2	0	14	62
Apprch %	9.1	63.6	27.3	0	0	0	60	40	0	12.5	0	87.5	
Total %	1.6	11.3	4.8	0	0	0	33.9	22.6	0	3.2	0	22.6	

Start Time	Nansemond Pkwy Southbound				Progress Rd Westbound				Nansemond Pkwy Northbound				Progress Rd Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	0	1	1	0	0	0	0	1	4	0	5	0	0	0	0	6
07:15 AM	0	0	0	0	0	0	0	0	0	4	0	4	0	0	4	4	8
07:30 AM	0	0	0	0	0	0	0	0	1	1	0	2	0	0	1	1	3
07:45 AM	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	3	4
Total Volume	0	0	1	1	0	0	0	0	3	9	0	12	1	0	7	8	21
% App. Total	0	0	100		0	0	0		25	75	0		12.5	0	87.5		
PHF	.000	.000	.250	.250	.000	.000	.000	.000	.750	.563	.000	.600	.250	.000	.438	.500	.656

Peak Hour Analysis From 12:00 PM to 04:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:30 PM																	
03:30 PM	0	0	0	0	0	0	0	0	2	1	0	3	0	0	1	1	4
03:45 PM	0	1	0	1	0	0	0	0	1	0	0	1	0	0	1	1	3
04:00 PM	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	2
04:15 PM	0	1	0	1	0	0	0	0	2	0	0	2	0	0	1	1	4
Total Volume	0	3	0	3	0	0	0	0	6	1	0	7	0	0	3	3	13
% App. Total	0	100	0		0	0	0		85.7	14.3	0		0	0	100		
PHF	.000	.750	.000	.750	.000	.000	.000	.000	.750	.250	.000	.583	.000	.000	.750	.750	.813

SPSA Counts: Wilroy Road Area

File Name : SPSA61603 Wilroy & Progress

Site Code : 61603

AM Counted: 6/02/2016

Start Date : 6/2/2016

PM Counted: 6/14/2016

Page No : 1

Groups Printed- All Vehicles -

Start Time	Wilroy Rd Southbound			Progress Rd Westbound			Wilroy Rd Northbound			Progress Rd Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	85	0	33	1	6	0	75	18	0	0	0	218
07:15 AM	4	65	1	15	0	1	0	64	13	0	0	0	163
07:30 AM	4	110	0	51	2	6	0	105	14	0	0	0	292
07:45 AM	9	105	0	29	0	1	0	92	33	0	0	0	269
Total	17	365	1	128	3	14	0	336	78	0	0	0	942
08:00 AM	9	83	1	32	1	0	0	83	37	0	0	0	246
08:15 AM	3	91	0	18	0	1	0	75	23	0	0	0	211
08:30 AM	2	68	0	35	0	2	0	93	31	0	0	0	231
08:45 AM	5	81	1	24	0	1	0	71	22	0	0	0	205
Total	19	323	2	109	1	4	0	322	113	0	0	0	893
02:00 PM	1	79	0	33	0	6	0	81	22	0	0	0	222
02:15 PM	2	69	0	31	0	3	0	88	44	0	0	0	237
02:30 PM	3	93	0	21	0	2	0	83	9	0	0	0	211
02:45 PM	0	113	0	0	0	0	0	38	10	0	0	0	161
Total	6	354	0	85	0	11	0	290	85	0	0	0	831
03:00 PM	2	84	0	83	0	7	0	108	51	0	0	0	335
03:15 PM	0	99	0	46	0	2	0	85	23	0	0	0	255
03:30 PM	5	104	0	68	0	11	0	91	26	0	0	0	305
03:45 PM	3	112	0	46	1	0	0	82	20	0	0	0	264
Total	10	399	0	243	1	20	0	366	120	0	0	0	1159
04:00 PM	3	129	0	34	1	1	0	95	25	0	0	0	288
04:15 PM	2	146	0	27	2	1	0	71	19	0	0	0	268
Grand Total	57	1716	3	626	8	51	0	1480	440	0	0	0	4381
Apprch %	3.2	96.6	0.2	91.4	1.2	7.4	0	77.1	22.9	0	0	0	
Total %	1.3	39.2	0.1	14.3	0.2	1.2	0	33.8	10	0	0	0	
All Vehicles	53	1654	3	568	8	51	0	1427	403	0	0	0	4167
% All Vehicles	93	96.4	100	90.7	100	100	0	96.4	91.6	0	0	0	95.1
	4	62	0	58	0	0	0	53	37	0	0	0	214
%	7	3.6	0	9.3	0	0	0	3.6	8.4	0	0	0	4.9

Start Time	Wilroy Rd Southbound				Progress Rd Westbound				Wilroy Rd Northbound				Progress Rd Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	4	110	0	114	51	2	6	59	0	105	14	119	0	0	0	0	292
07:45 AM	9	105	0	114	29	0	1	30	0	92	33	125	0	0	0	0	269
08:00 AM	9	83	1	93	32	1	0	33	0	83	37	120	0	0	0	0	246
08:15 AM	3	91	0	94	18	0	1	19	0	75	23	98	0	0	0	0	211
Total Volume	25	389	1	415	130	3	8	141	0	355	107	462	0	0	0	0	1018
% App. Total	6	93.7	0.2		92.2	2.1	5.7		0	76.8	23.2		0	0	0		
PHF	.694	.884	.250	.910	.637	.375	.333	.597	.000	.845	.723	.924	.000	.000	.000	.000	.872

Peak Hour Analysis From 12:00 PM to 04:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:00 PM																	
03:00 PM	2	84	0	86	83	0	7	90	0	108	51	159	0	0	0	0	335
03:15 PM	0	99	0	99	46	0	2	48	0	85	23	108	0	0	0	0	255
03:30 PM	5	104	0	109	68	0	11	79	0	91	26	117	0	0	0	0	305
03:45 PM	3	112	0	115	46	1	0	47	0	82	20	102	0	0	0	0	264
Total Volume	10	399	0	409	243	1	20	264	0	366	120	486	0	0	0	0	1159
% App. Total	2.4	97.6	0		92	0.4	7.6		0	75.3	24.7		0	0	0		
PHF	.500	.891	.000	.889	.732	.250	.455	.733	.000	.847	.588	.764	.000	.000	.000	.000	.865

SPSA Counts: Wilroy Road Area

File Name : SPSA61603 Wilroy & Progress

Site Code : 61603

AM Counted: 6/02/2016

Start Date : 6/2/2016

PM Counted: 6/14/2016

Page No : 1

Groups Printed- Trucks

Start Time	Wilroy Rd Southbound			Progress Rd Westbound			Wilroy Rd Northbound			Progress Rd Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	2	0	3	0	0	0	1	2	0	0	0	8
07:15 AM	0	0	0	1	0	0	0	2	1	0	0	0	4
07:30 AM	0	3	0	5	0	0	0	2	2	0	0	0	12
07:45 AM	0	2	0	1	0	0	0	1	1	0	0	0	5
Total	0	7	0	10	0	0	0	6	6	0	0	0	29
08:00 AM	0	0	0	4	0	0	0	1	3	0	0	0	8
08:15 AM	0	2	0	1	0	0	0	2	2	0	0	0	7
08:30 AM	0	1	0	3	0	0	0	3	4	0	0	0	11
08:45 AM	1	2	0	1	0	0	0	3	3	0	0	0	10
Total	1	5	0	9	0	0	0	9	12	0	0	0	36
02:00 PM	0	9	0	8	0	0	0	5	1	0	0	0	23
02:15 PM	1	3	0	10	0	0	0	3	2	0	0	0	19
02:30 PM	0	10	0	0	0	0	0	3	0	0	0	0	13
02:45 PM	0	3	0	0	0	0	0	1	1	0	0	0	5
Total	1	25	0	18	0	0	0	12	4	0	0	0	60
03:00 PM	1	3	0	8	0	0	0	7	5	0	0	0	24
03:15 PM	0	1	0	1	0	0	0	4	1	0	0	0	7
03:30 PM	0	7	0	4	0	0	0	3	3	0	0	0	17
03:45 PM	0	4	0	5	0	0	0	5	2	0	0	0	16
Total	1	15	0	18	0	0	0	19	11	0	0	0	64
04:00 PM	0	5	0	1	0	0	0	5	1	0	0	0	12
04:15 PM	1	5	0	2	0	0	0	2	3	0	0	0	13
Grand Total	4	62	0	58	0	0	0	53	37	0	0	0	214
Apprch %	6.1	93.9	0	100	0	0	0	58.9	41.1	0	0	0	
Total %	1.9	29	0	27.1	0	0	0	24.8	17.3	0	0	0	

Start Time	Wilroy Rd Southbound				Progress Rd Westbound				Wilroy Rd Northbound				Progress Rd Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	0	0	4	0	0	4	0	1	3	4	0	0	0	0	8
08:15 AM	0	2	0	2	1	0	0	1	0	2	2	4	0	0	0	0	7
08:30 AM	0	1	0	1	3	0	0	3	0	3	4	7	0	0	0	0	11
08:45 AM	1	2	0	3	1	0	0	1	0	3	3	6	0	0	0	0	10
Total Volume	1	5	0	6	9	0	0	9	0	9	12	21	0	0	0	0	36
% App. Total	16.7	83.3	0		100	0	0		0	42.9	57.1		0	0	0		
PHF	.250	.625	.000	.500	.563	.000	.000	.563	.000	.750	.750	.750	.000	.000	.000	.000	.818

Peak Hour Analysis From 12:00 PM to 04:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:00 PM																	
03:00 PM	1	3	0	4	8	0	0	8	0	7	5	12	0	0	0	0	24
03:15 PM	0	1	0	1	1	0	0	1	0	4	1	5	0	0	0	0	7
03:30 PM	0	7	0	7	4	0	0	4	0	3	3	6	0	0	0	0	17
03:45 PM	0	4	0	4	5	0	0	5	0	5	2	7	0	0	0	0	16
Total Volume	1	15	0	16	18	0	0	18	0	19	11	30	0	0	0	0	64
% App. Total	6.2	93.8	0		100	0	0		0	63.3	36.7		0	0	0		
PHF	.250	.536	.000	.571	.563	.000	.000	.563	.000	.679	.550	.625	.000	.000	.000	.000	.667

Intermodal Engineering, P.C.
intermodalengr@aol.com

SPSA Counts: Wilroy Road Area

File Name : SPSA61601 Wilroy & EB ramps

AM Counted: 6/2/2016

Site Code : 00061601

PM Counted: 6/2/2016

Start Date : 6/2/2016

Page No : 1

Groups Printed- All Vehicles

Start Time	Wilroy Rd Southbound			Olde Mill Rd Westbound				Wilroy Rd Northbound			EB Rt 58 ramp Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
07:00 AM	1	30	7	3	7	5	19	71	1	51	0	14	209	
07:15 AM	3	24	5	1	9	7	19	67	1	61	2	15	214	
07:30 AM	2	42	10	3	8	8	11	56	2	86	5	18	251	
07:45 AM	0	50	5	2	6	16	17	79	3	83	5	17	283	
Total	6	146	27	9	30	36	66	273	7	281	12	64	957	
08:00 AM	0	32	6	2	7	12	12	67	2	65	8	26	239	
08:15 AM	3	39	7	1	5	6	7	71	0	69	7	19	234	
08:30 AM	1	33	8	1	3	8	12	65	2	68	6	24	231	
08:45 AM	5	30	7	0	0	5	6	57	0	48	4	20	182	
Total	9	134	28	4	15	31	37	260	4	250	25	89	886	
02:00 PM	1	35	11	2	0	2	7	53	4	65	7	27	214	
02:15 PM	6	45	11	2	3	6	6	77	4	62	5	38	265	
02:30 PM	8	62	8	3	3	12	2	63	3	65	5	30	264	
02:45 PM	3	46	8	1	2	4	4	64	3	50	2	33	220	
Total	18	188	38	8	8	24	19	257	14	242	19	128	963	
03:00 PM	9	48	17	2	0	11	3	68	2	61	9	38	268	
03:15 PM	4	58	7	4	1	2	5	88	3	82	18	47	319	
03:30 PM	5	63	16	8	1	4	8	82	6	74	14	36	317	
03:45 PM	4	58	11	1	0	5	4	64	2	71	7	42	269	
Total	22	227	51	15	2	22	20	302	13	288	48	163	1173	
04:00 PM	9	62	15	1	2	7	2	74	3	77	8	38	298	
04:15 PM	3	66	13	3	2	5	3	74	4	79	8	46	306	
Grand Total	67	823	172	40	59	125	147	1240	45	1217	120	528	4583	
Apprch %	6.3	77.5	16.2	17.9	26.3	55.8	10.3	86.6	3.1	65.3	6.4	28.3		
Total %	1.5	18	3.8	0.9	1.3	2.7	3.2	27.1	1	26.6	2.6	11.5		

Start Time	Wilroy Rd Southbound				Olde Mill Rd Westbound				Wilroy Rd Northbound				EB Rt 58 ramp Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	2	42	10	54	3	8	8	19	11	56	2	69	86	5	18	109	251
07:45 AM	0	50	5	55	2	6	16	24	17	79	3	99	83	5	17	105	283
08:00 AM	0	32	6	38	2	7	12	21	12	67	2	81	65	8	26	99	239
08:15 AM	3	39	7	49	1	5	6	12	7	71	0	78	69	7	19	95	234
Total Volume	5	163	28	196	8	26	42	76	47	273	7	327	303	25	80	408	1007
% App. Total	2.6	83.2	14.3		10.5	34.2	55.3		14.4	83.5	2.1		74.3	6.1	19.6		
PHF	.417	.815	.700	.891	.667	.813	.656	.792	.691	.864	.583	.826	.881	.781	.769	.936	.890

Peak Hour Analysis From 12:00 PM to 04:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:15 PM																	
03:15 PM	4	58	7	69	4	1	2	7	5	88	3	96	82	18	47	147	319
03:30 PM	5	63	16	84	8	1	4	13	8	82	6	96	74	14	36	124	317
03:45 PM	4	58	11	73	1	0	5	6	4	64	2	70	71	7	42	120	269
04:00 PM	9	62	15	86	1	2	7	10	2	74	3	79	77	8	38	123	298
Total Volume	22	241	49	312	14	4	18	36	19	308	14	341	304	47	163	514	1203
% App. Total	7.1	77.2	15.7		38.9	11.1	50		5.6	90.3	4.1		59.1	9.1	31.7		
PHF	.611	.956	.766	.907	.438	.500	.643	.692	.594	.875	.583	.888	.927	.653	.867	.874	.943

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SPSA Counts: Wilroy Road Area

