Michael Baker
INTERNATIONAL

sawmpo

FY21 SMALL AREA STUDY
I-81 EXIT 235 AND ROUTE 256

FY 2021 SMALL AREA STUDY

I-81 Exit 235 and Route 256

July 2022

Prepared for:

Staunton Augusta Waynesboro Metropolitan Planning Organization

Prepared by:

Michael Baker INTERNATIONAL

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

1. Introduction

The Weyers Cave area has experienced an increase in traffic levels due to industrial, institutional, commercial, and residential development in the vicinity of the I-81 interchange at Route 256 (Exit 235). Exit 235 serves several regional generators including Blue Ridge Community College and the Shenandoah Valley Regional Airport. With Weyers Cave's status as a Designated Growth Area, future traffic conditions are anticipated to present several challenges to both motorized and non-motorized travelers. The Exit 235 Small Area Study seeks to identify and evaluate solutions to address periodic congestion at the Exit 235 Interchange, anticipate long-term corridor needs and accommodate future growth.

1.1 Study Area and Stakeholders

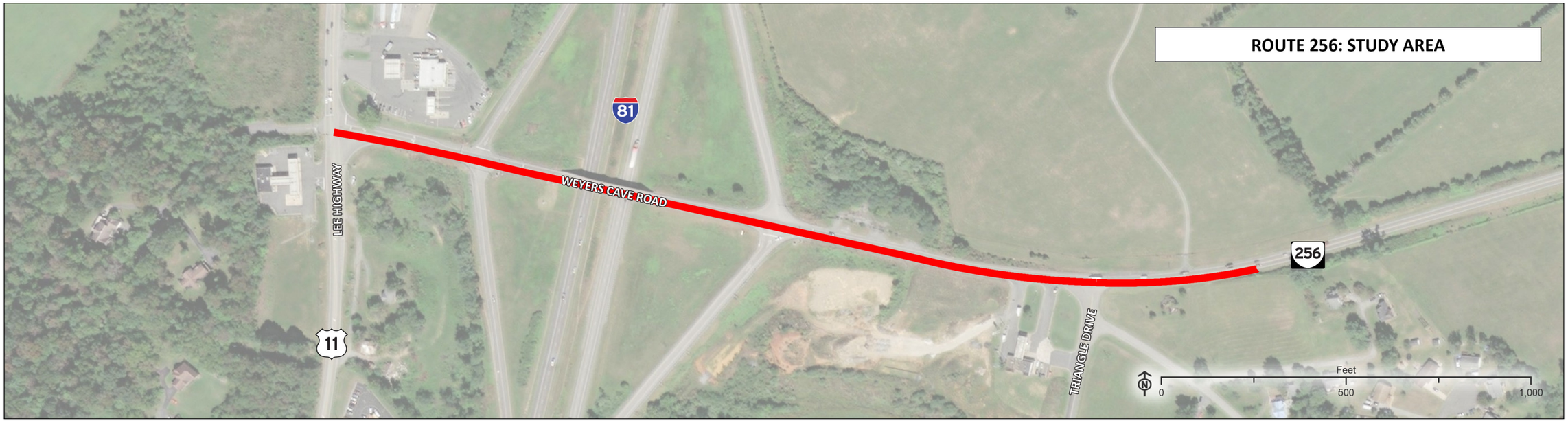
The study area extends along Weyers Cave Road (VA 256) from Lee Highway (US 11) in the west to Triangle Drive in the east as shown in Figure 1. The study area is approximately four-tenths (0.4) of a mile in length and includes the following intersections:

- Route 256 and US Route 11
- Route 256 and Southbound I-81 Ramp
- Route 256 and Northbound I-81 Ramp
- Route 256 and Triangle Drive

The study included a diverse stakeholder group that represents local, regional, and state goals for the Weyers Cave area. These members are:

- Staunton Augusta Waynesboro Metropolitan Planning Organization (SAWMPO)
- Central Shenandoah Planning District Commission (CSPDC)
- Blue Ridge Community College (BRCC)
- Shenandoah Valley Regional Airport (SVRA)
- Augusta County
- Virginia Department of Transportation (VDOT)
- Michael Baker International

Figure 1. Study Area



2. Existing Conditions

2.1 Traffic Conditions and Data

The study area existing conditions are based on 2021 traffic data and field visits. The study team performed a field visit on May 5, 2021 to help verify operational and safety concerns. Data collection included obtaining turn movement counts on April 13, 2021 and 2015-2019 crash data from VDOT. It should be noted that the traffic counts were calibrated due to COVID-19 impacts on travel patterns. The base year volumes are shown in Figure 2. The detailed process to develop these volumes can be found in Appendix A.

Crash data analyses included a review of time of day, weather conditions, crash severity, and crash type. Figures 3 and 4 show both the crash types and crash severity along the study area.

Finally, traffic operations were analyzed in accordance with the Traffic Operations and Safety Analysis Manual 2.0 (TOSAM). The study team updated the 2017 VDOT Synchro model with the base year volumes for peak hours between 7:15 AM to 8:15 AM and 4:30 PM to 5:30 PM. Measures of effectiveness for intersections include Highway Capacity Manual (HCM) control delay (seconds/vehicle) and Synchro 95th percentile queue length. Control delay is delay brought about by the presence of a traffic control device, including delay associated with vehicles slowing in advance of an intersection, the time spent stopped on an intersection approach, the time spent as vehicles move up in the queue, and the time needed for vehicles to accelerate to their desired speed. Whereas the queue length is the distance between the upstream and downstream ends of the queue. Figure 5 summarizes the intersection level of service (LOS), which is a graded measure of the operating conditions of a roadway.

2.1.1 Intersection of US Route 11 and Route 256

The intersection of US Route 11 and Route 256 is an existing signalized intersection controlling five approaches, one on Route 256 in the westbound direction, one on Ridgetop Drive (a private roadway) in the eastbound direction, two on US Route 11, and one from an inactive gas station (as of June 2021) in the southwest corner. The southbound US Route 11 left-turn is protected-permitted with a five-section traffic signal face, and the northbound left-turn is permissive. There is also a static flashing beacon for northbound US Route 11 drivers approaching the traffic signal. Other observations and comments from stakeholders include:

- Wide intersection due to traffic signal placement
- Queuing from I-81 southbound ramp nearing the US Route 11 and Route 256 intersection
- Driver confusion from left-turning vehicles making a left from southbound US Route 11 onto Route 256
- Sight distance is limited due to the vertical curve when approaching the signal on northbound US Route 11 This obstructs the traffic signal indication, however, the flashing beacon is placed in advance notifying roadway users a traffic signal is ahead
  - This issue also affects drivers ability to see approaching vehicles when making a permissive left-turn from southbound US Route 11
- Rutting in the northwest corner from vehicles making a right onto northbound US Route 11 from Route 256

Synchro analysis results can be found in Table 1.

Table 1. Synchro Analysis: Intersection of US Route 11 and Route 256

Direction	Lane Group	AM Peak Hour			PM Peak Hour		
		Delay (Sec/ veh)	LOS	Queue Length (ft)	Delay (Sec/ veh)	LOS	Queue Length (ft)
Ridgetop Drive Eastbound	Left	21.8	C	-	26.0	C	-
	Through	21.8	C	20	26.0	C	9
	Right	21.8	C	-	26.0	C	-
Route 256 Westbound	Left	48.6	D	483	37.7	D	130
	Through	48.6	D	483	37.7	D	130
	Right	22.4	C	0	26.8	C	12
US 11 Northbound	Left	34.2	C	16	26.3	C	20
	Through	43.4	D	155	31.6	C	136
	Right	34.9	C	0	27.7	C	42
US 11 Southbound	Left	31.8	C	155	17.9	B	176
	Through	24.4	C	136	15.3	B	149
	Right	24.4	C	136	15.3	B	149
Gas Station	Left	47.1	D	0	38.1	D	0
	Through	47.1	D	-	38.1	D	-
	Right	47.1	D	0	38.1	D	0
Overall		37	D	-	25.4	C	-