File Name : SPSA61601 Wilroy & EB ramps

AM Counted: 6/2/2016

Site Code : 00061601

PM Counted: 6/2/2016

Start Date : 6/2/2016

Page No : 1

Groups Printed- Trucks

Start Time	Wilroy Rd Southbound			Olde Mill Rd Westbound			Wilroy Rd Northbound			EB Rt 58 ramp Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	0	0	0	0	1	1	0	3	0	3	8
07:15 AM	0	0	0	0	0	0	0	3	0	2	0	1	6
07:30 AM	0	0	4	0	0	0	0	3	0	4	0	1	12
07:45 AM	0	0	0	0	0	0	2	3	0	2	0	1	8
Total	0	0	4	0	0	0	3	10	0	11	0	6	34
08:00 AM	0	1	1	0	0	0	0	4	0	5	0	0	11
08:15 AM	0	2	1	0	0	0	0	1	0	5	0	2	11
08:30 AM	0	1	2	0	0	0	0	4	0	4	0	0	11
08:45 AM	0	2	0	0	0	0	0	1	0	3	0	4	10
Total	0	6	4	0	0	0	0	10	0	17	0	6	43
02:00 PM	0	1	2	0	0	0	1	1	0	4	0	0	9
02:15 PM	0	0	6	0	0	0	0	2	0	0	0	2	10
02:30 PM	0	1	2	0	0	0	0	3	0	5	0	1	12
02:45 PM	0	0	4	0	0	0	0	1	0	1	0	4	10
Total	0	2	14	0	0	0	1	7	0	10	0	7	41
03:00 PM	0	0	5	0	0	0	0	2	0	2	0	2	11
03:15 PM	0	1	1	0	0	0	3	1	0	6	0	1	13
03:30 PM	0	0	1	0	0	0	0	0	0	1	0	2	4
03:45 PM	0	2	3	0	0	0	1	0	0	0	0	3	9
Total	0	3	10	0	0	0	4	3	0	9	0	8	37
04:00 PM	0	1	2	0	0	0	0	2	0	1	0	1	7
04:15 PM	0	1	1	0	0	0	0	2	0	3	0	0	7
Grand Total	0	13	35	0	0	0	8	34	0	51	0	28	169
Apprch %	0	27.1	72.9	0	0	0	19	81	0	64.6	0	35.4	
Total %	0	7.7	20.7	0	0	0	4.7	20.1	0	30.2	0	16.6	

Start Time	Wilroy Rd Southbound				Olde Mill Rd Westbound				Wilroy Rd Northbound				EB Rt 58 ramp Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	1	1	2	0	0	0	0	0	4	0	4	5	0	0	5	11
08:15 AM	0	2	1	3	0	0	0	0	0	1	0	1	5	0	2	7	11
08:30 AM	0	1	2	3	0	0	0	0	0	4	0	4	4	0	0	4	11
08:45 AM	0	2	0	2	0	0	0	0	0	1	0	1	3	0	4	7	10
Total Volume	0	6	4	10	0	0	0	0	0	10	0	10	17	0	6	23	43
% App. Total	0	60	40		0	0	0		0	100	0		73.9	0	26.1		
PHF	.000	.750	.500	.833	.000	.000	.000	.000	.000	.625	.000	.625	.850	.000	.375	.821	.977

Peak Hour Analysis From 12:00 PM to 04:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 02:30 PM																	
02:30 PM	0	1	2	3	0	0	0	0	0	3	0	3	5	0	1	6	12
02:45 PM	0	0	4	4	0	0	0	0	0	1	0	1	1	0	4	5	10
03:00 PM	0	0	5	5	0	0	0	0	0	2	0	2	2	0	2	4	11
03:15 PM	0	1	1	2	0	0	0	0	3	1	0	4	6	0	1	7	13
Total Volume	0	2	12	14	0	0	0	0	3	7	0	10	14	0	8	22	46
% App. Total	0	14.3	85.7		0	0	0		30	70	0		63.6	0	36.4		
PHF	.000	.500	.600	.700	.000	.000	.000	.000	.250	.583	.000	.625	.583	.000	.500	.786	.885

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SPSA Counts: Wilroy Road Area

File Name : SPSA61602 Wilroy & WB ramps

Site Code : 00061602

AM Counted: 6/2/2016

Start Date : 6/2/2016

PM Counted: 6/2/2016

Page No : 1

Groups Printed- All Vehicles

Start Time	Wilroy Rd Southbound			Westbound			Wilroy Rd Northbound			WB Rt 58 ramp Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	37	71	0	0	0	35	89	0	9	0	4	245
07:15 AM	0	32	82	0	0	0	36	91	0	8	0	4	253
07:30 AM	0	42	82	0	0	0	36	93	0	7	0	7	267
07:45 AM	0	37	64	0	0	0	61	65	0	12	0	3	242
Total	0	148	299	0	0	0	168	338	0	36	0	18	1007
08:00 AM	0	38	81	0	0	0	34	95	0	13	0	3	264
08:15 AM	0	46	58	0	0	0	41	100	0	9	0	2	256
08:30 AM	0	42	61	0	0	0	26	102	0	8	0	3	242
08:45 AM	0	41	67	0	0	0	35	73	0	7	0	2	225
Total	0	167	267	0	0	0	136	370	0	37	0	10	987
02:00 PM	0	34	39	0	1	0	30	69	0	2	1	8	184
02:15 PM	0	62	63	0	0	0	42	92	0	7	0	11	277
02:30 PM	0	51	46	0	0	0	38	78	0	8	0	7	228
02:45 PM	0	55	60	0	0	0	38	87	0	3	0	7	250
Total	0	202	208	0	1	0	148	326	0	20	1	33	939
03:00 PM	0	58	83	0	0	0	66	84	0	4	0	15	310
03:15 PM	0	51	90	0	0	0	48	120	0	7	0	10	326
03:30 PM	0	76	114	0	0	0	42	95	0	10	0	9	346
03:45 PM	0	56	81	0	0	0	29	95	0	2	0	13	276
Total	0	241	368	0	0	0	185	394	0	23	0	47	1258
04:00 PM	0	75	93	0	0	0	43	102	0	6	0	10	329
04:15 PM	0	62	90	0	0	0	27	119	0	9	0	17	324
Grand Total	0	895	1325	0	1	0	707	1649	0	131	1	135	4844
Apprch %	0	40.3	59.7	0	100	0	30	70	0	49.1	0.4	50.6	
Total %	0	18.5	27.4	0	0	0	14.6	34	0	2.7	0	2.8	

Start Time	Wilroy Rd Southbound				Westbound				Wilroy Rd Northbound				WB Rt 58 ramp Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30 AM																	
07:30 AM	0	42	82	124	0	0	0	0	36	93	0	129	7	0	7	14	267
07:45 AM	0	37	64	101	0	0	0	0	61	65	0	126	12	0	3	15	242
08:00 AM	0	38	81	119	0	0	0	0	34	95	0	129	13	0	3	16	264
08:15 AM	0	46	58	104	0	0	0	0	41	100	0	141	9	0	2	11	256
Total Volume	0	163	285	448	0	0	0	0	172	353	0	525	41	0	15	56	1029
% App. Total	0	36.4	63.6		0	0	0		32.8	67.2	0		73.2	0	26.8		
PHF	.000	.886	.869	.903	.000	.000	.000	.000	.705	.883	.000	.931	.788	.000	.536	.875	.963

Peak Hour Analysis From 12:00 PM to 04:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:15 PM																	
03:15 PM	0	51	90	141	0	0	0	0	48	120	0	168	7	0	10	17	326
03:30 PM	0	76	114	190	0	0	0	0	42	95	0	137	10	0	9	19	346
03:45 PM	0	56	81	137	0	0	0	0	29	95	0	124	2	0	13	15	276
04:00 PM	0	75	93	168	0	0	0	0	43	102	0	145	6	0	10	16	329
Total Volume	0	258	378	636	0	0	0	0	162	412	0	574	25	0	42	67	1277
% App. Total	0	40.6	59.4		0	0	0		28.2	71.8	0		37.3	0	62.7		
PHF	.000	.849	.829	.837	.000	.000	.000	.000	.844	.858	.000	.854	.625	.000	.808	.882	.923

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SPSA Counts: Wilroy Road Area

File Name : SPSA61602 Wilroy & WB ramps

Site Code : 00061602

AM Counted: 6/2/2016

Start Date : 6/2/2016

PM Counted: 6/2/2016

Page No : 1

Groups Printed- Trucks

Start Time	Wilroy Rd Southbound			Westbound			Wilroy Rd Northbound			WB Rt 58 ramp Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	6	0	0	0	1	4	0	0	0	0	11
07:15 AM	0	0	3	0	0	0	0	3	0	4	0	0	10
07:30 AM	0	4	6	0	0	0	3	3	0	0	0	1	17
07:45 AM	0	1	3	0	0	0	2	1	0	1	0	0	8
Total	0	5	18	0	0	0	6	11	0	5	0	1	46
08:00 AM	0	2	5	0	0	0	2	4	0	1	0	0	14
08:15 AM	0	1	3	0	0	0	1	5	0	0	0	1	11
08:30 AM	0	3	3	0	0	0	2	7	0	3	0	0	18
08:45 AM	0	1	5	0	0	0	0	2	0	0	0	0	8
Total	0	7	16	0	0	0	5	18	0	4	0	1	51
02:00 PM	0	6	4	0	0	0	1	3	0	0	0	0	14
02:15 PM	0	6	7	0	0	0	5	2	0	0	0	0	20
02:30 PM	0	3	2	0	0	0	2	4	0	3	0	0	14
02:45 PM	0	2	2	0	0	0	0	0	0	1	0	0	5
Total	0	17	15	0	0	0	8	9	0	4	0	0	53
03:00 PM	0	3	3	0	0	0	2	5	0	0	0	0	13
03:15 PM	0	1	4	0	0	0	1	2	0	2	0	0	10
03:30 PM	0	5	2	0	0	0	0	2	0	4	0	1	14
03:45 PM	0	1	3	0	0	0	2	1	0	0	0	0	7
Total	0	10	12	0	0	0	5	10	0	6	0	1	44
04:00 PM	0	2	2	0	0	0	0	1	0	1	0	0	6
04:15 PM	0	2	2	0	0	0	2	4	0	1	0	0	11
Grand Total	0	43	65	0	0	0	26	53	0	21	0	3	211
Apprch %	0	39.8	60.2	0	0	0	32.9	67.1	0	87.5	0	12.5	
Total %	0	20.4	30.8	0	0	0	12.3	25.1	0	10	0	1.4	

Start Time	Wilroy Rd Southbound				Westbound				Wilroy Rd Northbound				WB Rt 58 ramp Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:45 AM																	
07:45 AM	0	1	3	4	0	0	0	0	2	1	0	3	1	0	0	1	8
08:00 AM	0	2	5	7	0	0	0	0	2	4	0	6	1	0	0	1	14
08:15 AM	0	1	3	4	0	0	0	0	1	5	0	6	0	0	1	1	11
08:30 AM	0	3	3	6	0	0	0	0	2	7	0	9	3	0	0	3	18
Total Volume	0	7	14	21	0	0	0	0	7	17	0	24	5	0	1	6	51
% App. Total	0	33.3	66.7		0	0	0		29.2	70.8	0		83.3	0	16.7		
PHF	.000	.583	.700	.750	.000	.000	.000	.000	.875	.607	.000	.667	.417	.000	.250	.500	.708

Start Time	Wilroy Rd Southbound				Westbound				Wilroy Rd Northbound				WB Rt 58 ramp Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 12:00 PM to 04:15 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 02:00 PM																	
02:00 PM	0	6	4	10	0	0	0	0	1	3	0	4	0	0	0	0	14
02:15 PM	0	6	7	13	0	0	0	0	5	2	0	7	0	0	0	0	20
02:30 PM	0	3	2	5	0	0	0	0	2	4	0	6	3	0	0	3	14
02:45 PM	0	2	2	4	0	0	0	0	0	0	0	0	1	0	0	1	5
Total Volume	0	17	15	32	0	0	0	0	8	9	0	17	4	0	0	4	53
% App. Total	0	53.1	46.9		0	0	0		47.1	52.9	0		100	0	0		
PHF	.000	.708	.536	.615	.000	.000	.000	.000	.400	.563	.000	.607	.333	.000	.000	.333	.663

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Appendix C – Traffic Analysis
Report



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Intersection

Int Delay, s/veh 0.4

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	6	5	3864	0	2	0	2125	36	0	0	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Yield	Yield	Yield
RT Channelized	-	-	-	None	-	-	-	Yeild	-	-	None	-	-	Free
Storage Length	-	250	-	-	-	250	-	200	-	-	-	-	-	-
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	2	-	-	0	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	50	62	92	25	25	25	85	60	25	25	25	25	25	69
Heavy Vehicles, %	0	29	7	0	0	0	7	34	0	0	0	0	0	36
Mvmt Flow	12	8	4200	0	8	0	2500	60	0	0	0	0	0	0

Major/Minor

	Major1			Major2				Minor1			
Conflicting Flow All	1825	2500	0	0	3066	4200	0	0	5256	6756	2100
Stage 1	-	-	-	-	-	-	-	-	4240	4240	-
Stage 2	-	-	-	-	-	-	-	-	1016	2516	-
Critical Hdwy	5.6	5.88	-	-	5.6	5.3	-	-	5.7	6.5	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	6.6	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	6	5.5	-
Follow-up Hdwy	2.3	3.39	-	-	2.3	3.1	-	-	3.8	4	3.9
Pot Cap-1 Maneuver	155	47	-	-	30	9	-	-	1	0	37
Stage 1	-	-	-	-	-	-	-	-	2	7	-
Stage 2	-	-	-	-	-	-	-	-	284	57	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	81	81	-	-	30	30	-	-	1	0	37
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	2	0	-
Stage 1	-	-	-	-	-	-	-	-	2	0	-
Stage 2	-	-	-	-	-	-	-	-	284	0	-

Approach

	EB	WB	NB
HCM Control Delay, s	0.3	0.5	0
HCM LOS			A

Minor Lane/Major Mvmt

	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	-	81	-	-	30	-	-
HCM Lane V/C Ratio	-	0.248	-	-	0.267	-	-
HCM Control Delay (s)	0	63.9	-	-	164	-	-
HCM Lane LOS	A	F	-	-	F	-	-
HCM 95th %tile Q(veh)	-	0.9	-	-	0.8	-	-

Intersection

Int Delay, s/veh 13.6

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	13	17	2456	0	0	3270	16	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	Yeild	-	-	None
Storage Length	-	250	-	-	250	-	200	-	-	-
Veh in Median Storage, #	-	-	0	-	-	0	-	-	2	-
Grade, %	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	47	91	25	25	93	67	25	25	25
Heavy Vehicles, %	0	29	7	0	0	7	34	0	0	0
Mvmt Flow	20	36	2699	0	0	3516	24	0	0	0

Major/Minor

	Major1			Major2			Minor1			
Conflicting Flow All	2567	3516	0	0	2699	0	0	4217	6327	1349
Stage 1	-	-	-	-	-	-	-	2811	2811	-
Stage 2	-	-	-	-	-	-	-	1406	3516	-
Critical Hdwy	5.6	5.88	-	-	5.3	-	-	5.7	6.5	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.6	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	6	5.5	-
Follow-up Hdwy	2.3	3.39	-	-	3.1	-	-	3.8	4	3.9
Pot Cap-1 Maneuver	59	~ 12	-	-	56	-	-	5	0	123
Stage 1	-	-	-	-	-	-	-	17	40	-
Stage 2	-	-	-	-	-	-	-	175	17	-
Platoon blocked, %			-	-						
Mov Cap-1 Maneuver	~ 17	~ 17	-	-	56	-	-	5	0	123
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	16	0	-
Stage 1	-	-	-	-	-	-	-	17	0	-
Stage 2	-	-	-	-	-	-	-	175	0	-