Figure 2. Recommended Base Year Volumes

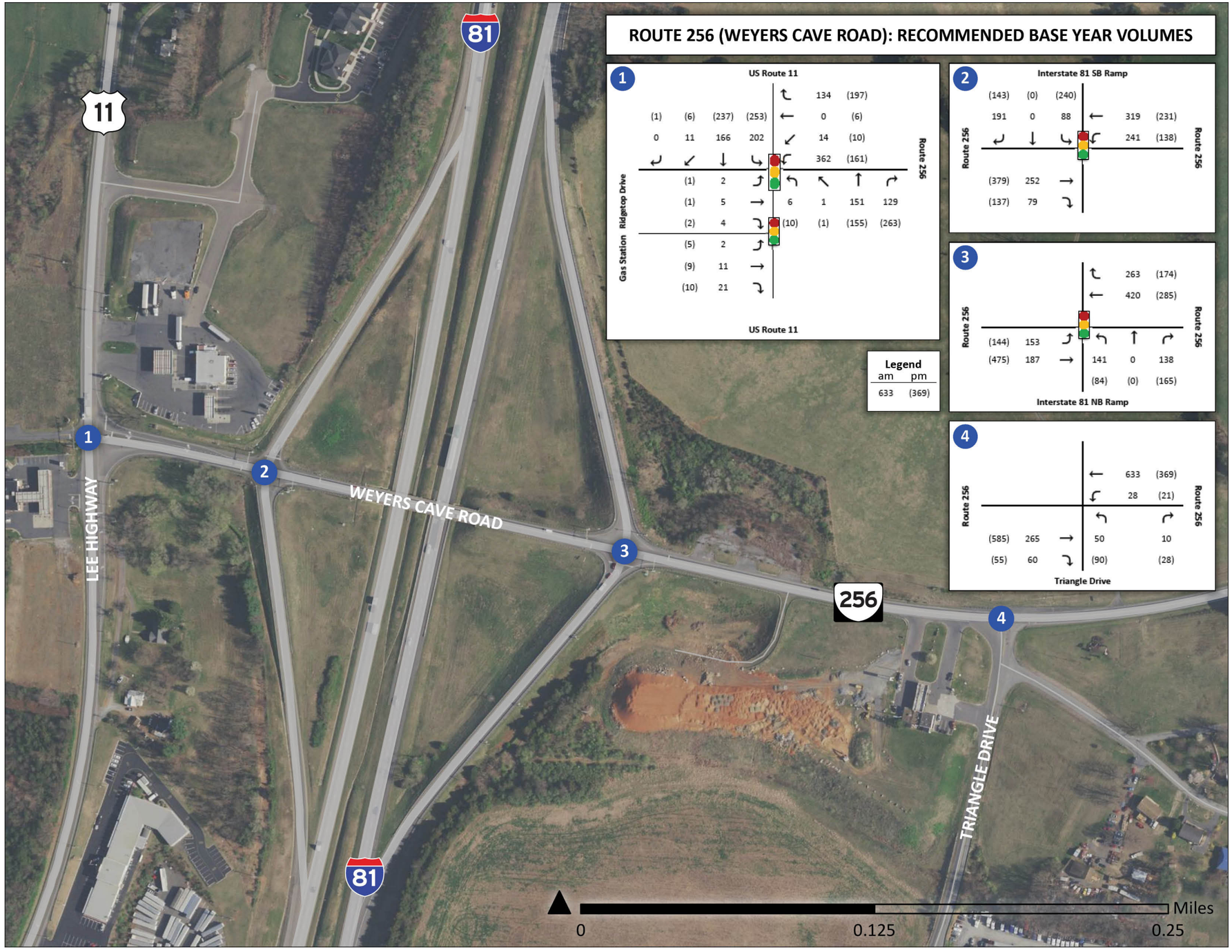


Figure 3. Crashes by Type

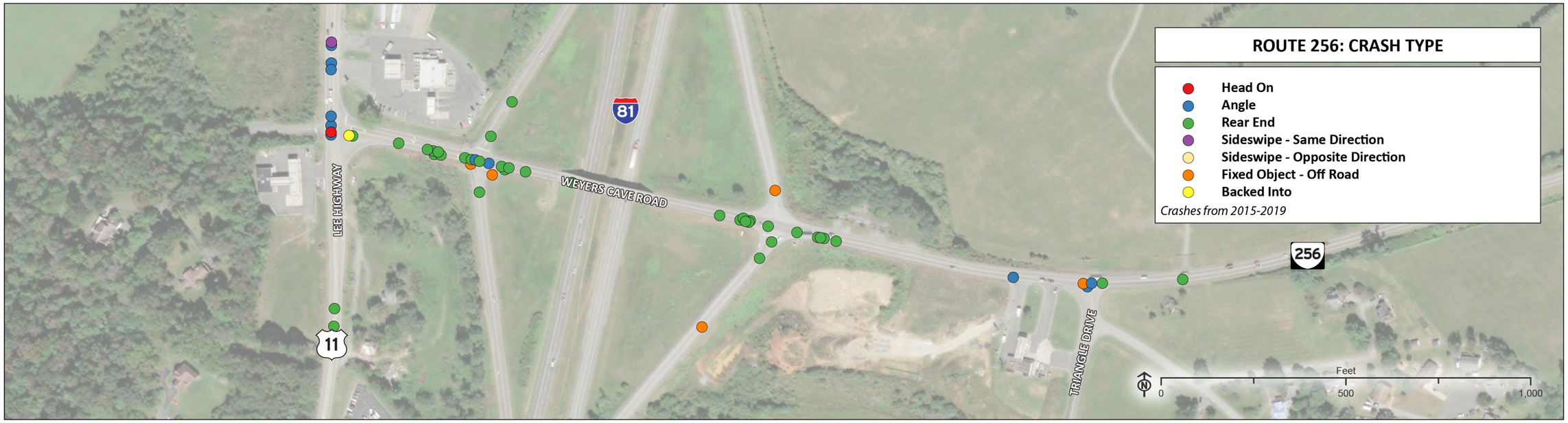


Figure 4. Crashes by Severity

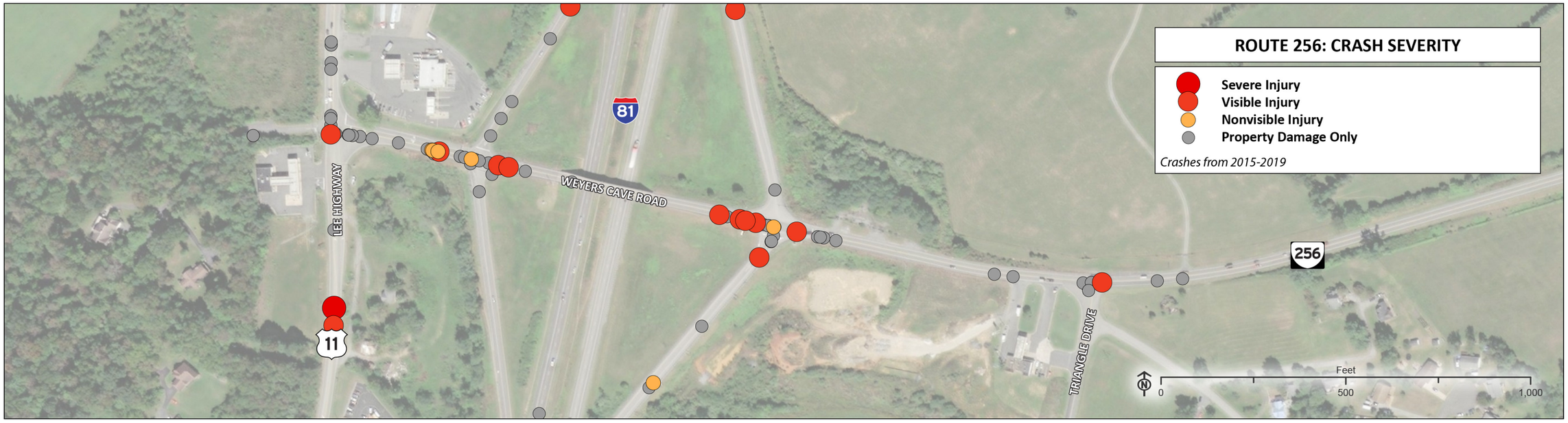


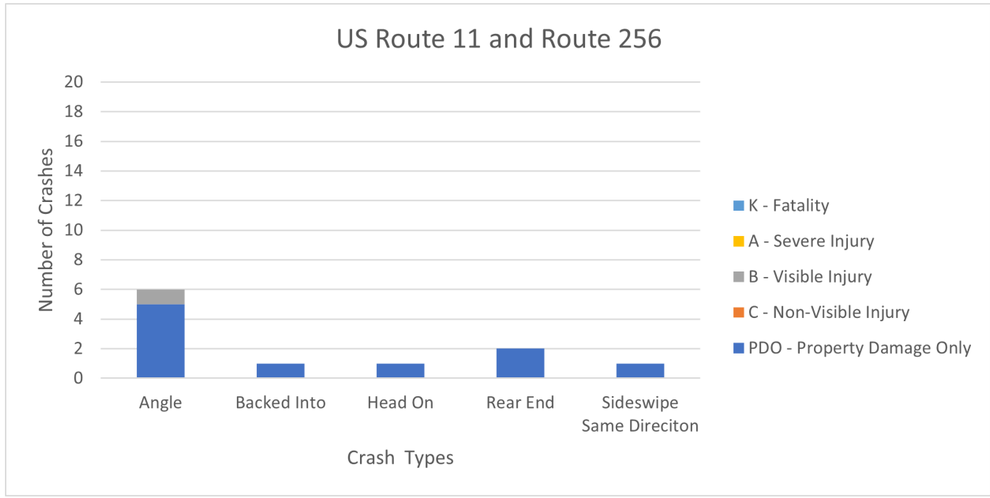
Figure 5. Intersection Level of Service Summary