Approach

	EB	WB	NB
HCM Control Delay, s	31.1	0	0
HCM LOS			A

Minor Lane/Major Mvmt

	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	-	~ 17	-	-	56	-	-
HCM Lane V/C Ratio	-	3.304	-	-	-	-	-
HCM Control Delay (s)	0	\$ 1526.9	-	-	0	-	-
HCM Lane LOS	A	F	-	-	A	-	-
HCM 95th %tile Q(veh)	-	7.7	-	-	0	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Yield	Yield	Yield
RT Channelized	-	-	Free
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	25	69
Heavy Vehicles, %	0	0	36
Mvmt Flow	0	0	0

Major/Minor

Conflicting Flow All

Stage 1

Stage 2

Critical Hdwy

Critical Hdwy Stg 1

Critical Hdwy Stg 2

Follow-up Hdwy

Pot Cap-1 Maneuver

Stage 1

Stage 2

Platoon blocked, %

Mov Cap-1 Maneuver

Mov Cap-2 Maneuver

Stage 1

Stage 2

Approach

HCM Control Delay, s

HCM LOS

Minor Lane/Major Mvmt

Intersection

Int Delay, s/veh 3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	19	0	58	0	0	0	73	121	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	175	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	53	25	76	25	25	25	76	84	25
Heavy Vehicles, %	6	0	14	0	0	0	4	8	0
Mvmt Flow	36	0	76	0	0	0	96	144	4

Major/Minor

	Minor2			Major1		
Conflicting Flow All	533	535	195	236	0	0
Stage 1	195	195	-	-	-	-
Stage 2	338	340	-	-	-	-
Critical Hdwy	6.46	6.5	6.34	4.14	-	-
Critical Hdwy Stg 1	5.46	5.5	-	-	-	-
Critical Hdwy Stg 2	5.46	5.5	-	-	-	-
Follow-up Hdwy	3.554	4	3.426	2.236	-	-
Pot Cap-1 Maneuver	501	454	817	1319	-	-
Stage 1	828	743	-	-	-	-
Stage 2	714	643	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	461	0	817	1319	-	-
Mov Cap-2 Maneuver	461	0	-	-	-	-
Stage 1	828	0	-	-	-	-
Stage 2	658	0	-	-	-	-

Approach

	EB	NB
HCM Control Delay, s	11.1	3.1
HCM LOS	B	

Minor Lane/Major Mvmt

	NBL	NBT	NBR	EBLn1	EBLn2	SBL	SBT	SBR
Capacity (veh/h)	1319	-	-	461	817	1446	-	-
HCM Lane V/C Ratio	0.073	-	-	0.078	0.093	-	-	-
HCM Control Delay (s)	7.9	0	-	13.5	9.9	0	-	-
HCM Lane LOS	A	A	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	0.3	0.3	0	-	-

Phone:
E-mail:

Fax:

Operational Analysis

Analyst: Kanchan BK
 Agency/Co.: HDR Engineering Inc
 Date Performed: 6/21/2016
 Analysis Time Period: AM Peak
 Freeway/Dir of Travel: Route 13/58/460 Westbound
 Weaving Location: Ramp to Portsmouth Blvd
 Analysis Year: 2016
 Description: SPSA Traffic Impact Assessment - Existing

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	875	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	60	mi/h
Freeway maximum capacity, cIFL	1900*	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				veh/h
	VFF	VRF	VFR	VRR	
Volume, V	1169	3	0	989	
Peak hour factor, PHF	0.85	0.69	0.25	0.85	
Peak 15-min volume, v15	344	1	0	291	
Trucks and buses	7	100	0	8	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.667	1.000	0.962	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1423	7	0	1210	pc/h
Volume ratio, VR		0.003			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	1.0	int/mi
Minimum RF lane changes, LCRF	2	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	14	lc/h
Weaving lane changes, LCW	275	lc/h
Non-weaving vehicle index, INW	230	
Non-weaving lane change, LCNW	246	lc/h
Total lane changes, LCALL	521	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.150
-----------------------------	-------

Average weaving speed, SW	60.0	mi/h
Average non-weaving speed, SNW	56.7	mi/h

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	56.7	mi/h
Weaving segment density, D	11.6	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio		
Weaving segment flow rate, v		veh/h
Weaving segment capacity, cW		veh/h

_____Limitations on Weaving Segments_____

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	2620	875	a,b
Density-based capacity, cIWL (pc/h/ln)		1900*	1766	c
v/c ratio		1.00	Analyzed	d

Notes:

- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- d. Volumes exceed the weaving segment capacity. The level of service is F.

Phone:
E-mail:

Fax:

Operational Analysis

Analyst: Kanchan BK
 Agency/Co.: HDR Engineering Inc
 Date Performed: 5/9/2016
 Analysis Time Period: PM Peak
 Freeway/Dir of Travel: Route 13/58/460 Westbound
 Weaving Location: Ramp to Portsmouth Blvd
 Analysis Year: 2016
 Description: SPSA Traffic Impact Assessment - Existing

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	875	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	60	mi/h
Freeway maximum capacity, cIFL	1900*	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				veh/h
	VFF	VRF	VFR	VRR	
Volume, V	1798	3	0		1520
Peak hour factor, PHF	0.93	0.75	0.25		0.93
Peak 15-min volume, v15	483	1	0		409
Trucks and buses	7	100	0		8 %
Recreational vehicles	0	0	0		0 %
Trucks and buses PCE, ET	1.5	1.5	1.5		1.5
Recreational vehicle PCE, ER	1.2	1.2	1.2		1.2
Heavy vehicle adjustment, fHV	0.966	0.667	1.000		0.962
Driver population adjustment, fP	1.00	1.00	1.00		1.00
Flow rate, v	2001	6	0		1700 pc/h
Volume ratio, VR		0.002			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	1.0	int/mi
Minimum RF lane changes, LCRF	2	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	12	lc/h
Weaving lane changes, LCW	273	lc/h
Non-weaving vehicle index, INW	324	
Non-weaving lane change, LCNW	466	lc/h
Total lane changes, LCALL	739	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.198
-----------------------------	-------

Average weaving speed, SW	60.0	mi/h
Average non-weaving speed, SNW	55.5	mi/h

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	55.5	mi/h
Weaving segment density, D	16.7	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio		
Weaving segment flow rate, v		veh/h
Weaving segment capacity, cW		veh/h

_____Limitations on Weaving Segments_____

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	2611	875	a,b
Density-based capacity, cIWL (pc/h/ln)		1900*	1767	c
v/c ratio		1.00	Analyzed	d

Notes:

- In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- Volumes exceed the weaving segment capacity. The level of service is F.

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	146	53
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	94	66
Heavy Vehicles, %	0	0	2
Mvmt Flow	0	155	80

Major/Minor Major2

Conflicting Flow All	148	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.1	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.2	-	-
Pot Cap-1 Maneuver	1446	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1446	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach SB

HCM Control Delay, s 0

HCM LOS

Minor Lane/Major Mvmt

Intersection

Int Delay, s/veh 4.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	47	0	90	0	0	0	85	173	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	175	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	25	54	25	25	25	79	83	25
Heavy Vehicles, %	0	0	3	0	0	0	8	1	0
Mvmt Flow	60	0	167	0	0	0	108	208	0

Major/Minor

	Minor2			Major1		
Conflicting Flow All	635	635	211	231	0	0
Stage 1	211	211	-	-	-	-
Stage 2	424	424	-	-	-	-
Critical Hdwy	6.4	6.5	6.23	4.18	-	-
Critical Hdwy Stg 1	5.4	5.5	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.327	2.272	-	-
Pot Cap-1 Maneuver	446	399	827	1302	-	-
Stage 1	829	731	-	-	-	-
Stage 2	664	590	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	404	0	827	1302	-	-
Mov Cap-2 Maneuver	404	0	-	-	-	-
Stage 1	829	0	-	-	-	-
Stage 2	602	0	-	-	-	-

Approach

	EB	NB
HCM Control Delay, s	11.8	2.7
HCM LOS	B	

Minor Lane/Major Mvmt

	NBL	NBT	NBR	EBLn1	EBLn2	SBL	SBT	SBR
Capacity (veh/h)	1302	-	-	404	827	1375	-	-
HCM Lane V/C Ratio	0.083	-	-	0.149	0.202	-	-	-
HCM Control Delay (s)	8	0	-	15.5	10.4	0	-	-
HCM Lane LOS	A	A	-	C	B	A	-	-
HCM 95th %tile Q(veh)	0.3	-	-	0.5	0.8	0	-	-

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	172	34
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	90	85
Heavy Vehicles, %	0	2	0
Mvmt Flow	0	191	40

Major/Minor Major2

Conflicting Flow All	208	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.1	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.2	-	-
Pot Cap-1 Maneuver	1375	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1375	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach SB

HCM Control Delay, s 0












HCM LOS

Minor Lane/Major Mvmt

HCM 2010 Signalized Intersection Summary

3:

6/21/2016

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Volume (veh/h)	130	11	355	107	25	390		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1743	1900	1863	1759	1900	1865		
Adj Flow Rate, veh/h	203	31	423	149	36	443		
Adj No. of Lanes	1	1	1	1	0	1		
Peak Hour Factor	0.64	0.35	0.84	0.72	0.69	0.88		
Percent Heavy Veh, %	9	0	2	8	2	2		
Cap, veh/h	374	363	1071	860	131	995		
Arrive On Green	0.22	0.22	0.57	0.57	0.57	0.57		
Sat Flow, veh/h	1660	1615	1863	1495	60	1731		
Grp Volume(v), veh/h	203	31	423	149	479	0		
Grp Sat Flow(s),veh/h/ln	1660	1615	1863	1495	1791	0		
Q Serve(g_s), s	4.3	0.6	5.0	1.9	0.0	0.0		
Cycle Q Clear(g_c), s	4.3	0.6	5.0	1.9	5.9	0.0		
Prop In Lane	1.00	1.00		1.00	0.08			
Lane Grp Cap(c), veh/h	374	363	1071	860	1127	0		
V/C Ratio(X)	0.54	0.09	0.39	0.17	0.43	0.00		
Avail Cap(c_a), veh/h	374	363	1071	860	1127	0		
HCM Platoon Ratio	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	0.00		
Uniform Delay (d), s/veh	13.7	12.2	4.7	4.0	4.9	0.0		
Incr Delay (d2), s/veh	5.6	0.5	1.1	0.4	1.2	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	2.6	0.3	2.8	0.8	3.3	0.0		
LnGrp Delay(d),s/veh	19.3	12.7	5.8	4.5	6.0	0.0		
LnGrp LOS	B	B	A	A	A			
Approach Vol, veh/h	234		572			479		
Approach Delay, s/veh	18.4		5.4			6.0		
Approach LOS	B		A			A		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		27.0				27.0		13.0
Change Period (Y+Rc), s		4.0				4.0		4.0
Max Green Setting (Gmax), s		23.0				23.0		9.0
Max Q Clear Time (g_c+I1), s		7.0				7.9		6.3
Green Ext Time (p_c), s		5.7				5.5		0.2
Intersection Summary								
HCM 2010 Ctrl Delay			8.0					
HCM 2010 LOS			A					

HCM 2010 Signalized Intersection Summary

3:

6/21/2016



Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Volume (veh/h)	243	21	366	120	10	399		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1759	1900	1810	1727	1900	1822		
Adj Flow Rate, veh/h	333	60	431	203	20	448		
Adj No. of Lanes	1	1	1	1	0	1		
Peak Hour Factor	0.73	0.35	0.85	0.59	0.50	0.89		
Percent Heavy Veh, %	8	0	5	10	4	4		
Cap, veh/h	670	646	724	587	106	700		
Arrive On Green	0.40	0.40	0.40	0.40	0.40	0.40		
Sat Flow, veh/h	1675	1615	1810	1468	30	1751		
Grp Volume(v), veh/h	333	60	431	203	468	0		
Grp Sat Flow(s),veh/h/ln	1675	1615	1810	1468	1781	0		
Q Serve(g_s), s	6.0	0.9	7.5	3.9	0.0	0.0		
Cycle Q Clear(g_c), s	6.0	0.9	7.5	3.9	8.3	0.0		
Prop In Lane	1.00	1.00		1.00	0.04			
Lane Grp Cap(c), veh/h	670	646	724	587	806	0		
V/C Ratio(X)	0.50	0.09	0.60	0.35	0.58	0.00		
Avail Cap(c_a), veh/h	670	646	724	587	806	0		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	0.00		
Uniform Delay (d), s/veh	9.0	7.5	9.5	8.4	9.7	0.0		
Incr Delay (d2), s/veh	2.6	0.3	3.6	1.6	3.0	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	3.2	0.5	4.4	1.8	4.7	0.0		
LnGrp Delay(d),s/veh	11.6	7.8	13.0	10.0	12.7	0.0		
LnGrp LOS	B	A	B	A	B			
Approach Vol, veh/h	393		634			468		
Approach Delay, s/veh	11.0		12.1			12.7		
Approach LOS	B		B			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		20.0				20.0		20.0
Change Period (Y+Rc), s		4.0				4.0		4.0
Max Green Setting (Gmax), s		16.0				16.0		16.0
Max Q Clear Time (g_c+I1), s		9.5				10.3		8.0
Green Ext Time (p_c), s		3.2				2.9		0.8
Intersection Summary								
HCM 2010 Ctrl Delay			12.0					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	41	15	172	353	163	285
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	250	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	54	87	89	88	70
Heavy Vehicles, %	5	15	6	5	4	5
Mvmt Flow	52	28	198	397	185	407

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	983	296	592 0
Stage 1	389	-	- -
Stage 2	594	-	- -
Critical Hdwy	6.9	7.2	4.22 -
Critical Hdwy Stg 1	5.9	-	- -
Critical Hdwy Stg 2	5.9	-	- -
Follow-up Hdwy	3.55	3.45	2.26 -
Pot Cap-1 Maneuver	241	663	953 -
Stage 1	645	-	- -
Stage 2	506	-	- -
Platoon blocked, %			- -
Mov Cap-1 Maneuver	191	663	953 -
Mov Cap-2 Maneuver	191	-	- -
Stage 1	645	-	- -
Stage 2	401	-	- -

Approach	EB	NB	SB
HCM Control Delay, s	23.7	3.2	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	953	-	191	663	-	-
HCM Lane V/C Ratio	0.207	-	0.272	0.042	-	-
HCM Control Delay (s)	9.8	-	30.7	10.7	-	-
HCM Lane LOS	A	-	D	B	-	-
HCM 95th %tile Q(veh)	0.8	-	1.1	0.1	-	-

Intersection

Int Delay, s/veh 3.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	25	42	162	412	258	378
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	250	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	62	81	83	85	86	84
Heavy Vehicles, %	39	2	3	4	1	2
Mvmt Flow	40	52	195	485	300	450

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	1158	375	750
Stage 1	525	-	-
Stage 2	633	-	-
Critical Hdwy	7.58	6.94	4.16
Critical Hdwy Stg 1	6.58	-	-
Critical Hdwy Stg 2	6.58	-	-
Follow-up Hdwy	3.89	3.32	2.23
Pot Cap-1 Maneuver	142	623	848
Stage 1	465	-	-
Stage 2	402	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	109	623	848
Mov Cap-2 Maneuver	109	-	-
Stage 1	465	-	-
Stage 2	310	-	-























Approach	EB	NB	SB
HCM Control Delay, s	30.9	3	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	848	-	109	623	-	-
HCM Lane V/C Ratio	0.23	-	0.37	0.083	-	-
HCM Control Delay (s)	10.5	-	56.2	11.3	-	-
HCM Lane LOS	B	-	F	B	-	-
HCM 95th %tile Q(veh)	0.9	-	1.5	0.3	-	-

HCM 2010 Signalized Intersection Summary

3:























6/21/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	303	25	80	8	26	42	47	273	7	5	163	28
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	1900	1874	1900	1900	1900	1900	1827	1827	1900	1900	1863	1496
Adj Flow Rate, veh/h	344	32	104	12	32	64	68	317	12	12	201	40
Adj No. of Lanes	1	1	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.88	0.78	0.77	0.67	0.81	0.66	0.69	0.86	0.58	0.42	0.81	0.70
Percent Heavy Veh, %	0	6	6	0	0	0	4	4	0	0	2	27
Cap, veh/h	516	200	649	66	135	369	439	893	415	401	910	327
Arrive On Green	0.23	0.51	0.51	0.23	0.23	0.23	0.06	0.26	0.26	0.06	0.26	0.26
Sat Flow, veh/h	1810	388	1262	3	592	1615	1740	3471	1615	1810	3539	1272
Grp Volume(v), veh/h	344	0	136	44	0	64	68	317	12	12	201	40
Grp Sat Flow(s),veh/h/ln	1810	0	1651	595	0	1615	1740	1736	1615	1810	1770	1272
Q Serve(g_s), s	7.8	0.0	3.1	1.5	0.0	2.2	2.0	5.2	0.4	0.3	3.1	1.7
Cycle Q Clear(g_c), s	7.8	0.0	3.1	1.5	0.0	2.2	2.0	5.2	0.4	0.3	3.1	1.7
Prop In Lane	1.00		0.76	0.27		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	516	0	849	0	0	369	439	893	415	401	910	327
V/C Ratio(X)	0.67	0.00	0.16	0.00	0.00	0.17	0.16	0.36	0.03	0.03	0.22	0.12
Avail Cap(c_a), veh/h	516	0	849	0	0	369	439	893	415	401	910	327
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.9	0.0	9.0	0.0	0.0	21.7	17.2	21.3	19.5	16.8	20.5	19.9
Incr Delay (d2), s/veh	6.7	0.0	0.4	0.0	0.0	1.0	0.8	1.1	0.1	0.1	0.6	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	0.0	1.5	0.0	0.0	1.1	1.0	2.6	0.2	0.2	1.6	0.7
LnGrp Delay(d),s/veh	21.5	0.0	9.4	0.0	0.0	22.7	18.0	22.4	19.6	16.9	21.0	20.7
LnGrp LOS	C		A			C	B	C	B	B	C	C
Approach Vol, veh/h		480			108			397			253	
Approach Delay, s/veh		18.1			13.5			21.5			20.8	
Approach LOS		B			B			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.0	22.0		40.0	8.0	22.0	20.0	20.0				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	4.0	18.0		28.0	4.0	18.0	16.0	16.0				
Max Q Clear Time (g_c+I1), s	2.3	7.2		5.1	4.0	5.1	9.8	4.2				
Green Ext Time (p_c), s	0.0	2.5		1.3	0.0	2.7	0.6	1.0				
Intersection Summary												
HCM 2010 Ctrl Delay			19.3									
HCM 2010 LOS			B									

HCM 2010 Signalized Intersection Summary

3:

6/21/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	304	47	163	14	4	18	19	308	14	22	241	49
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	1845	1847	1900	1900	1900	1900	1496	1881	1900	1900	1863	1624
Adj Flow Rate, veh/h	327	72	187	32	8	28	32	350	24	36	251	64
Adj No. of Lanes	1	1	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.93	0.65	0.87	0.44	0.50	0.64	0.59	0.88	0.58	0.61	0.96	0.77
Percent Heavy Veh, %	3	0	0	0	0	0	27	1	0	0	2	17
Cap, veh/h	504	234	608	95	14	369	355	919	415	387	910	355
Arrive On Green	0.23	0.51	0.51	0.23	0.23	0.23	0.06	0.26	0.26	0.06	0.26	0.26
Sat Flow, veh/h	1757	455	1183	9	62	1615	1425	3574	1615	1810	3539	1380
Grp Volume(v), veh/h	327	0	259	40	0	28	32	350	24	36	251	64
Grp Sat Flow(s),veh/h/ln	1757	0	1638	71	0	1615	1425	1787	1615	1810	1770	1380
Q Serve(g_s), s	7.3	0.0	6.4	1.8	0.0	1.0	1.1	5.6	0.8	1.0	4.0	2.5
Cycle Q Clear(g_c), s	7.3	0.0	6.4	1.8	0.0	1.0	1.1	5.6	0.8	1.0	4.0	2.5
Prop In Lane	1.00		0.72	0.80		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	504	0	842	0	0	369	355	919	415	387	910	355
V/C Ratio(X)	0.65	0.00	0.31	0.00	0.00	0.08	0.09	0.38	0.06	0.09	0.28	0.18
Avail Cap(c_a), veh/h	504	0	842	0	0	369	355	919	415	387	910	355
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.3	0.0	9.8	0.0	0.0	21.2	17.0	21.4	19.6	17.0	20.8	20.3
Incr Delay (d2), s/veh	6.3	0.0	0.9	0.0	0.0	0.4	0.5	1.2	0.3	0.5	0.8	1.1
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	6.4	0.0	3.1	0.0	0.0	0.5	0.5	2.9	0.4	0.5	2.0	1.1
LnGrp Delay(d),s/veh	20.6	0.0	10.8	0.0	0.0	21.6	17.5	22.6	19.9	17.5	21.5	21.4
LnGrp LOS	C		B			C	B	C	B	B	C	C
Approach Vol, veh/h		586			68			406			351	
Approach Delay, s/veh		16.3			8.9			22.0			21.1	
Approach LOS		B			A			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.0	22.0		40.0	8.0	22.0	20.0	20.0				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	4.0	18.0		28.0	4.0	18.0	16.0	16.0				
Max Q Clear Time (g_c+I1), s	3.0	7.6		8.4	3.1	6.0	9.3	3.8				
Green Ext Time (p_c), s	0.0	2.9		2.0	0.0	3.2	0.6	1.6				
Intersection Summary												
HCM 2010 Ctrl Delay			18.8									
HCM 2010 LOS			B									

Intersection

Int Delay, s/veh 3.5

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	8	5	5460	0	3	0	3003	36	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	Yeild	-	-	None
Storage Length	-	250	-	-	-	250	-	200	-	-	-
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	2	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-
Peak Hour Factor	50	62	92	25	25	25	85	60	25	25	25
Heavy Vehicles, %	0	29	7	0	0	0	7	34	0	0	0
Mvmt Flow	16	8	5935	0	12	0	3533	60	0	0	0

Major/Minor

	Major1			Major2				Minor1			
Conflicting Flow All	2579	3533	0	0	4332	5935	0	0	7420	9540	2967
Stage 1	-	-	-	-	-	-	-	-	5983	5983	-
Stage 2	-	-	-	-	-	-	-	-	1437	3557	-
Critical Hdwy	5.6	5.88	-	-	5.6	5.3	-	-	5.7	6.5	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	6.6	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	6	5.5	-
Follow-up Hdwy	2.3	3.39	-	-	2.3	3.1	-	-	3.8	4	3.9
Pot Cap-1 Maneuver	58	11	-	-	~ 5	1	-	-	0	0	9
Stage 1	-	-	-	-	-	-	-	-	0	1	-
Stage 2	-	-	-	-	-	-	-	-	168	16	-
Platoon blocked, %			-	-			-	-			
Mov Cap-1 Maneuver	24	24	-	-	~ 5	5	-	-	0	0	9
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	0	0	-
Stage 1	-	-	-	-	-	-	-	-	0	0	-
Stage 2	-	-	-	-	-	-	-	-	168	0	-

Approach

	EB	WB	NB
HCM Control Delay, s	1.7	6.6	0
HCM LOS			A

Minor Lane/Major Mvmt

	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	-	24	-	-	5	-	-
HCM Lane V/C Ratio	-	1.003	-	-	2.4	-	-
HCM Control Delay (s)	0	\$ 419.8	-	-	-\$ 1976.4	-	-
HCM Lane LOS	A	F	-	-	F	-	-
HCM 95th %tile Q(veh)	-	3	-	-	2.6	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Yield	Yield	Yield
RT Channelized	-	-	Free
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	25	69
Heavy Vehicles, %	0	0	36
Mvmt Flow	0	0	0

Major/Minor

Conflicting Flow All
Stage 1
Stage 2
Critical Hdwy
Critical Hdwy Stg 1
Critical Hdwy Stg 2
Follow-up Hdwy
Pot Cap-1 Maneuver
Stage 1
Stage 2
Platoon blocked, %
Mov Cap-1 Maneuver
Mov Cap-2 Maneuver
Stage 1
Stage 2

Approach

HCM Control Delay, s
HCM LOS

Minor Lane/Major Mvmt

Intersection

Int Delay, s/veh 77.6

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	18	17	3470	0	0	4620	16	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	Yeild	-	-	None
Storage Length	-	250	-	-	250	-	200	-	-	-
Veh in Median Storage, #	-	-	0	-	-	0	-	-	2	-
Grade, %	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	47	91	25	25	93	67	25	25	25
Heavy Vehicles, %	0	29	7	0	0	7	34	0	0	0
Mvmt Flow	28	36	3813	0	0	4968	24	0	0	0

Major/Minor	Major1			Major2			Minor1			
Conflicting Flow All	3626	4968	0	0	3813	0	0	5928	8909	1907
Stage 1	-	-	-	-	-	-	-	3941	3941	-
Stage 2	-	-	-	-	-	-	-	1987	4968	-
Critical Hdwy	5.6	5.88	-	-	5.3	-	-	5.7	6.5	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.6	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	6	5.5	-
Follow-up Hdwy	2.3	3.39	-	-	3.1	-	-	3.8	4	3.9
Pot Cap-1 Maneuver	~ 14	~ 2	-	-	14	-	-	0	0	51
Stage 1	-	-	-	-	-	-	-	3	10	-
Stage 2	-	-	-	-	-	-	-	83	3	-
Platoon blocked, %			-	-		-	-			
Mov Cap-1 Maneuver	~ 3	~ 3	-	-	14	-	-	0	0	51
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	3	0	-
Stage 1	-	-	-	-	-	-	-	3	0	-
Stage 2	-	-	-	-	-	-	-	83	0	-

Approach	EB	WB	NB
HCM Control Delay, s	177.5	0	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	-	~ 3	-	-	14	-	-
HCM Lane V/C Ratio	-	21.288	-	-	-	-	-
HCM Control Delay (s)	§	10773.9	-	-	0	-	-
HCM Lane LOS	A	F	-	-	A	-	-
HCM 95th %tile Q(veh)	-	10	-	-	0	-	-

Notes

~: Volume exceeds capacity §: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Yield	Yield	Yield
RT Channelized	-	-	Free
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	25	69
Heavy Vehicles, %	0	0	36
Mvmt Flow	0	0	0

Major/Minor

- Conflicting Flow All
 - Stage 1
 - Stage 2
- Critical Hdwy
- Critical Hdwy Stg 1
- Critical Hdwy Stg 2
- Follow-up Hdwy
- Pot Cap-1 Maneuver
 - Stage 1
 - Stage 2
- Platoon blocked, %
- Mov Cap-1 Maneuver
- Mov Cap-2 Maneuver
 - Stage 1
 - Stage 2

Approach

HCM Control Delay, s
 HCM LOS

Minor Lane/Major Mvmt

Phone:
E-mail:

Fax:

Operational Analysis

Analyst: Kanchan BK
 Agency/Co.: HDR Engineering Inc
 Date Performed: 6/21/2016
 Analysis Time Period: AM Peak
 Freeway/Dir of Travel: Route 13/58/460 Westbound
 Weaving Location: Ramp to Portsmouth Blvd
 Analysis Year: 2030
 Description: SPSA Traffic Impact Assessment - No Built

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	875	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	60	mi/h
Freeway maximum capacity, cIFL	1900*	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1651	3	0	1388	veh/h
Peak hour factor, PHF	0.85	0.69	0.25	0.85	
Peak 15-min volume, v15	486	1	0	408	
Trucks and buses	7	100	0	8	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.667	1.000	0.962	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2010	7	0	1698	pc/h
Volume ratio, VR		0.002			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	1.0	int/mi
Minimum RF lane changes, LCRF	2	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	14	lc/h
Weaving lane changes, LCW	275	lc/h
Non-weaving vehicle index, INW	324	
Non-weaving lane change, LCNW	468	lc/h
Total lane changes, LCALL	743	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.199
-----------------------------	-------

Average weaving speed, SW	60.0	mi/h
Average non-weaving speed, SNW	55.4	mi/h

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	55.4	mi/h
Weaving segment density, D	16.7	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio		
Weaving segment flow rate, v		veh/h
Weaving segment capacity, cW		veh/h

_____Limitations on Weaving Segments_____

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	2613	875	a,b
Density-based capacity, cIWL (pc/h/ln)		1900*	1767	c
v/c ratio		1.00	Analyzed	d

Notes:

- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- d. Volumes exceed the weaving segment capacity. The level of service is F.

Phone:
E-mail:

Fax:

Operational Analysis

Analyst: Kanchan BK
 Agency/Co.: HDR Engineering Inc
 Date Performed: 6/21/2016
 Analysis Time Period: PM Peak
 Freeway/Dir of Travel: Route 13/58/460 Westbound
 Weaving Location: Ramp to Portsmouth Blvd
 Analysis Year: 2030
 Description: SPSA Traffic Impact Assessment - No Built

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	875	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	60	mi/h
Freeway maximum capacity, cIFL	1900*	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	2541	3	0	2127	veh/h
Peak hour factor, PHF	0.93	0.25	0.25	0.93	
Peak 15-min volume, v15	683	3	0	572	
Trucks and buses	7	100	0	8	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.667	1.000	0.962	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2828	18	0	2379	pc/h
Volume ratio, VR		0.003			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	1.0	int/mi
Minimum RF lane changes, LCRF	2	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	36	lc/h
Weaving lane changes, LCW	297	lc/h
Non-weaving vehicle index, INW	456	
Non-weaving lane change, LCNW	776	lc/h
Total lane changes, LCALL	1073	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.265
-----------------------------	-------

Average weaving speed, SW	60.0	mi/h
Average non-weaving speed, SNW	53.5	mi/h

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.5	mi/h
Weaving segment density, D	24.4	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio		
Weaving segment flow rate, v		veh/h
Weaving segment capacity, cW		veh/h

_____Limitations on Weaving Segments_____

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	2628	875	a,b
Density-based capacity, cIWL (pc/h/ln)		1900*	1766	c
v/c ratio		1.00	Analyzed	d

Notes:

- In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- Volumes exceed the weaving segment capacity. The level of service is F.