As shown in Table 1, The intersection experiences more delay in the AM peak period, than the PM peak period. This is a result of a higher left-turn volume movement from Route 256 onto southbound US Route 11, where vehicles experience 48.6 seconds/vehicle of delay. In the PM peak period, traffic delay is less than the AM, however the westbound and northbound movements still experience delay of about 30 seconds/vehicle.

Crash summary results can be found in figure 6.

The most frequent crash type at this intersection is an angle crash. These crashes typically involved either northbound left-turns from US Route 11 onto Ridgetop Drive with the southbound US Route 11 through movement or vehicles entering/exiting the BP gas station driveway. As mentioned previously, the intersection is wide and the northbound stop bar significantly set back from where most movements occur. In addition, the combination of turning distance lengths and the permissive green can contribute to driver right-of-way confusion. Finally, the BP gas station driveways do not meet access management standards which, increases the risk of these types of crashes.

Figure 6. Crashes at US Route 11



2.1.2 Intersection of Southbound I-81 Ramp and Route 256

The intersection of the southbound I-81 Ramp and Route 256 is an existing signalized intersection controlling vehicles entering and exiting between Route 256 and I-81. No turn lanes exist on any approach, although passenger vehicles were observed using the additional pavement width on the southbound off-ramp to make a right onto Route 256. Other observations and comments from stakeholders include:

- Left-turns have a leading signal phase to enter the I-81 southbound ramp
- Queuing was observed between the two ramp signals, although queues did clear each cycle
- Rutting is observed between the shoulder and pavement on the southbound I-81 ramp
- Stakeholders mention that operations do get worse during incidents and James Madison University sporting events

Synchro analysis results can be found in Table 2.

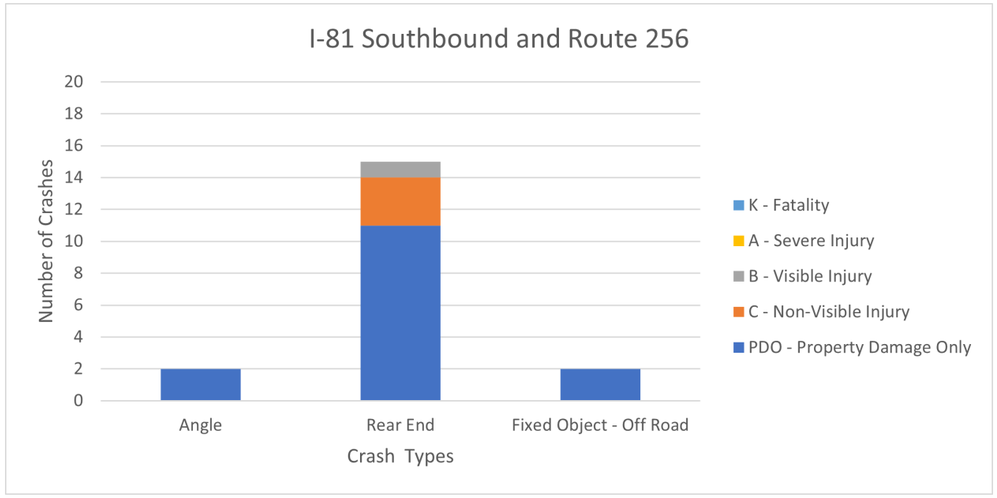
Table 2. Synchro Analysis: Intersection of Southbound I-81 Ramp and Route 256

Direction	Lane Group	AM Peak Hour			PM Peak Hour		
		Delay (Sec/ veh)	LOS	Queue Length (ft)	Delay (Sec/ veh)	LOS	Queue Length (ft)
Route 256 Eastbound	Through	16.8	B	302	41.0	D	471
	Right	16.8	B	302	41.0	D	471
Route 256 Westbound	Left	16.6	B	359	15.3	B	185
	Through	16.6	B	359	15.3	B	185
I-81 Southbound	Left	51.7	D	222	41.0	D	255
	Through	51.7	D	222	41.0	D	255
	Right	51.7	D	222	41.0	D	255
Overall		24.9	C	-	33.6	C	-

As a result of no turn lanes and the high left and right-turning volumes, the intersection experiences delays and queues that impact through traveling vehicles today. The AM peak period experiences an intersection delay of 24.9 seconds/vehicle with relatively minimal issues on most approaches. However during the PM peak period, the intersection experiences more delay on all approaches. The intersection delay is 33.6 seconds/vehicle and consistent queuing on all approaches, the worst being the eastbound approach at 471 feet.

Crash summary results can be found in figure 7.

Figure 7. Crashes at Intersection of Southbound I-81 Ramp and Route 256



Approximately half of the rear-end crashes are occurring westbound on Route 256. Rear-end crashes also occurred on the southbound I-81 ramp, and eastbound on Route 256. The crashes at this intersection can be attributed to the lack of turn lanes, which could provide refuge for turning vehicles and improve operations.

2.1.3 Intersection of Northbound I-81 Ramp and Route 256

The intersection of the northbound I-81 Ramp and Route 256 is an existing signalized intersection controlling vehicles entering and exiting between Route 256 and I-81. None of the four approaches has a turn lane. Other observations and comments from stakeholders include:

- Left-turns have a leading signal phase to enter the I-81 northbound ramp
- Queuing was observed between the two ramp signals, although not as bad as the southbound I-81 ramp
- Queuing was also observed between the signal and Triangle Drive
- Stakeholders mention that operations do get worse during incidents and James Madison University events, especially with vehicles attempting to make a left from I-81 northbound to Route 256 westbound

Synchro analysis results can be found in Table 3.

Table 3. Synchro Analysis: Intersection of Northbound I-81 Ramp and Route 256

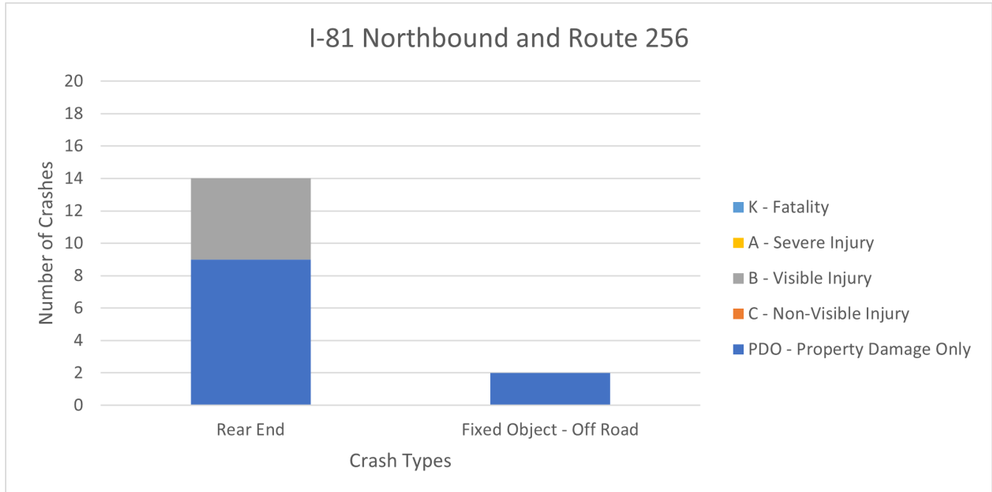
Direction	Lane Group	AM Peak Hour			PM Peak Hour		
		Delay (Sec/veh)	LOS	Queue Length (ft)	Delay (Sec/veh)	LOS	Queue Length (ft)
Route 256 Eastbound	Left	11.6	B	159	6.7	A	108
	Through	11.6	B	159	6.7	A	108
Route 256 Westbound	Through	24.5	C	536	22.8	C	347
	Right	24.5	C	536	22.8	C	347
I-81 Northbound Ramp	Left	54.2	D	257	33.4	C	132
	Through	54.2	D	257	33.4	C	132
	Right	54.2	D	257	33.4	C	132
Overall		27.5	C	-	17.3	B	-