Intersection

Int Delay, s/veh 4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	29	0	88	0	0	0	110	183	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	175	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	53	25	76	25	25	25	76	84	25
Heavy Vehicles, %	6	0	14	0	0	0	4	8	0
Mvmt Flow	55	0	116	0	0	0	145	218	8

Major/Minor

	Minor2			Major1		
Conflicting Flow All	807	811	296	356	0	0
Stage 1	296	296	-	-	-	-
Stage 2	511	515	-	-	-	-
Critical Hdwy	6.46	6.5	6.34	4.14	-	-
Critical Hdwy Stg 1	5.46	5.5	-	-	-	-
Critical Hdwy Stg 2	5.46	5.5	-	-	-	-
Follow-up Hdwy	3.554	4	3.426	2.236	-	-
Pot Cap-1 Maneuver	345	316	716	1192	-	-
Stage 1	746	672	-	-	-	-
Stage 2	594	538	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	297	0	716	1192	-	-
Mov Cap-2 Maneuver	297	0	-	-	-	-
Stage 1	746	0	-	-	-	-
Stage 2	511	0	-	-	-	-

Approach

	EB	NB
HCM Control Delay, s	13.8	3.3
HCM LOS	B	

Minor Lane/Major Mvmt

	NBL	NBT	NBR	EBLn1	EBLn2	SBL	SBT	SBR
Capacity (veh/h)	1192	-	-	297	716	1354	-	-
HCM Lane V/C Ratio	0.121	-	-	0.184	0.162	-	-	-
HCM Control Delay (s)	8.4	0	-	19.8	11	0	-	-
HCM Lane LOS	A	A	-	C	B	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	0.7	0.6	0	-	-

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	221	80
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	94	66
Heavy Vehicles, %	0	0	2
Mvmt Flow	0	235	121

Major/Minor Major2

Conflicting Flow All	226	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.1	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.2	-	-
Pot Cap-1 Maneuver	1354	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1354	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach SB

HCM Control Delay, s 0

HCM LOS

Minor Lane/Major Mvmt

Intersection

Int Delay, s/veh 6.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	71	0	136	0	0	0	129	262	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	175	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	25	54	25	25	25	79	83	25
Heavy Vehicles, %	0	0	3	0	0	0	8	1	0
Mvmt Flow	91	0	252	0	0	0	163	316	0

Major/Minor

	Minor2			Major1		
Conflicting Flow All	961	961	319	349	0	0
Stage 1	319	319	-	-	-	-
Stage 2	642	642	-	-	-	-
Critical Hdwy	6.4	6.5	6.23	4.18	-	-
Critical Hdwy Stg 1	5.4	5.5	-	-	-	-
Critical Hdwy Stg 2	5.4	5.5	-	-	-	-
Follow-up Hdwy	3.5	4	3.327	2.272	-	-
Pot Cap-1 Maneuver	287	258	719	1177	-	-
Stage 1	741	657	-	-	-	-
Stage 2	528	472	-	-	-	-
Platoon blocked, %					-	-
Mov Cap-1 Maneuver	239	0	719	1177	-	-
Mov Cap-2 Maneuver	239	0	-	-	-	-
Stage 1	741	0	-	-	-	-
Stage 2	439	0	-	-	-	-

Approach

	EB	NB
HCM Control Delay, s	17	2.9
HCM LOS	C	

Minor Lane/Major Mvmt

	NBL	NBT	NBR	EBLn1	EBLn2	SBL	SBT	SBR
Capacity (veh/h)	1177	-	-	239	719	1256	-	-
HCM Lane V/C Ratio	0.139	-	-	0.381	0.35	-	-	-
HCM Control Delay (s)	8.6	0	-	29	12.7	0	-	-
HCM Lane LOS	A	A	-	D	B	A	-	-
HCM 95th %tile Q(veh)	0.5	-	-	1.7	1.6	0	-	-

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	260	51
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	90	85
Heavy Vehicles, %	0	2	0
Mvmt Flow	0	289	60

Major/Minor Major2

Conflicting Flow All	316	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.1	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.2	-	-
Pot Cap-1 Maneuver	1256	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1256	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach SB

HCM Control Delay, s 0












HCM LOS

Minor Lane/Major Mvmt

HCM 2010 Signalized Intersection Summary

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6/21/2016

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Volume (veh/h)	190	16	519	156	37	569		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1743	1900	1863	1759	1900	1866		
Adj Flow Rate, veh/h	297	46	618	217	54	647		
Adj No. of Lanes	1	1	1	1	0	1		
Peak Hour Factor	0.64	0.35	0.84	0.72	0.69	0.88		
Percent Heavy Veh, %	9	0	2	8	2	2		
Cap, veh/h	553	538	993	798	103	838		
Arrive On Green	0.33	0.33	0.53	0.53	0.53	0.53		
Sat Flow, veh/h	1660	1615	1863	1495	71	1570		
Grp Volume(v), veh/h	297	46	618	217	701	0		
Grp Sat Flow(s),veh/h/ln	1660	1615	1863	1495	1642	0		
Q Serve(g_s), s	8.7	1.2	13.9	4.8	6.9	0.0		
Cycle Q Clear(g_c), s	8.7	1.2	13.9	4.8	20.8	0.0		
Prop In Lane	1.00	1.00		1.00	0.08			
Lane Grp Cap(c), veh/h	553	538	993	798	940	0		
V/C Ratio(X)	0.54	0.09	0.62	0.27	0.75	0.00		
Avail Cap(c_a), veh/h	553	538	993	798	940	0		
HCM Platoon Ratio	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	0.00		
Uniform Delay (d), s/veh	16.2	13.7	9.8	7.6	10.9	0.0		
Incr Delay (d2), s/veh	3.7	0.3	2.9	0.8	5.4	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	4.5	0.6	7.8	2.1	10.7	0.0		
LnGrp Delay(d),s/veh	19.9	14.0	12.7	8.5	16.3	0.0		
LnGrp LOS	B	B	B	A	B			
Approach Vol, veh/h	343		835			701		
Approach Delay, s/veh	19.1		11.6			16.3		
Approach LOS	B		B			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		36.0				36.0		24.0
Change Period (Y+Rc), s		4.0				4.0		4.0
Max Green Setting (Gmax), s		32.0				32.0		20.0
Max Q Clear Time (g_c+I1), s		15.9				22.8		10.7
Green Ext Time (p_c), s		8.7				5.9		0.7
Intersection Summary								
HCM 2010 Ctrl Delay			14.7					
HCM 2010 LOS			B					

HCM 2010 Signalized Intersection Summary

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6/21/2016



Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Volume (veh/h)	243	21	366	120	10	399		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1759	1900	1810	1727	1900	1822		
Adj Flow Rate, veh/h	333	60	431	203	20	448		
Adj No. of Lanes	1	1	1	1	0	1		
Peak Hour Factor	0.73	0.35	0.85	0.59	0.50	0.89		
Percent Heavy Veh, %	8	0	5	10	4	4		
Cap, veh/h	614	592	905	734	78	875		
Arrive On Green	0.37	0.37	0.50	0.50	0.50	0.50		
Sat Flow, veh/h	1675	1615	1810	1468	31	1749		
Grp Volume(v), veh/h	333	60	431	203	468	0		
Grp Sat Flow(s),veh/h/ln	1675	1615	1810	1468	1780	0		
Q Serve(g_s), s	9.4	1.5	9.4	4.8	0.0	0.0		
Cycle Q Clear(g_c), s	9.4	1.5	9.4	4.8	10.4	0.0		
Prop In Lane	1.00	1.00		1.00	0.04			
Lane Grp Cap(c), veh/h	614	592	905	734	953	0		
V/C Ratio(X)	0.54	0.10	0.48	0.28	0.49	0.00		
Avail Cap(c_a), veh/h	614	592	905	734	953	0		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(l)	1.00	1.00	1.00	1.00	1.00	0.00		
Uniform Delay (d), s/veh	15.0	12.5	9.8	8.7	10.1	0.0		
Incr Delay (d2), s/veh	3.4	0.3	1.8	0.9	1.8	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	4.9	0.7	5.1	2.1	5.7	0.0		
LnGrp Delay(d),s/veh	18.4	12.8	11.6	9.6	11.9	0.0		
LnGrp LOS	B	B	B	A	B			
Approach Vol, veh/h	393		634			468		
Approach Delay, s/veh	17.6		11.0			11.9		
Approach LOS	B		B			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		34.0				34.0		26.0
Change Period (Y+Rc), s		4.0				4.0		4.0
Max Green Setting (Gmax), s		30.0				30.0		22.0
Max Q Clear Time (g_c+11), s		11.4				12.4		11.4
Green Ext Time (p_c), s		6.0				5.9		0.9
Intersection Summary								
HCM 2010 Ctrl Delay			13.0					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 10.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	60	22	251	516	238	417
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	250	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	54	87	89	88	70
Heavy Vehicles, %	5	15	6	5	4	5
Mvmt Flow	76	41	289	580	270	596

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	1435	433	866
Stage 1	568	-	-
Stage 2	867	-	-
Critical Hdwy	6.9	7.2	4.22
Critical Hdwy Stg 1	5.9	-	-
Critical Hdwy Stg 2	5.9	-	-
Follow-up Hdwy	3.55	3.45	2.26
Pot Cap-1 Maneuver	121	536	748
Stage 1	522	-	-
Stage 2	364	-	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	~ 74	536	748
Mov Cap-2 Maneuver	~ 74	-	-
Stage 1	522	-	-
Stage 2	223	-	-

Approach	EB	NB	SB
HCM Control Delay, s	140.7	4.3	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	748	-	74	536	-	-
HCM Lane V/C Ratio	0.386	-	1.026	0.076	-	-
HCM Control Delay (s)	12.8	-	209.6	12.3	-	-
HCM Lane LOS	B	-	F	B	-	-
HCM 95th %tile Q(veh)	1.8	-	5.5	0.2	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 21.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	37	61	237	602	377	553
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	250	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	62	81	83	85	86	84
Heavy Vehicles, %	39	2	3	4	1	2
Mvmt Flow	60	75	286	708	438	658

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	1693	548	1097
Stage 1	768	-	-
Stage 2	925	-	-
Critical Hdwy	7.58	6.94	4.16
Critical Hdwy Stg 1	6.58	-	-
Critical Hdwy Stg 2	6.58	-	-
Follow-up Hdwy	3.89	3.32	2.23
Pot Cap-1 Maneuver	~ 57	480	626
Stage 1	335	-	-
Stage 2	270	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	~ 31	480	626
Mov Cap-2 Maneuver	~ 31	-	-
Stage 1	335	-	-
Stage 2	147	-	-

Approach	EB	NB	SB
HCM Control Delay, s	\$ 321	4.4	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	626	-	31	480	-	-
HCM Lane V/C Ratio	0.456	-	1.925	0.157	-	-
HCM Control Delay (s)	15.5	-	\$ 708.6	13.9	-	-
HCM Lane LOS	C	-	F	B	-	-
HCM 95th %tile Q(veh)	2.4	-	6.9	0.6	-	-























Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 2010 Signalized Intersection Summary

3:























6/21/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	428	35	113	11	37	59	66	386	10	7	230	40
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	1900	1874	1900	1900	1900	1900	1827	1827	1900	1900	1863	1496
Adj Flow Rate, veh/h	486	45	147	16	46	89	96	449	17	17	284	57
Adj No. of Lanes	1	1	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.88	0.78	0.77	0.67	0.81	0.66	0.69	0.86	0.58	0.42	0.81	0.70
Percent Heavy Veh, %	0	6	6	0	0	0	4	4	0	0	2	27
Cap, veh/h	516	199	650	65	144	369	407	893	415	344	860	309
Arrive On Green	0.23	0.51	0.51	0.23	0.23	0.23	0.07	0.26	0.26	0.06	0.24	0.24
Sat Flow, veh/h	1810	387	1264	3	629	1615	1740	3471	1615	1810	3539	1272
Grp Volume(v), veh/h	486	0	192	62	0	89	96	449	17	17	284	57
Grp Sat Flow(s),veh/h/ln	1810	0	1651	632	0	1615	1740	1736	1615	1810	1770	1272
Q Serve(g_s), s	14.4	0.0	4.5	2.1	0.0	3.1	2.8	7.7	0.6	0.5	4.6	2.5
Cycle Q Clear(g_c), s	14.4	0.0	4.5	2.1	0.0	3.1	2.8	7.7	0.6	0.5	4.6	2.5
Prop In Lane	1.00		0.77	0.26		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	516	0	849	0	0	369	407	893	415	344	860	309
V/C Ratio(X)	0.94	0.00	0.23	0.00	0.00	0.24	0.24	0.50	0.04	0.05	0.33	0.18
Avail Cap(c_a), veh/h	516	0	849	0	0	369	407	893	415	344	860	309
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.4	0.0	9.3	0.0	0.0	22.0	17.6	22.2	19.5	17.6	21.8	21.0
Incr Delay (d2), s/veh	27.4	0.0	0.6	0.0	0.0	1.5	1.4	2.0	0.2	0.3	1.0	1.3
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	13.1	0.0	2.2	0.0	0.0	1.6	1.5	3.9	0.3	0.3	2.4	1.0
LnGrp Delay(d),s/veh	46.7	0.0	10.0	0.0	0.0	23.6	18.9	24.2	19.7	17.9	22.8	22.3
LnGrp LOS	D		A			C	B	C	B	B	C	C
Approach Vol, veh/h		678			151			562			358	
Approach Delay, s/veh		36.3			13.9			23.2			22.5	
Approach LOS		D			B			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.0	22.0		40.0	9.0	21.0	20.0	20.0				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	4.0	18.0		28.0	5.0	17.0	16.0	16.0				
Max Q Clear Time (g_c+I1), s	2.5	9.7		6.5	4.8	6.6	16.4	5.1				
Green Ext Time (p_c), s	0.0	3.0		1.9	0.0	3.5	0.0	1.4				
Intersection Summary												
HCM 2010 Ctrl Delay			27.3									
HCM 2010 LOS			C									

HCM 2010 Signalized Intersection Summary

3:

6/21/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	430	66	230	20	6	25	27	435	20	31	341	69
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	1845	1847	1900	1900	1900	1900	1496	1881	1900	1900	1863	1624
Adj Flow Rate, veh/h	462	102	264	45	12	39	46	494	34	51	355	90
Adj No. of Lanes	1	1	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.93	0.65	0.87	0.44	0.50	0.64	0.59	0.88	0.58	0.61	0.96	0.77
Percent Heavy Veh, %	3	0	0	0	0	0	27	1	0	0	2	17
Cap, veh/h	504	235	608	94	15	369	316	919	415	329	910	355
Arrive On Green	0.23	0.51	0.51	0.23	0.23	0.23	0.06	0.26	0.26	0.06	0.26	0.26
Sat Flow, veh/h	1757	457	1182	9	66	1615	1425	3574	1615	1810	3539	1380
Grp Volume(v), veh/h	462	0	366	57	0	39	46	494	34	51	355	90
Grp Sat Flow(s),veh/h/ln	1757	0	1638	75	0	1615	1425	1787	1615	1810	1770	1380
Q Serve(g_s), s	13.7	0.0	9.8	2.8	0.0	1.3	1.6	8.3	1.1	1.4	5.8	3.6
Cycle Q Clear(g_c), s	13.7	0.0	9.8	2.8	0.0	1.3	1.6	8.3	1.1	1.4	5.8	3.6
Prop In Lane	1.00		0.72	0.79		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	504	0	842	0	0	369	316	919	415	329	910	355
V/C Ratio(X)	0.92	0.00	0.43	0.00	0.00	0.11	0.15	0.54	0.08	0.16	0.39	0.25
Avail Cap(c_a), veh/h	504	0	842	0	0	369	316	919	415	329	910	355
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.8	0.0	10.6	0.0	0.0	21.3	17.3	22.4	19.7	17.5	21.5	20.7
Incr Delay (d2), s/veh	23.8	0.0	1.6	0.0	0.0	0.6	1.0	2.3	0.4	1.0	1.3	1.7
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	11.9	0.0	4.8	0.0	0.0	0.7	0.7	4.4	0.5	0.8	3.0	1.5
LnGrp Delay(d),s/veh	42.6	0.0	12.3	0.0	0.0	21.9	18.2	24.7	20.1	18.5	22.7	22.4
LnGrp LOS	D		B			C	B	C	C	B	C	C
Approach Vol, veh/h		828			96			574			496	
Approach Delay, s/veh		29.2			8.9			23.9			22.2	
Approach LOS		C			A			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.0	22.0		40.0	8.0	22.0	20.0	20.0				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	4.0	18.0		28.0	4.0	18.0	16.0	16.0				
Max Q Clear Time (g_c+I1), s	3.4	10.3		11.8	3.6	7.8	15.7	4.8				
Green Ext Time (p_c), s	0.0	3.4		2.8	0.0	4.1	0.1	2.3				
Intersection Summary												
HCM 2010 Ctrl Delay			25.0									
HCM 2010 LOS			C									

Phone:
E-mail:

Fax:

Operational Analysis

Analyst: Kanchan BK
 Agency/Co.: HDR Engineering Inc
 Date Performed: 6/21/2016
 Analysis Time Period: AM Peak
 Freeway/Dir of Travel: Route 13/58/460 Westbound
 Weaving Location: Ramp to Portsmouth Blvd
 Analysis Year: 2030
 Description: SPSA Traffic Impact Assessment - Alternative 1

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	875	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	60	mi/h
Freeway maximum capacity, cIFL	1900*	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1651	0	0	1388	veh/h
Peak hour factor, PHF	0.85	0.25	0.25	0.85	
Peak 15-min volume, v15	486	0	0	408	
Trucks and buses	7	100	7	8	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.667	0.966	0.962	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2010	0	0	1698	pc/h
Volume ratio, VR		0.000			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	1.0	int/mi
Minimum RF lane changes, LCRF	2	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	261	lc/h
Non-weaving vehicle index, INW	324	
Non-weaving lane change, LCNW	468	lc/h
Total lane changes, LCALL	729	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.196
-----------------------------	-------

Average weaving speed, SW	60.0	mi/h
Average non-weaving speed, SNW	55.6	mi/h

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	55.6	mi/h
Weaving segment density, D	16.7	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio	0.523	
Weaving segment flow rate, v	3576	veh/h
Weaving segment capacity, cW	6833	veh/h

_____Limitations on Weaving Segments_____

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	2596	875	a,b
Density-based capacity, cIWL (pc/h/ln)		1900*	1768	c
v/c ratio		1.00	0.523	d

Notes:

- In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- Volumes exceed the weaving segment capacity. The level of service is F.

Phone:
E-mail:

Fax:

Operational Analysis

Analyst: Kanchan BK
 Agency/Co.: HDR Engineering Inc
 Date Performed: 6/21/2016
 Analysis Time Period: PM Peak
 Freeway/Dir of Travel: Route 13/58/460 Westbound
 Weaving Location: Ramp to Portsmouth Blvd
 Analysis Year: 2030
 Description: SPSA Traffic Impact Assessment - Alternative 1

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	875	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	60	mi/h
Freeway maximum capacity, cIFL	1900*	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	2541	0	0	2134	veh/h
Peak hour factor, PHF	0.93	0.25	0.25	0.93	
Peak 15-min volume, v15	683	0	0	574	
Trucks and buses	7	100	100	8	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.667	0.667	0.962	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2828	0	0	2386	pc/h
Volume ratio, VR		0.000			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	1.0	int/mi
Minimum RF lane changes, LCRF	2	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	0	lc/h
Weaving lane changes, LCW	261	lc/h
Non-weaving vehicle index, INW	456	
Non-weaving lane change, LCNW	778	lc/h
Total lane changes, LCALL	1039	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.259
-----------------------------	-------

Average weaving speed, SW	60.0	mi/h
Average non-weaving speed, SNW	53.7	mi/h

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.7	mi/h
Weaving segment density, D	24.3	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio	0.736	
Weaving segment flow rate, v	5027	veh/h
Weaving segment capacity, cW	6833	veh/h

_____Limitations on Weaving Segments_____

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	2596	875	a,b
Density-based capacity, cIWL (pc/h/ln)		1900*	1768	c
v/c ratio		1.00	0.736	d

Notes:

- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- d. Volumes exceed the weaving segment capacity. The level of service is F.

Intersection

Int Delay, s/veh 2.6

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	8	0	5460	0	3	0	3003	36	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	-	Yeild	-	-	None
Storage Length	-	250	-	-	-	250	-	200	-	-	-
Veh in Median Storage, #	-	-	0	-	-	-	0	-	-	2	-
Grade, %	-	-	0	-	-	-	0	-	-	0	-
Peak Hour Factor	50	62	92	25	25	25	85	60	25	25	25
Heavy Vehicles, %	0	29	7	0	0	0	7	34	0	0	0
Mvmt Flow	16	0	5935	0	12	0	3533	60	0	0	0

Major/Minor

	Major1			Major2				Minor1			
Conflicting Flow All	2579	3533	0	0	4332	5935	0	0	7404	9524	2967
Stage 1	-	-	-	-	-	-	-	-	5967	5967	-
Stage 2	-	-	-	-	-	-	-	-	1437	3557	-
Critical Hdwy	5.6	5.88	-	-	5.6	5.3	-	-	5.7	6.5	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	6.6	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	6	5.5	-
Follow-up Hdwy	2.3	3.39	-	-	2.3	3.1	-	-	3.8	4	3.9
Pot Cap-1 Maneuver	58	11	-	-	~ 5	1	-	-	0	0	9
Stage 1	-	-	-	-	-	-	-	-	0	1	-
Stage 2	-	-	-	-	-	-	-	-	168	16	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	58	58	-	-	~ 5	5	-	-	0	0	9
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	-	0	0	-
Stage 1	-	-	-	-	-	-	-	-	0	0	-
Stage 2	-	-	-	-	-	-	-	-	168	0	-

Approach

	EB	WB	NB
HCM Control Delay, s	0.2	6.6	0
HCM LOS			A

Minor Lane/Major Mvmt

	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	-	58	-	-	5	-	-
HCM Lane V/C Ratio	-	0.276	-	-	2.4	-	-
HCM Control Delay (s)	0	89.2	-	-	-\$ 1976.4	-	-
HCM Lane LOS	A	F	-	-	F	-	-
HCM 95th %tile Q(veh)	-	1	-	-	2.6	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Yield	Yield	Yield
RT Channelized	-	-	Free
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	25	69
Heavy Vehicles, %	0	0	36
Mvmt Flow	0	0	0

Major/Minor

Conflicting Flow All
Stage 1
Stage 2
Critical Hdwy
Critical Hdwy Stg 1
Critical Hdwy Stg 2
Follow-up Hdwy
Pot Cap-1 Maneuver
Stage 1
Stage 2
Platoon blocked, %
Mov Cap-1 Maneuver
Mov Cap-2 Maneuver
Stage 1
Stage 2

Approach

HCM Control Delay, s
HCM LOS

Minor Lane/Major Mvmt

Intersection

Int Delay, s/veh 3.2

Movement	EBU	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	18	0	3470	0	0	4620	16	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	-	None	-	-	Yeild	-	-	None
Storage Length	-	250	-	-	250	-	200	-	-	-
Veh in Median Storage, #	-	-	0	-	-	0	-	-	2	-
Grade, %	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	65	47	91	25	25	93	67	25	25	25
Heavy Vehicles, %	0	29	7	0	0	7	34	0	0	0
Mvmt Flow	28	0	3813	0	0	4968	24	0	0	0

Major/Minor	Major1			Major2			Minor1			
Conflicting Flow All	3626	4968	0	0	3813	0	0	5856	8837	1907
Stage 1	-	-	-	-	-	-	-	3869	3869	-
Stage 2	-	-	-	-	-	-	-	1987	4968	-
Critical Hdwy	5.6	5.88	-	-	5.3	-	-	5.7	6.5	7.1
Critical Hdwy Stg 1	-	-	-	-	-	-	-	6.6	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	6	5.5	-
Follow-up Hdwy	2.3	3.39	-	-	3.1	-	-	3.8	4	3.9
Pot Cap-1 Maneuver	~ 14	2	-	-	14	-	-	1	0	51
Stage 1	-	-	-	-	-	-	-	3	11	-
Stage 2	-	-	-	-	-	-	-	83	3	-
Platoon blocked, %			-	-						
Mov Cap-1 Maneuver	~ 14	14	-	-	14	-	-	1	0	51
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	3	0	-
Stage 1	-	-	-	-	-	-	-	3	0	-
Stage 2	-	-	-	-	-	-	-	83	0	-

Approach	EB	WB	NB
HCM Control Delay, s	7.3	0	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR
Capacity (veh/h)	-	14	-	-	14	-	-
HCM Lane V/C Ratio	-	1.978	-	-	-	-	-
HCM Control Delay (s)	0	\$ 1008.8	-	-	0	-	-
HCM Lane LOS	A	F	-	-	A	-	-
HCM 95th %tile Q(veh)	-	4.2	-	-	0	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	0	0
Conflicting Peds, #/hr	0	0	0
Sign Control	Yield	Yield	Yield
RT Channelized	-	-	Free
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	25	69
Heavy Vehicles, %	0	0	36
Mvmt Flow	0	0	0

Major/Minor

Conflicting Flow All
Stage 1
Stage 2
Critical Hdwy
Critical Hdwy Stg 1
Critical Hdwy Stg 2
Follow-up Hdwy
Pot Cap-1 Maneuver
Stage 1
Stage 2
Platoon blocked, %
Mov Cap-1 Maneuver
Mov Cap-2 Maneuver
Stage 1
Stage 2

Approach

HCM Control Delay, s
HCM LOS

Minor Lane/Major Mvmt

Phone:
E-mail:

Fax:

Operational Analysis

Analyst: Kanchan BK
 Agency/Co.: HDR Engineering Inc
 Date Performed: 5/9/2016
 Analysis Time Period: AM Peak
 Freeway/Dir of Travel: Route 13/58/460 Westbound
 Weaving Location: Ramp to Portsmouth Blvd
 Analysis Year: 2030
 Description: SPSA Traffic Impact Assessment - Alternative 2

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	875	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	60	mi/h
Freeway maximum capacity, cIFL	1900*	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	1651	6	0	1390	veh/h
Peak hour factor, PHF	0.85	0.69	0.25	0.85	
Peak 15-min volume, v15	486	2	0	409	
Trucks and buses	7	29	7	8	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.873	0.966	0.962	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2010	10	0	1701	pc/h
Volume ratio, VR		0.003			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	1.0	int/mi
Minimum RF lane changes, LCRF	2	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	20	lc/h
Weaving lane changes, LCW	281	lc/h
Non-weaving vehicle index, INW	325	
Non-weaving lane change, LCNW	468	lc/h
Total lane changes, LCALL	749	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.200
-----------------------------	-------

Average weaving speed, SW	60.0	mi/h
Average non-weaving speed, SNW	55.4	mi/h

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	55.4	mi/h
Weaving segment density, D	16.8	pc/mi/ln
Level of service, LOS	B	
Weaving segment v/c ratio		
Weaving segment flow rate, v		veh/h
Weaving segment capacity, cW		veh/h

_____Limitations on Weaving Segments_____

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	2621	875	a,b
Density-based capacity, cIWL (pc/h/ln)		1900*	1766	c
v/c ratio		1.00	Analyzed	d

Notes:

- In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- Volumes exceed the weaving segment capacity. The level of service is F.

Phone:
E-mail:

Fax:

Operational Analysis

Analyst: Kanchan BK
 Agency/Co.: HDR Engineering Inc
 Date Performed: 6/21/2016
 Analysis Time Period: PM Peak
 Freeway/Dir of Travel: Route 13/58/460 Westbound
 Weaving Location: Ramp to Portsmouth Blvd
 Analysis Year: 2030
 Description: SPSA Traffic Impact Assessment - Alternative 2

Inputs

Segment Type	Freeway	
Weaving configuration	One-Sided	
Number of lanes, N	4	ln
Weaving segment length, LS	875	ft
Freeway free-flow speed, FFS	60	mi/h
Minimum segment speed, SMIN	60	mi/h
Freeway maximum capacity, cIFL	1900*	pc/h/ln
Terrain type	Level	
Grade	0.00	%
Length	0.00	mi

Conversion to pc/h Under Base Conditions

	Volume Components				
	VFF	VRF	VFR	VRR	
Volume, V	2541	20	0	2134	veh/h
Peak hour factor, PHF	0.93	0.75	0.25	0.75	
Peak 15-min volume, v15	683	7	0	711	
Trucks and buses	7	29	0	0	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.966	0.873	1.000	1.000	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2828	31	0	2845	pc/h
Volume ratio, VR		0.005			

Configuration Characteristics

Number of maneuver lanes, NWL	2	ln
Interchange density, ID	1.0	int/mi
Minimum RF lane changes, LCRF	2	lc/pc
Minimum FR lane changes, LCFR	1	lc/pc
Minimum RR lane changes, LCRR		lc/pc
Minimum weaving lane changes, LCMIN	62	lc/h
Weaving lane changes, LCW	323	lc/h
Non-weaving vehicle index, INW	496	
Non-weaving lane change, LCNW	872	lc/h
Total lane changes, LCALL	1195	lc/h

Weaving and Non-Weaving Speeds

Weaving intensity factor, W	0.289
-----------------------------	-------

Average weaving speed, SW	60.0	mi/h
Average non-weaving speed, SNW	52.7	mi/h

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	52.7	mi/h
Weaving segment density, D	27.0	pc/mi/ln
Level of service, LOS	C	
Weaving segment v/c ratio		
Weaving segment flow rate, v		veh/h
Weaving segment capacity, cW		veh/h

_____Limitations on Weaving Segments_____

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	2646	875	a,b
Density-based capacity, cIWL (pc/h/ln)		1900*	1765	c
v/c ratio		1.00	Analyzed	d

Notes:

- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- d. Volumes exceed the weaving segment capacity. The level of service is F.