As a result of no turn lanes and the high left and right-turning volumes, the intersection does experience delays and queues that impact through traveling vehicles. The AM peak period experiences an intersection delay of 27.5 seconds/vehicle with relatively minimal issues on most approaches. During the PM peak the intersection experiences 17.3 seconds/vehicle and consistent queuing on all approaches. In both instances, the westbound Route 256 movement experiences similar delay and queues. The westbound Route 256 AM approach delay is 24.5 seconds/vehicle and the PM approach delay is 22.8 seconds/vehicle.

Crash summary results can be found in Figure 8.

Most rear end crashes either occurred in the eastbound or westbound directions on Route 256. These crashes can be attributed to the lack of turn lanes at the intersection. Turn lanes could provide refuge for turning vehicles and improve operations.

Figure 8. Crashes at I-81 Northbound Ramp



2.1.4 Intersection of Triangle Drive and Route 256

The intersection of Triangle and Route 256 is an unsignalized intersection with minor street stop-control. The intersection serves a gas station and an industrial area to the south. No turn lanes exist on any approach. Other observations and comments from stakeholders include:

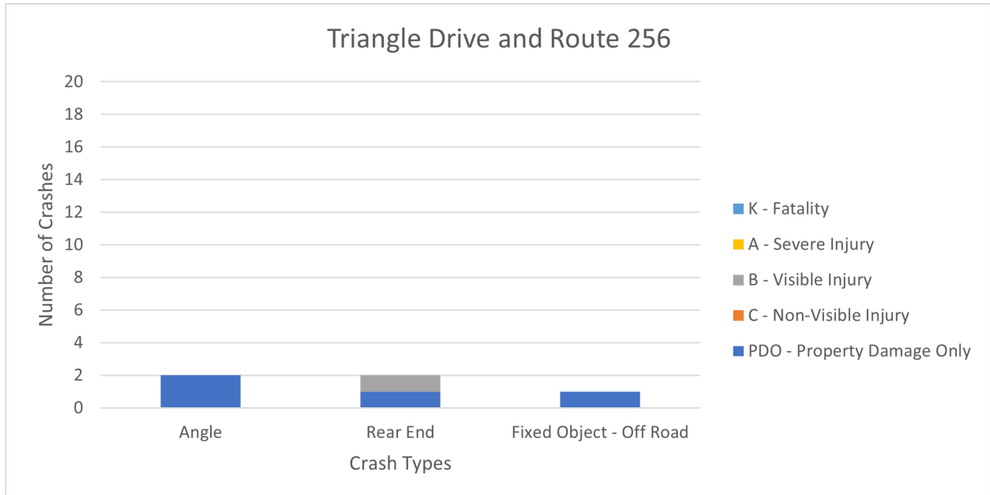
- Rutting was observed on the right-side approach of the intersection
- Traffic signage (as of June 2021) looks to have been hit
- Sight distance is adequate in both directions
- Queue's had been observed near Triangle Drive on Route 256 as result of the northbound I-81 ramp traffic signal

Synchro analysis results can be found in Table 4.

Table 4. Synchro Analysis: Triangle Drive and Route 256

Direction	Lane Group	AM Peak Hour			PM Peak Hour		
		Delay (Sec/ veh)	LOS	Queue Length (ft)	Delay (Sec/ veh)	LOS	Queue Length (ft)
Route 256 Eastbound	Through	0.0	A	0	0.0	A	0
	Right	0.0	A	0	0.0	A	0
Route 256 Westbound	Left	0.7	A	2	0.9	A	2
	Through	0.7	A	2	0.9	A	2
Triangle Dr. Northbound	Left	29.0	D	32	41.2	E	82
	Right	29.0	D	32	41.2	E	82
Overall		2.1	A	-	4.5	A	-

Figure 9. Crashes at the Intersection of Triangle Drive and Route 256



The intersection of Triangle Drive and Route 256 is an existing unsignalized intersection with minor stop-control. The intersection serves a gas station and an industrial area to the south. No turn lanes exist on any approach. Other observations and comments from stakeholders include:

Crash summary results can be found in figure 9.

This intersection was not observed to have any significant crash issues. The two angle crashes involved left-turning vehicles on Route 256 onto Triangle Drive with through-bound Route 256 vehicles. The one rear-end was a result of a left-turning Route 256 vehicle turning onto Triangle Drive being struck by a Route 256 through-bound vehicle.

3. Future Traffic Conditions

3.1 Future Growth

The stakeholder group agreed on a 2045 forecast year to evaluate future operations of the study intersections. The study team then developed growth rates in accordance with IIM-TMPD-7.0 Traffic Forecasting. The growth rates were based on the Staunton Augusta Waynesboro MPO Travel Demand Modal, historical volumes, funded developments, and planned expansions at SVRA and BRCC. Appendix A documents development of the growth rates. VDOT TMPD and the stakeholder group approved the growth rates on June 10, 2021. The 2045 traffic volumes can be found in Figure 11 and are based on the following assumptions:

- 1% background linear growth rate applied to Route 256
- Apply the same methodology for the I-81 ramp Volumes as the March 2021 Memo
  - 2.00% linear growth rate be applied to the daily ramp volume estimate by dividing the 2017, 12-hour turning movement counts by 0.75
  - The additional volume will be carried back towards the east on Route 256 to account for the higher growth associated with the airport and planned improvements to the east
- 1% linear growth rate applied to US 11
- Zero or no growth for the northbound approach of Triangle Drive
- Site Traffic ITE Calculation for the funded Park and Ride Lot entrance at Triangle Drive using ITE Trip Generation Code 090 – Park and Ride Lot with Bus or Light Rail
- Site Traffic ITE Calculation for the Landings Drive Weyers Caver Apartment Complex using the highest of the two ITE Trip Generation Codes 221 – Multifamily Housing (Mid-Rise) or 231 – Mid Rise with 1st Floor Commercial

3.2 Funded Traffic Improvements

There are multiple funded improvements on the Route 256 corridor that are expected to be completed before the analysis year. These improvements include:

- Intersection of Southbound I-81 Ramp and Route 256: eastbound Route 256 right-turn lane
- Intersection of Northbound I-81 Ramp and Route 256: westbound Route 256 right-turn lane
- Park N' Ride lot located on north side of Route 256 between the northbound I-81 ramp and Triangle Drive
- Shared use path on south side of Route 256 between the northbound I-81 ramp and the gas station
- Westbound Route 256 left-turn lane at Triangle Drive

Figure 10 summarizes all improvements in one concept.

3.3 Future No Improvement Traffic Operations

The Synchro models were updated with 2045 volumes, the funded improvements, and optimized signal timings. Detailed results of the no improvements can be found in Section 4. Figure 12 summarizes the future No Improvement conditions on Route 256.

In general, operational delay worsens for all intersections by 2045. The AM overall intersection delay increases from 37.0 seconds/vehicle to 47.4 seconds/vehicle. At both ramps the right-turn lanes help the approaches for those directions, however, the overall ramp operations will get worse and be over capacity with the possibility of queues backing-up into upstream intersections impacting those operations.