Intersection

Int Delay, s/veh 4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Vol, veh/h	29	6	88	0	0	0	110	183	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None
Storage Length	175	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-
Peak Hour Factor	53	62	76	25	25	25	76	84	25
Heavy Vehicles, %	6	29	14	0	0	0	4	8	0
Mvmt Flow	55	10	116	0	0	0	145	218	0

Major/Minor

	Minor2			Major1		
Conflicting Flow All	803	803	296	356	0	0
Stage 1	296	296	-	-	-	-
Stage 2	507	507	-	-	-	-
Critical Hdwy	6.46	6.79	6.34	4.14	-	-
Critical Hdwy Stg 1	5.46	5.79	-	-	-	-
Critical Hdwy Stg 2	5.46	5.79	-	-	-	-
Follow-up Hdwy	3.554	4.261	3.426	2.236	-	-
Pot Cap-1 Maneuver	347	288	716	1192	-	-
Stage 1	746	622	-	-	-	-
Stage 2	597	497	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	299	0	716	1192	-	-
Mov Cap-2 Maneuver	299	0	-	-	-	-
Stage 1	746	0	-	-	-	-
Stage 2	515	0	-	-	-	-

Approach

	EB	NB
HCM Control Delay, s	13.7	3.4
HCM LOS	B	

Minor Lane/Major Mvmt

	NBL	NBT	NBR	EBLn1	EBLn2	SBL	SBT	SBR
Capacity (veh/h)	1192	-	-	299	716	1364	-	-
HCM Lane V/C Ratio	0.121	-	-	0.183	0.175	-	-	-
HCM Control Delay (s)	8.4	0	-	19.7	11.1	0	-	-
HCM Lane LOS	A	A	-	C	B	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	0.7	0.6	0	-	-

Intersection

Int Delay, s/veh

Movement	SBL	SBT	SBR
Vol, veh/h	0	221	80
Conflicting Peds, #/hr	0	0	0
Sign Control	Free	Free	Free
RT Channelized	-	-	None
Storage Length	-	-	-
Veh in Median Storage, #	-	0	-
Grade, %	-	0	-
Peak Hour Factor	25	94	66
Heavy Vehicles, %	0	0	2
Mvmt Flow	0	235	121

Major/Minor Major2

Conflicting Flow All	218	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.1	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.2	-	-
Pot Cap-1 Maneuver	1364	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	1364	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach SB

HCM Control Delay, s 0

HCM LOS

Minor Lane/Major Mvmt

Intersection

Int Delay, s/veh 8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	71	20	136	0	0	0	129	262	0	0	260	51
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	175	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	53	62	76	25	25	25	76	84	25	25	94	66
Heavy Vehicles, %	6	29	14	0	0	0	4	8	0	0	0	2
Mvmt Flow	134	32	179	0	0	0	170	312	0	0	277	77

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	966	966	315	354	0	0	312	0	0
Stage 1	315	315	-	-	-	-	-	-	-
Stage 2	651	651	-	-	-	-	-	-	-
Critical Hdwy	6.46	6.79	6.34	4.14	-	-	4.1	-	-
Critical Hdwy Stg 1	5.46	5.79	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.46	5.79	-	-	-	-	-	-	-
Follow-up Hdwy	3.554	4.261	3.426	2.236	-	-	2.2	-	-
Pot Cap-1 Maneuver	278	229	698	1194	-	-	1260	-	-
Stage 1	731	610	-	-	-	-	-	-	-
Stage 2	512	425	-	-	-	-	-	-	-
Platoon blocked, %									
Mov Cap-1 Maneuver	230	0	698	1194	-	-	1260	-	-
Mov Cap-2 Maneuver	230	0	-	-	-	-	-	-	-
Stage 1	731	0	-	-	-	-	-	-	-
Stage 2	424	0	-	-	-	-	-	-	-












Approach	EB	NB	SB
HCM Control Delay, s	23.3	3	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	SBL	SBT	SBR
Capacity (veh/h)	1194	-	-	230	698	1260	-	-
HCM Lane V/C Ratio	0.142	-	-	0.582	0.303	-	-	-
HCM Control Delay (s)	8.5	0	-	40.4	12.4	0	-	-
HCM Lane LOS	A	A	-	E	B	A	-	-
HCM 95th %tile Q(veh)	0.5	-	-	3.3	1.3	0	-	-

HCM 2010 Signalized Intersection Summary

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6/21/2016

								
Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Volume (veh/h)	190	16	519	162	37	570		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1743	1900	1863	1743	1900	1866		
Adj Flow Rate, veh/h	297	46	618	225	54	648		
Adj No. of Lanes	1	1	1	1	0	1		
Peak Hour Factor	0.64	0.35	0.84	0.72	0.69	0.88		
Percent Heavy Veh, %	9	0	2	9	2	2		
Cap, veh/h	553	538	993	790	102	837		
Arrive On Green	0.33	0.33	0.53	0.53	0.53	0.53		
Sat Flow, veh/h	1660	1615	1863	1482	71	1569		
Grp Volume(v), veh/h	297	46	618	225	702	0		
Grp Sat Flow(s),veh/h/ln	1660	1615	1863	1482	1640	0		
Q Serve(g_s), s	8.7	1.2	13.9	5.0	6.9	0.0		
Cycle Q Clear(g_c), s	8.7	1.2	13.9	5.0	20.8	0.0		
Prop In Lane	1.00	1.00		1.00	0.08			
Lane Grp Cap(c), veh/h	553	538	993	790	939	0		
V/C Ratio(X)	0.54	0.09	0.62	0.28	0.75	0.00		
Avail Cap(c_a), veh/h	553	538	993	790	939	0		
HCM Platoon Ratio	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	0.00		
Uniform Delay (d), s/veh	16.2	13.7	9.8	7.7	10.9	0.0		
Incr Delay (d2), s/veh	3.7	0.3	2.9	0.9	5.4	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	4.5	0.6	7.8	2.2	10.8	0.0		
LnGrp Delay(d),s/veh	19.9	14.0	12.7	8.6	16.3	0.0		
LnGrp LOS	B	B	B	A	B			
Approach Vol, veh/h	343		843			702		
Approach Delay, s/veh	19.1		11.6			16.3		
Approach LOS	B		B			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		36.0				36.0		24.0
Change Period (Y+Rc), s		4.0				4.0		4.0
Max Green Setting (Gmax), s		32.0				32.0		20.0
Max Q Clear Time (g_c+I1), s		15.9				22.8		10.7
Green Ext Time (p_c), s		9.0				6.0		0.7
Intersection Summary								
HCM 2010 Ctrl Delay			14.7					
HCM 2010 LOS			B					

HCM 2010 Signalized Intersection Summary

3:

6/21/2016



Movement	WBL	WBR	NBT	NBR	SBL	SBT		
Lane Configurations								
Volume (veh/h)	342	30	535	220	15	583		
Number	3	18	2	12	1	6		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00			
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00		
Adj Sat Flow, veh/h/ln	1743	1900	1810	1712	1900	1822		
Adj Flow Rate, veh/h	468	86	629	373	30	655		
Adj No. of Lanes	1	1	1	1	0	1		
Peak Hour Factor	0.73	0.35	0.85	0.59	0.50	0.89		
Percent Heavy Veh, %	9	0	5	11	4	4		
Cap, veh/h	609	592	905	727	80	831		
Arrive On Green	0.37	0.37	0.50	0.50	0.50	0.50		
Sat Flow, veh/h	1660	1615	1810	1455	34	1662		
Grp Volume(v), veh/h	468	86	629	373	685	0		
Grp Sat Flow(s),veh/h/ln	1660	1615	1810	1455	1695	0		
Q Serve(g_s), s	14.9	2.1	16.0	10.3	3.9	0.0		
Cycle Q Clear(g_c), s	14.9	2.1	16.0	10.3	19.9	0.0		
Prop In Lane	1.00	1.00		1.00	0.04			
Lane Grp Cap(c), veh/h	609	592	905	727	910	0		
V/C Ratio(X)	0.77	0.15	0.70	0.51	0.75	0.00		
Avail Cap(c_a), veh/h	609	592	905	727	910	0		
HCM Platoon Ratio	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	0.00		
Uniform Delay (d), s/veh	16.8	12.7	11.5	10.1	12.2	0.0		
Incr Delay (d2), s/veh	9.0	0.5	4.4	2.6	5.7	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	8.3	1.0	9.0	4.6	10.8	0.0		
LnGrp Delay(d),s/veh	25.8	13.2	15.9	12.7	17.9	0.0		
LnGrp LOS	C	B	B	B	B			
Approach Vol, veh/h	554		1002			685		
Approach Delay, s/veh	23.9		14.7			17.9		
Approach LOS	C		B			B		
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		34.0				34.0		26.0
Change Period (Y+Rc), s		4.0				4.0		4.0
Max Green Setting (Gmax), s		30.0				30.0		22.0
Max Q Clear Time (g_c+I1), s		18.0				21.9		16.9
Green Ext Time (p_c), s		7.5				5.6		0.9
Intersection Summary								
HCM 2010 Ctrl Delay			17.9					
HCM 2010 LOS			B					

Intersection

Int Delay, s/veh 10.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	60	22	251	522	238	417
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	250	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	79	54	87	89	88	70
Heavy Vehicles, %	5	15	6	5	4	5
Mvmt Flow	76	41	289	587	270	596

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	1438	433	866
Stage 1	568	-	-
Stage 2	870	-	-
Critical Hdwy	6.9	7.2	4.22
Critical Hdwy Stg 1	5.9	-	-
Critical Hdwy Stg 2	5.9	-	-
Follow-up Hdwy	3.55	3.45	2.26
Pot Cap-1 Maneuver	121	536	748
Stage 1	522	-	-
Stage 2	363	-	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	~ 74	536	748
Mov Cap-2 Maneuver	~ 74	-	-
Stage 1	522	-	-
Stage 2	223	-	-

Approach	EB	NB	SB
HCM Control Delay, s	140.7	4.2	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	748	-	74	536	-	-
HCM Lane V/C Ratio	0.386	-	1.026	0.076	-	-
HCM Control Delay (s)	12.8	-	209.6	12.3	-	-
HCM Lane LOS	B	-	F	B	-	-
HCM 95th %tile Q(veh)	1.8	-	5.5	0.2	-	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 22.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	37	61	237	622	377	553
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	250	150	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	62	81	83	85	86	84
Heavy Vehicles, %	39	2	3	4	1	2
Mvmt Flow	60	75	286	732	438	658

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	1705	548	1097
Stage 1	768	-	-
Stage 2	937	-	-
Critical Hdwy	7.58	6.94	4.16
Critical Hdwy Stg 1	6.58	-	-
Critical Hdwy Stg 2	6.58	-	-
Follow-up Hdwy	3.89	3.32	2.23
Pot Cap-1 Maneuver	~ 56	480	626
Stage 1	335	-	-
Stage 2	265	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	~ 30	480	626
Mov Cap-2 Maneuver	~ 30	-	-
Stage 1	335	-	-
Stage 2	144	-	-

Approach	EB	NB	SB
HCM Control Delay, s	\$ 336.6	4.3	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	626	-	30	480	-	-
HCM Lane V/C Ratio	0.456	-	1.989	0.157	-	-
HCM Control Delay (s)	15.5	-	\$ 743.8	13.9	-	-
HCM Lane LOS	C	-	F	B	-	-
HCM 95th %tile Q(veh)	2.4	-	6.9	0.6	-	-























Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 2010 Signalized Intersection Summary

3:























6/21/2016

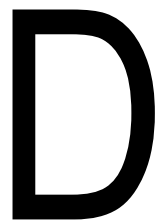
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	434	35	113	11	37	59	66	386	10	7	230	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	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	1776	1830	1900	1900	1900	1900	1827	1827	1900	1900	1863	1496
Adj Flow Rate, veh/h	493	45	147	16	46	89	96	449	17	17	284	57
Adj No. of Lanes	1	1	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.88	0.78	0.77	0.67	0.81	0.66	0.69	0.86	0.58	0.42	0.81	0.70
Percent Heavy Veh, %	7	0	0	0	0	0	4	4	0	0	2	27
Cap, veh/h	547	202	658	61	134	345	388	879	409	327	849	305
Arrive On Green	0.27	0.53	0.53	0.21	0.21	0.21	0.07	0.25	0.25	0.05	0.24	0.24
Sat Flow, veh/h	1691	378	1234	3	629	1615	1740	3471	1615	1810	3539	1272
Grp Volume(v), veh/h	493	0	192	62	0	89	96	449	17	17	284	57
Grp Sat Flow(s),veh/h/ln	1691	0	1612	632	0	1615	1740	1736	1615	1810	1770	1272
Q Serve(g_s), s	16.6	0.0	4.7	2.3	0.0	3.4	3.0	8.3	0.6	0.5	5.0	2.7
Cycle Q Clear(g_c), s	16.6	0.0	4.7	2.3	0.0	3.4	3.0	8.3	0.6	0.5	5.0	2.7
Prop In Lane	1.00		0.77	0.26		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	547	0	860	0	0	345	388	879	409	327	849	305
V/C Ratio(X)	0.90	0.00	0.22	0.00	0.00	0.26	0.25	0.51	0.04	0.05	0.33	0.19
Avail Cap(c_a), veh/h	547	0	860	0	0	345	388	879	409	327	849	305
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.2	0.0	9.3	0.0	0.0	24.6	19.3	24.0	21.1	19.3	23.5	22.7
Incr Delay (d2), s/veh	20.5	0.0	0.6	0.0	0.0	1.8	1.5	2.1	0.2	0.3	1.1	1.3
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	12.8	0.0	2.2	0.0	0.0	1.7	1.6	4.2	0.3	0.3	2.5	1.0
LnGrp Delay(d),s/veh	40.7	0.0	9.9	0.0	0.0	26.4	20.8	26.1	21.3	19.6	24.6	24.0
LnGrp LOS	D		A			C	C	C	C	B	C	C
Approach Vol, veh/h		685			151			562			358	
Approach Delay, s/veh		32.1			15.5			25.1			24.3	
Approach LOS		C			B			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.0	23.0		44.0	9.0	22.0	24.0	20.0				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	4.0	19.0		32.0	5.0	18.0	20.0	16.0				
Max Q Clear Time (g_c+I1), s	2.5	10.3		6.7	5.0	7.0	18.6	5.4				
Green Ext Time (p_c), s	0.0	3.1		2.0	0.0	3.6	0.3	1.4				
Intersection Summary												
HCM 2010 Ctrl Delay			26.8									
HCM 2010 LOS			C									