Figure 10. Funded Traffic Improvements

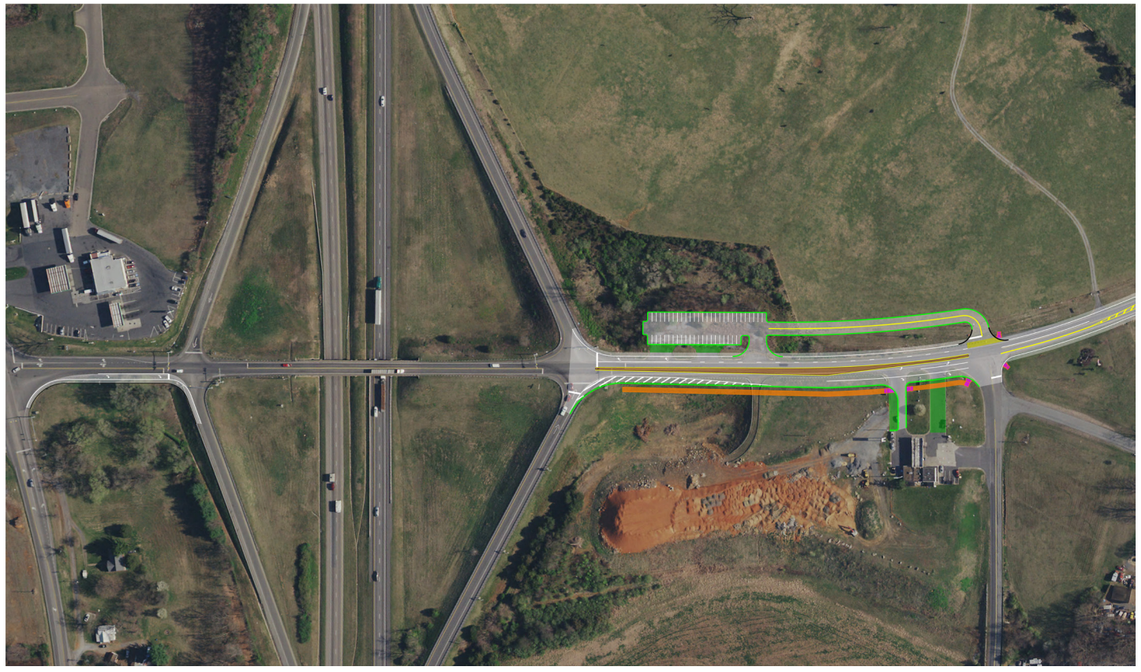


Figure 11. 2045 Future Volumes

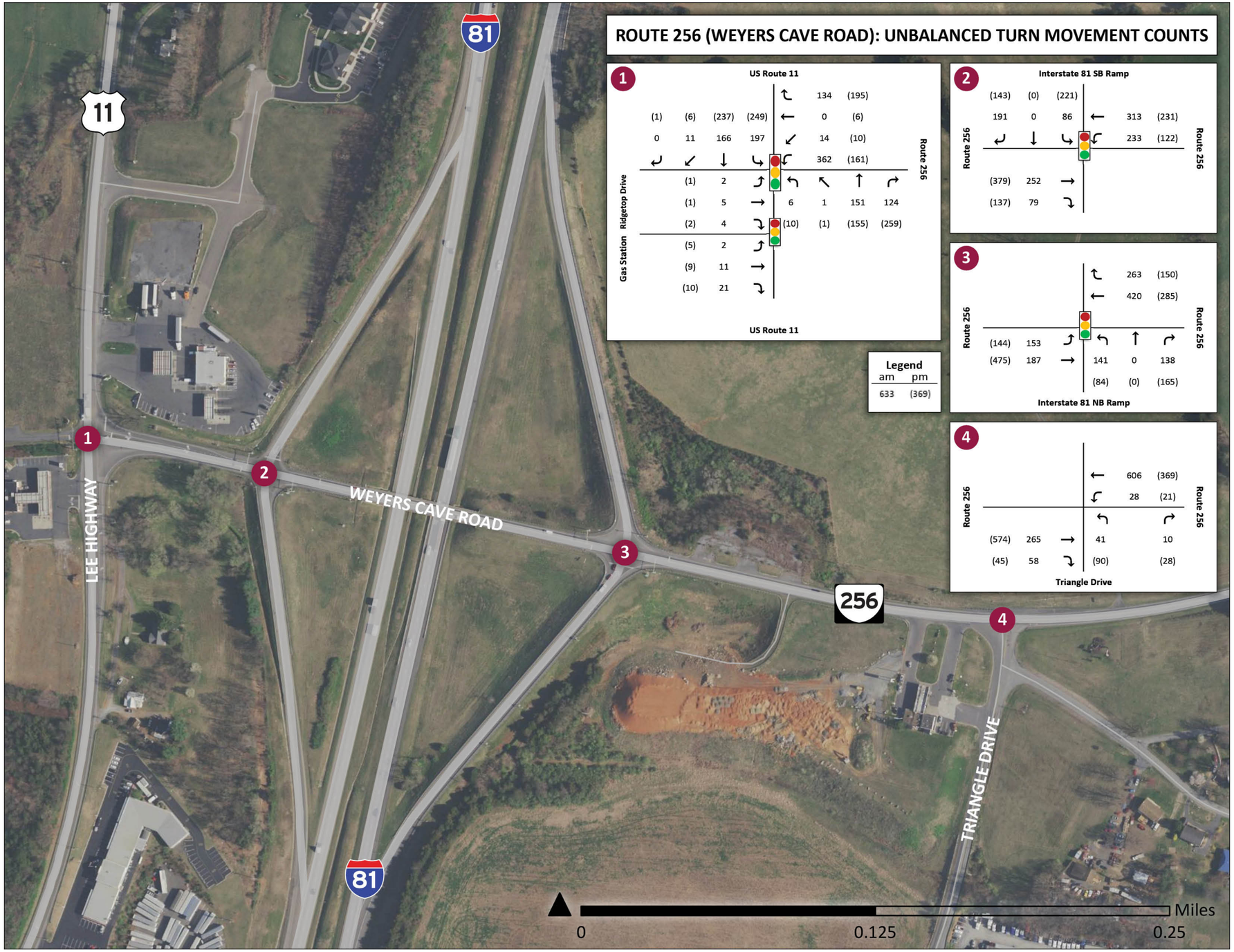


Figure 12. Future No Improvement

4. Alternatives Analysis

The study team and stakeholders determined to move forward with an alternatives analysis on all intersections but Triangle Drive and Route 256. However, this intersection should be monitored once the funded improvements are constructed and if additional development occurs on the northside of Route 256. The study team's goal was to develop multiple alternatives that would address current and future needs. Each alternative was focused on providing innovative ways to enhance safety and improve operations.

The study team evaluated multiple options that addressed context, operations, and safety when developing alternatives for each intersection. A preliminary analysis was performed using the VDOT Junction Screening Tool (VJuST) to evaluate Volume-to-Capacity (V/C) ratios (when applicable) and conflict points to help screen initial ideas. The stakeholder group review all initial concepts to determine what would advance to the detailed alternatives analysis. The detailed analyses were reviewed in SIDRA and Synchro. The analyses also evaluated the crash modification factor (CMF) for each alternative. CMFs are research developed percentages which demonstrates the anticipated crash reduction of an improvement. The CMF provided in this report are from the VDOT SMART SCALE preferred CMF list. These alternatives were advanced for further review by stakeholders and the public.

4.1 Intersection of US Route 11 and Route 256

Each proposed recommendation at US Route 11 and Route 256 requires the reconstruction of Ridgetop Drive, which is presented in each alternative figure. The reconstruction of Ridgetop Drive does assume to be built to VDOT roadway design standards.

4.1.1 Minimally managed improvements

This alternative removes the traffic signal phase for the southwest gas station. The access to the southwest gas station on Route 256 is restricted to a right-in/left-in/right-out access and one of the northeast gas station driveway's is restricted to a right-in/right-out by installing a median on Route 256. Finally, the Ridgetop Drive improvement improves the existing road cross-section and provides access to the southwest gas station and any future development in the northwest corner.

A concept sketch of this alternative is shown in Figure 13.

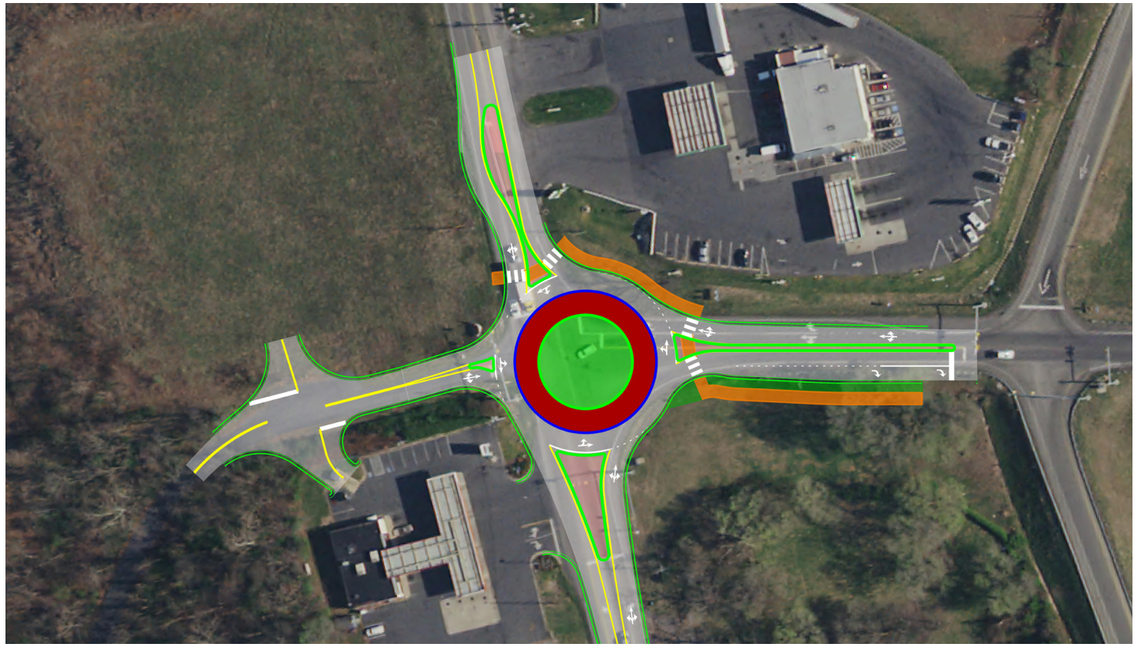
4.1.2 Single-lane roundabout

This alternative reconfigures the intersection to a single-lane roundabout. The access to the southwest gas station on Route 256 is restricted to a right-in/right-out. Similar to the previous alternative, the Ridgetop Drive improvement will still improve the existing road cross-section and provides access to the southwest gas station and any future development in the northwest corner. The roundabout is assumed to have a 150 foot diameter with 16' circulating lanes. The roundabout was concepted to accommodate a WB-67 tractor trailer using AutoTurn software.

A concept sketch of this alternative is shown in Figure 14.

Figure 13. US 11: Minimally Managed Improvements

Figure 14. US 11:Single-Lane Roundabout



4.1.3 Alternative Summary

The anticipated AM and PM 2045 operational results can be found in Table 5.

Of all the alternatives examined, the single-lane roundabout provides the greatest operational and safety benefit. Overall intersection delay decreases up to 70% and crashes are anticipated to reduce by up to 60%. The operations for the single-lane roundabout are improved, however queues traveling westbound in the AM on Route 256 extend up to 249 feet. Similar crash benefits are expected at 60% but less rear-ends are expected at the I-81 southbound ramp and Route 256 intersection. Finally, the minimally managed improvement is expected to improve operations up to 20%. Safety benefits are expected to be up to 15% for enhanced signal conspicuity at the main intersection and up to 60% reduction in access management related crashes at the two gas station driveways.

Table 5. US 11: 2045 Operational Results for Alternatives

Direction	Lane Group	No Improvements			Minimally Managed			Single-lane Roundabout		
		Delay (Sec/veh)	LOS	Queue Length (ft)	Delay (Sec/veh)	LOS	Queue Length (ft)	Delay (Sec/veh)	LOS	Queue Length (ft)
AM Peak Hour										
Ridgetop Drive Eastbound	Left	20.6	C	-	15.9	B	-	8.2	A	9
	Through	20.6	C	18	15.9	B	22	8.2	A	9
	Right	20.6	C	-	15.9	B	-	8.2	A	9
Route 256 Westbound	Left	31.0	C	226	40.6	D	349	12.7	B	192
	Through	31.0	C	226	40.6	D	349	12.6	B	192
	Right	21.9	C	0	22.9	C	7	12.8	B	192
US 11 Northbound	Left	40.7	D	18	24.8	C	3	9.1	A	83
	Through	127.9	F	261	36.0	C	172	9.3	A	83
	Right	41.5	D	13	27.2	C	0	9.4	A	83
US 11 Southbound	Left	54.3	D	265	22.7	C	168	16.5	B	235
	Through	27.1	C	186	24.2	C	178	16.5	B	235
	Right	27.1	C	186	24.2	C	178	16.2	B	235
Gas Station	Left	47.1	D	0	N/A - Vehicles routed to Ridgetop Drive			N/A - Vehicles routed to Ridgetop Drive		
	Through	47.1	D	-						
	Right	47.1	D	0						
Overall		47.4	D	-	30.1	C	-	13.1	B	-
PM Peak Hour										
Ridgetop Drive Eastbound	Left	38.4	D	-	25.0	C	-	6.8	A	5
	Through	38.4	D	18	25.0	C	23	6.8	A	5
	Right	38.4	D	-	25.0	C	-	6.8	A	5
Route 256 Westbound	Left	45.2	D	226	42.0	D	146	9.3	A	98
	Through	45.2	D	226	42.0	D	146	9.3	A	98
	Right	35.7	D	0	51.8	D	57	9.7	A	98
US 11 Northbound	Left	28.0	C	18	20.4	C	4	12.4	B	170
	Through	32.3	C	261	24.9	C	151	12.5	B	170
	Right	30.5	C	13	22.8	C	64	12.5	B	170
US 11 Southbound	Left	16.7	B	265	11.4	B	146	12.8	B	191
	Through	15.4	B	186	9.8	A	135	12.8	B	191
	Right	15.4	B	186	9.8	A	135	12.6	B	191
Gas Station	Left	57.1	E	0	N/A - Vehicles routed to Ridgetop Drive			N/A - Vehicles routed to Ridgetop Drive		
	Through	57.1	E	-						
	Right	57.1	E	0						
Overall		28.3	C	-	25.4	C	-	11.7	B	-

4.2 I-81 and Route 256 interchange

Apart from one alternative, the alternatives for Route 256 and the ramps can be implemented individually and do not rely on the construction of another. The study team reviewed and decided not to advance alternatives for a partial re-route roundabout scenario for the southbound I-81 ramp, a diverging diamond interchange, and a single point urban interchange. Although these ideas had positive operational and safety benefits, the cost to construct them compared to the selected alternatives was high, and the study team indicated that these were not contextually sensitive solutions. The study team advanced the following alternatives for detailed reviewed of the interchange:

4.2.1 Single-lane teardrop roundabout

This alternative reconfigures either ramp intersection to a single-lane teardrop style roundabout. These improvements are not anticipated to impact the bridge and are considered projects of independent utility. Both roundabouts incorporate the funded improvements. Both roundabouts are assumed to have a 160 foot diameter with 16' circulating lanes. The roundabouts were concepted to accommodate a WB-67 tractor trailer using AutoTurn software. It should be noted that the northbound ramp roundabout could be increased in size to accommodate larger trucks better. A concept sketch for each ramp node of this alternative is shown in Figure 15.

4.2.2 Three-lane bridge deck with left-turn lane

This alternative widens the bridge deck to three lanes and reconfigures both ramp intersections with Route 256. The number of through lanes would remain the same, however a left-turn lane would be provided for both ramps to allow refuge for vehicles making a left onto I-81. This improvement would incorporate the funded improvements. A concept sketch of this alternative is shown in Figure 16.

4.2.3 Alternative Summary

The anticipated operational results for both the I-81 southbound ramp and I-81 northbound ramp on Route 256 can be found in Tables 6 and 7, respectively.

The roundabouts provide the most operational and safety benefit. Both intersections would expect significant operational improvements. The southbound I-81 ramp is anticipated to see the worst peak hour delays decrease from 60.0 seconds/vehicle to 11.7 seconds/vehicle in the PM peak hour. The northbound I-81 ramp would see the worst peak hour delay decrease from 40.7 seconds/vehicle to 9.1 seconds/vehicle in the PM peak hour. Furthermore, the queues between the bridges reduce which also reduces the risk of rear end crashes. Finally, the bridge widening does improve overall delay and queue lengths, however the crash benefit is less than the roundabout, which is an anticipated 15% crash reduction compared to the 60% crash reduction of a roundabout.