HCM 2010 Signalized Intersection Summary

3:

6/21/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	450	66	230	20	6	25	27	435	20	31	341	69
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	1827	1847	1900	1900	1900	1900	1496	1881	1900	1900	1863	1624
Adj Flow Rate, veh/h	484	102	264	45	12	39	46	494	34	51	355	90
Adj No. of Lanes	1	1	0	0	1	1	1	2	1	1	2	1
Peak Hour Factor	0.93	0.65	0.87	0.44	0.50	0.64	0.59	0.88	0.58	0.61	0.96	0.77
Percent Heavy Veh, %	4	0	0	0	0	0	27	1	0	0	2	17
Cap, veh/h	560	243	630	88	14	345	301	905	409	311	897	350
Arrive On Green	0.27	0.53	0.53	0.21	0.21	0.21	0.05	0.25	0.25	0.05	0.25	0.25
Sat Flow, veh/h	1740	457	1182	9	66	1615	1425	3574	1615	1810	3539	1380
Grp Volume(v), veh/h	484	0	366	57	0	39	46	494	34	51	355	90
Grp Sat Flow(s),veh/h/ln	1740	0	1638	75	0	1615	1425	1787	1615	1810	1770	1380
Q Serve(g_s), s	15.5	0.0	10.1	3.1	0.0	1.5	1.7	9.0	1.2	1.5	6.2	3.9
Cycle Q Clear(g_c), s	15.5	0.0	10.1	3.1	0.0	1.5	1.7	9.0	1.2	1.5	6.2	3.9
Prop In Lane	1.00		0.72	0.79		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	560	0	874	0	0	345	301	905	409	311	897	350
V/C Ratio(X)	0.86	0.00	0.42	0.00	0.00	0.11	0.15	0.55	0.08	0.16	0.40	0.26
Avail Cap(c_a), veh/h	560	0	874	0	0	345	301	905	409	311	897	350
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.5	0.0	10.5	0.0	0.0	23.8	18.9	24.3	21.4	19.1	23.2	22.4
Incr Delay (d2), s/veh	16.2	0.0	1.5	0.0	0.0	0.7	1.1	2.4	0.4	1.1	1.3	1.8
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	11.9	0.0	4.8	0.0	0.0	0.7	0.8	4.7	0.6	0.8	3.2	1.6
LnGrp Delay(d),s/veh	35.7	0.0	12.0	0.0	0.0	24.4	20.0	26.6	21.8	20.2	24.5	24.1
LnGrp LOS	D		B			C	B	C	C	C	C	C
Approach Vol, veh/h		850			96			574			496	
Approach Delay, s/veh		25.5			9.9			25.8			24.0	
Approach LOS		C			A			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	8.0	23.0		44.0	8.0	23.0	24.0	20.0				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	4.0	19.0		31.0	4.0	19.0	20.0	16.0				
Max Q Clear Time (g_c+I1), s	3.5	11.0		12.1	3.7	8.2	17.5	5.1				
Green Ext Time (p_c), s	0.0	3.5		3.0	0.0	4.2	0.5	2.3				
Intersection Summary												
HCM 2010 Ctrl Delay			24.5									
HCM 2010 LOS			C									

A large, bold, black letter 'D' is positioned on the right side of the page, partially overlapping a dark red vertical bar on the left and a grey horizontal bar at the top.

Appendix D – Signal Warrant
Summary Worksheet



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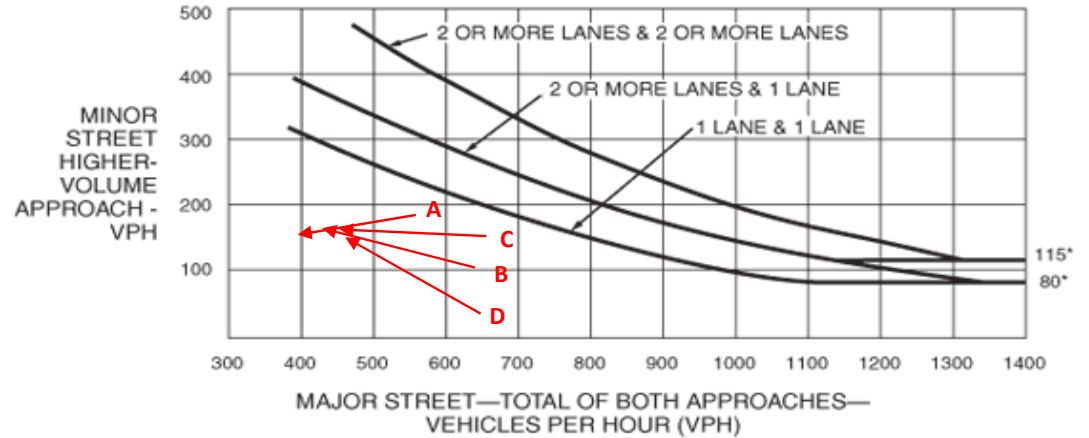
Start Time	Nansemond Pkwy Southbound			Progress Rd Westbound			Nansemond Pkwy Northbound			Progress Rd Eastbound		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
07:00 AM	0	37	19	0	0	0	15	36	0	2	0	10
07:15 AM	0	37	4	0	0	0	12	32	1	5	0	18
07:30 AM	0	39	10	0	0	0	24	26	0	3	0	19
07:45 AM	0	33	20	0	0	0	22	27	0	9	0	11
08:00 AM	0	39	9	0	0	0	27	25	0	5	2	11
08:15 AM	0	34	12	0	0	0	17	29	0	3	0	8
08:30 AM	0	29	10	0	0	0	22	36	0	1	0	13
08:45 AM	1	30	13	0	0	0	21	17	0	3	0	4
02:00 PM	0	32	8	0	0	0	16	32	0	11	2	21
02:15 PM	0	28	13	0	0	0	20	34	0	11	0	9
02:30 PM	0	24	7	0	0	0	20	27	0	12	0	15
02:45 PM	0	35	10	0	0	0	17	33	0	12	0	9
03:00 PM	0	33	10	0	0	0	14	37	0	8	2	25
03:15 PM	0	27	9	0	0	0	25	23	0	3	2	18
03:30 PM	0	38	10	0	0	0	24	52	0	13	0	42
03:45 PM	0	48	8	0	0	0	27	42	0	10	0	16
04:00 PM	0	41	9	0	0	0	13	48	0	15	0	20
04:15 PM	0	45	7	0	0	0	21	31	0	9	0	12

	Major St Both Approach	Minor St One Direction
	1 lanes	2 lanes
7 AM - 8 AM	394	77
7:15 AM - 8:15 AM	387	83
7:30 AM - 8:30 AM	393	71
7:45 AM - 8:45 AM	391	63
8:00 AM - 9:00 AM	371	50

2:00 PM - 3 PM	356	102
2:15 PM - 3:15 PM	362	103
2:30 PM - 3:30 PM	351	106
2:45 PM - 3:45 PM	397	134
3:00 PM - 4 PM	427	139
3:15 PM - 4:15 PM	444	139
3:30 PM - 4:30 PM	464	137

471
470
464
454
421
0
458
465
457
531
566
583
601

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

Nanesmond & Progress

Existing		
Peak Hour		
	Major (both Approaches)	Minor (one-direction)
	1 Lane	2 lanes
AM	394	77
PM	464	137

No-Action

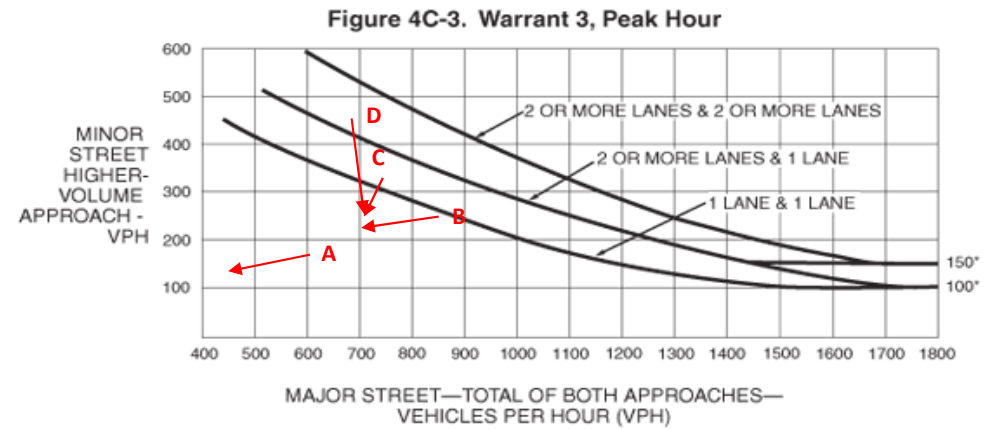
Peak Hour		
	Major (both Approaches)	Minor (one-direction)
	2 lanes	2 lanes
AM	596	117
PM	702	207

Alternative 1

Peak Hour		
	Major (both Approaches)	Minor (one-direction)
	2 lanes	2 lanes
AM	596	101
PM	702	227

Alternative 2

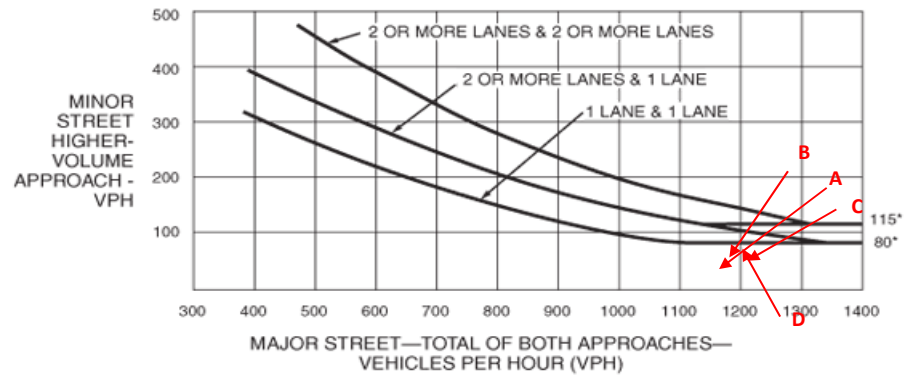
Peak Hour		
	Major (both Approaches)	Minor (one-direction)
	2 lanes	2 lanes
AM	596	123
PM	702	227



Start Time	Wilroy Rd Southbound				Westbound				Wilroy Rd Northbound				WB Rt 58 ramp Eastbound			
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
07:00 AM	0	37	71	0	0	0	0	0	35	89	0	0	9	0	4	0
07:15 AM	0	32	82	0	0	0	0	0	36	91	0	0	8	0	4	0
07:30 AM	0	42	82	1	0	0	0	0	36	93	0	0	7	0	7	0
07:45 AM	0	37	64	0	0	0	0	0	61	65	0	0	12	0	3	0
08:00 AM	0	38	81	0	0	0	0	0	34	95	0	3	13	0	3	0
08:15 AM	0	46	58	0	0	0	0	0	41	100	0	2	9	0	2	0
08:30 AM	0	42	61	0	0	0	0	0	26	102	0	0	8	0	3	0
08:45 AM	0	41	67	0	0	0	0	0	35	73	0	0	7	0	2	0
02:00 PM	0	34	39	0	0	1	0	0	30	69	0	0	2	1	8	0
02:15 PM	0	62	63	0	0	0	0	0	42	92	0	0	7	0	11	0
02:30 PM	0	51	46	0	0	0	0	0	38	78	0	0	8	0	7	0
02:45 PM	0	55	60	0	0	0	0	0	38	87	0	0	3	0	7	0
03:00 PM	0	58	83	0	0	0	0	0	66	84	0	0	4	0	15	0
03:15 PM	0	51	90	0	0	0	0	0	48	120	0	0	7	0	10	0
03:30 PM	0	76	114	0	0	0	0	0	42	95	0	0	10	0	9	0
03:45 PM	0	56	81	0	0	0	0	0	29	95	0	0	2	0	13	0
04:00 PM	0	75	93	0	0	0	0	0	43	102	0	0	6	0	10	0
04:15 PM	0	62	90	1	0	0	0	0	27	119	0	0	9	0	17	0

	Major St Both Approach	Minor St One Direction
	2 lanes	2 lanes
7 AM - 8 AM	954	54
7:15 AM - 8:15 AM	973	57
7:30 AM - 8:30 AM	979	56
7:45 AM - 8:45 AM	956	53
8:00 AM - 9:00 AM	945	47
2:00 PM - 3 PM	884	54
2:15 PM - 3:15 PM	1003	62
2:30 PM - 3:30 PM	1053	61
2:45 PM - 3:45 PM	1167	65
3:00 PM - 4 PM	1188	70
3:15 PM - 4:15 PM	1210	67
3:30 PM - 4:30 PM	1200	76

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

Existing

Peak Hour		
	Major (both Approaches)	Minor (one-direction)
	2 lanes	2 lanes
AM	973	56
PM	1210	67

No-Action

Peak Hour		
	Major (both Approaches)	Minor (one-direction)
	2 lanes	2 lanes
AM	962	82
PM	1769	98

Alternative 1

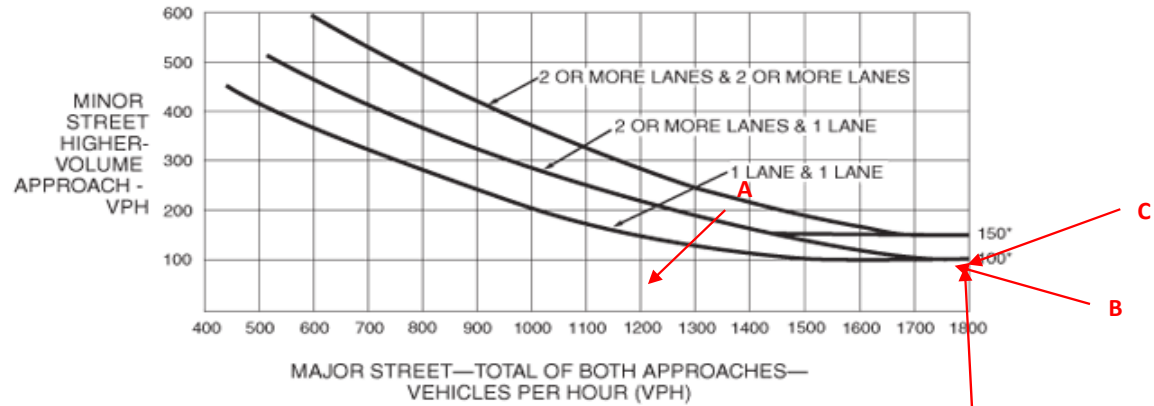
Peak Hour		
	Major (both Approaches)	Minor (one-direction)
	2 lanes	2 lanes
AM	1434	82
PM	1809	98

Alternative 2

Peak Hour		
	Major (both Approaches)	Minor (one-direction)
	2 lanes	2 lanes
AM	1428	82
PM	1789	98

Wilroy Road and WB Ramps

Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.



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