Figure 15. I-81 Interchange: Single-Lane Teardrop Roundabout

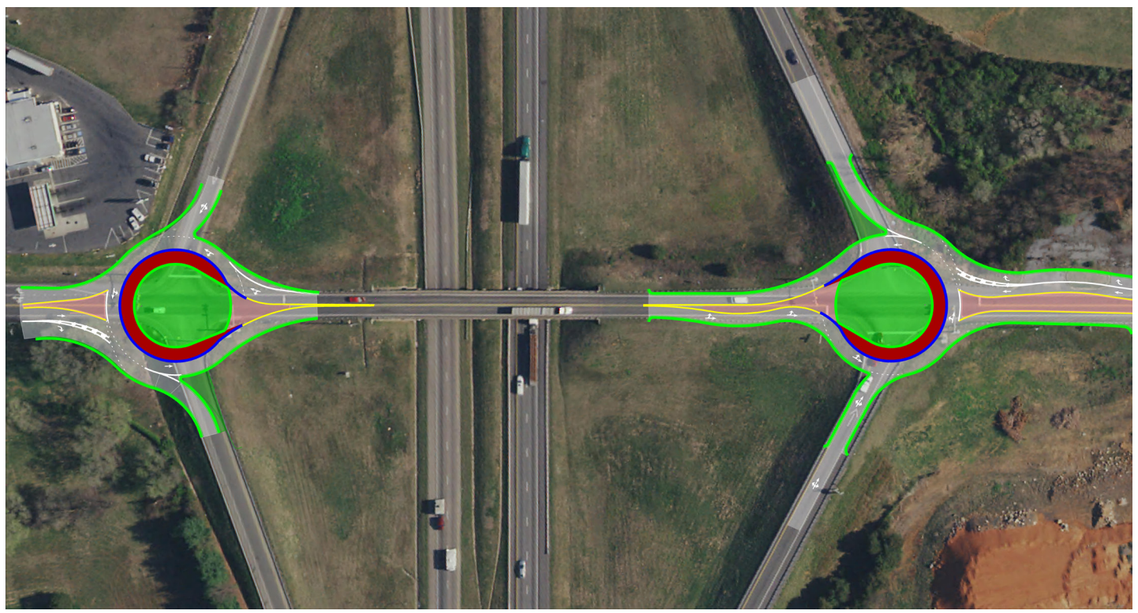
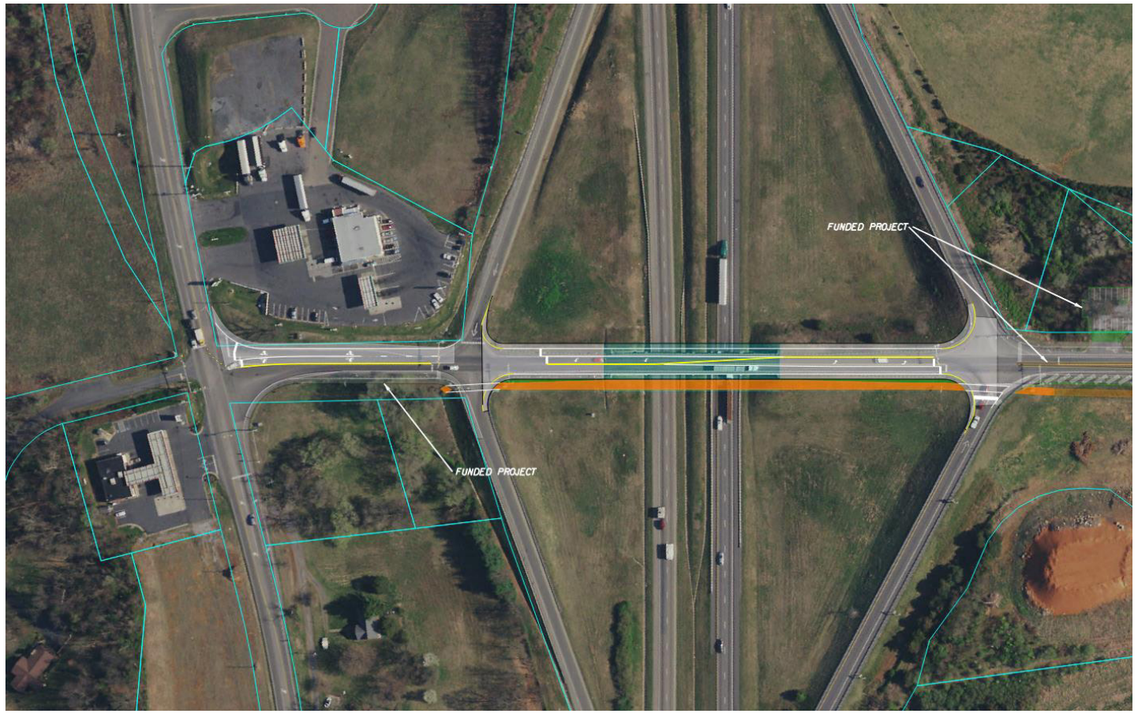


Figure 16. I-81 Interchange: Three-Lane Bridge



4.2.4 Corridor Evaluation and Phasing

All proposed alternatives will enhance the operations and safety of the corridor. However, implementation of the alternatives together at a corridor level must be considered. The most operational beneficial and safest corridor alternative would be roundabouts at all three locations since no queuing is anticipated to back-up into an upstream roundabout in the AM and PM peak hours. If US 11 and Route 256 is improved with the minimally managed scenario and the bridge is widened, operations will be improvement but queuing may still back-up into each intersection during the AM or PM peak hours between Route 11 and the southbound I-81 ramp on Route 256. The distance between these two intersections are about 300 feet, the AM controlling queue is at Route 11 and Route 256 in the westbound direction at 349 feet. The PM controlling queue is at the southbound I-81 ramp and Route 256 in the eastbound direction at 370 feet. This issue will be more problematic with a corridor scenario where there is a roundabout at either node and the minimally managed or bridge widening is implemented since the queue may back into the roundabout. However, more importantly, the no improvement scenario showed that the southbound I-81 ramp and Route 256 intersection is over-capacity meaning that this intersection with no improvement would significantly impact the operations of a roundabout at Route 11 and Route 256. Therefore, it is recommended that if the roundabout at Route 11 and Route 256 is pursued, the bridge widening or roundabout at the southbound I-81 ramp is implemented first.

Table 7. I-81 Interchange: Operational Results for Alternatives (Northbound)

Direction	Lane Group	No Improvements			Roundabout			Three-Lane Bridge		
		Delay (Sec/veh)	LOS	Queue Length (ft)	Delay (Sec/veh)	LOS	Queue Length (ft)	Delay (Sec/veh)	LOS	Queue Length (ft)
AM Peak Hour										
Route 256 Eastbound	Left	45.8	D	252	6.9	A	0	12.5	B	49
	Through	45.8	D	252	6.9	A	0	2.7	A	36
Route 256 Westbound	Through	19.6	B	372	10.2	B	141	25.9	C	395
	Right	13.7	B	43	10.2	B	103	15.3	B	49
I-81 Northbound	Left	89.6	F	451	12.5	B	137	49.3	D	334
	Through	89.6	F	451	12.3	B	137	49.3	D	334
	Right	89.6	F	451	12.8	B	137	49.3	D	334
Overall		60.0	D	451	9.9	A	-	23.7	C	-
PM Peak Hour										
Route 256 Eastbound	Left	31.6	C	371	12.5	B	0	3.2	A	22
	Through	31.6	C	371	12.7	B	0	4.1	A	145
Route 256 Westbound	Through	13.3	B	229	6.5	A	62	17.3	B	252
	Right	11.0	B	35	6.5	A	46	13.2	B	45
I-81 Northbound	Left	94.6	F	461	18.6	B	168	36.7	D	210
	Through	94.6	F	461	18.1	B	168	36.7	D	210
	Right	94.6	F	461	18.5	B	168	36.7	D	210
Overall		36.9	D	-	11.6	B	-	14.4	B	-

Table 6. I-81 Interchange: Operational Results for Alternatives (Southbound)

Direction	Lane Group	No Improvements			Roundabout			Three-Lane Bridge		
		Delay (Sec/veh)	LOS	Queue Length (ft)	Delay (Sec/veh)	LOS	Queue Length (ft)	Delay (Sec/veh)	LOS	Queue Length (ft)
AM Peak Hour										
Route 256 Eastbound	Through	5.7	A	52	7.8	A	65	17.1	B	164
	Right	0.2	A	0	7.8	A	33	8.9	A	15
Route 256 Westbound	Left	53.4	D	675	10.9	B	0	6.4	A	50
	Through	53.4	D	675	10.8	B	0	2.7	A	46
I-81 Southbound	Left	98.7	F	431	21.8	C	229	42.0	D	287
	Through	98.7	F	431	21.1	C	229	42.0	D	287
	Right	98.7	F	431	21.4	C	229	42.0	D	287
Overall		51.7	D	-	12.9	B	-	17.2	B	-
PM Peak Hour										
Route 256 Eastbound	Through	15.7	B	152	12.3	B	161	26.8	C	370
	Right	3.3	A	5	10.8	B	56	5.3	A	7
Route 256 Westbound	Left	70.5	E	476	7.3	A	0	16.1	B	109
	Through	70.5	E	476	7.2	A	0	3.5	A	37
I-81 Southbound	Left	105.8	F	686	20.4	C	302	52.8	D	438
	Through	105.8	F	686	20.0	C	302	52.8	D	438
	Right	105.8	F	686	20.4	C	302	52.8	D	438
Overall		60	E	-	13.3	B	-	27.9	C	-

5. Conceptual Level Construction Costs and Impacts

The study team developed construction level cost estimate ranges using the Statewide Planning Tool (SPLCE) and VDOT unit cost averages. Costs in the tables below do include detailed construction and preliminary engineering (PE) estimates. The study team evaluated the right-of-way impacts qualitatively and used the SPLCE recommended right-of-way and utility percentage based on the conceptual sketches and parcel lines.

5.1 Intersection of US Route 11 and Route 256

Table 8 summarizes the construction cost ranges and right-of-way impacts.

Table 8. US 11: Construction Cost Ranges and Right-of-Way Impacts

	No Improvements	Minimally Managed	Single-lane Roundabout
Estimated Cost (Construction + PE)	-	$2,620,000	$4,260,000
Right-of-way Impacts	-	None to minimal takes	Minimal to moderate takes

All improvements assume that Ridgetop Drive reconstruction would occur, therefore, those costs are included. The Ridgetop Drive improvement will also impact nearby properties since the road is being widening and its elevation adjusted. The southwest gas station and northwest property would be impacted. The minimally managed improvement is anticipated to be the least costly since the majority of work is only on Route 11. The traffic signal will need to be reconstructed. The roundabout is more costly since the amount of pavement and median construction that would need to occur increases cost. The anticipated maintenance of traffic would be a large cost item due to the construction method involved with roundabout construction.

5.2 I-81 and Route 256 interchange

Table 9 summarizes the construction cost ranges and right-of-way impacts.

Table 9. I-81 Interchange: Construction Cost Ranges and Right-of-Way Impacts

	No Improvements	Three-Lane Bridge	Roundabout
Estimated Cost (Construction + PE)	-	$16,500,000	$5.0M to $7.0M each
Right-of-way Impacts	-	None to minimal takes	Minimal to moderate takes at I81 SB/Rte 256

Both advanced improvements should have minimal right-of-way impact since most work should occur within the interchange area. The southbound I-81 roundabout alternative is anticipated to have some impact to the BP gas station and the southwest corner of the intersection. The bridge widening and the combination of the roundabouts may have a similar construction cost, however, the roundabouts can be implemented in phases, if both are advanced for funding. This independent utility advantage may increase funding chances or decrease traffic disruptions during construction. Furthermore, the roundabouts construction does not preclude from a future bridge widening or vice versa. Finally, both improvements are anticipated to disrupt traffic during construction, however the bridge widening does have a high risk of lane closures on I-81 which increases construction timeline and cost.

6. Public Involvement Results

The community provided feedback was requested via a virtual survey and in-person public meeting. The virtual survey was conducted between December 3rd and December 23rd, 2021. The in-person public meeting was conducted in-person at BRCC on March 7, 2022. Below is a summary of the public comments:

- 447 responses were received for the virtual survey
  - 53% of respondents live/work within the study area
- Community feedback generally agreed with the identified issues from the study team
- Most respondents agreed that doing no improvements was not acceptable

6.1 Intersection of US Route 11 and Route 256

Figure 17 summarizes the average rating from the virtual survey. Comments from the public meeting are summarized in this section.

Most respondents and comments at the in-person meeting agreed that something should occur. The roundabout was rated most favorably with a 3.36 average score out of 5, whereas the minimally managed option received a 2.86 average score. Comments during the meeting felt that reducing access to the gas station driveways and improving Ridgetop Drive would improve safety. As well, there was a general misunderstanding of how a roundabout works, which was explained further by study team members during the in-person meeting.

6.2 6.2 I-81 and Route 256 interchange

Figure 18 summarizes the average rating from the virtual survey. Comments from the public meeting are summarized in this section.

Most respondents and comments at the in-person meeting agreed that something should occur. The bridge was rated most favorably with a 3.60 average score out of 5, whereas both roundabouts received more than a 3.00 average score. Comments during the meeting and on the survey liked the bridge widening but felt that the bridge widening should consider more lanes. During the in-person meeting, community feedback generally did not disagree or agree with multiple roundabouts on the corridor, but at least one roundabout on the segment was viewed favorably.

Figure 17. US 11: Metroquest Summary

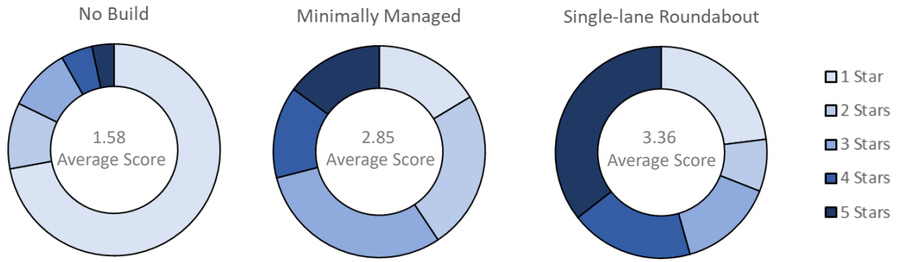
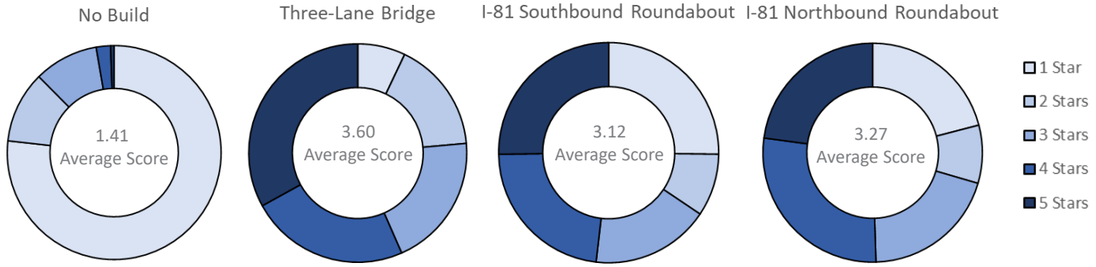


Figure 18. I-81 Interchange: Metroquest Summary



7. Conclusions and Recommendations

The study highlighted several issues within the study area that would be addressed by the alternatives. Based on stakeholder input and community involvement, there was a consensus that improvements were needed within the study area to enhance safety and improve operations. Depending on the funding source, such as SMART SCALE, lower cost improvements with high benefits tend to score better and receive funding. The roundabouts at all locations generally have a high benefit compared to the other advanced alternatives, and provide independent utility that could permit them to be submitted for funding as separate projects. However, based on stakeholder and community feedback, it may be best to consider an implementation plan of one roundabout at the most favorable location on the corridor to monitor performance and improve community support. If the bridge widening is pursued, a more detailed construction requirements review (such as superstructure/substructure performance and I-81 maintenance of traffic risks) is recommended to help reduce cost risk and increase competitiveness. The bridge widening could still be implemented with the construction of one or both of the roundabout concepts.

1. Appendix A: Route 256 Area Plan - Base Year Volumes and Future Growth Rates

Michael Baker INTERNATIONAL

Memorandum

TO:	Adam Campbell, PLA, VDOT Matt Bond, P.E., VDOT	**DATE:**	May 26, 2021
FROM:	Daniel Scolese, P.E.	**SUBJECT:**	Small Area Study Exit 235 and Route 256: Base Year Volumes and Future Growth Rate
CC:	Zach Beard, CSPDC		

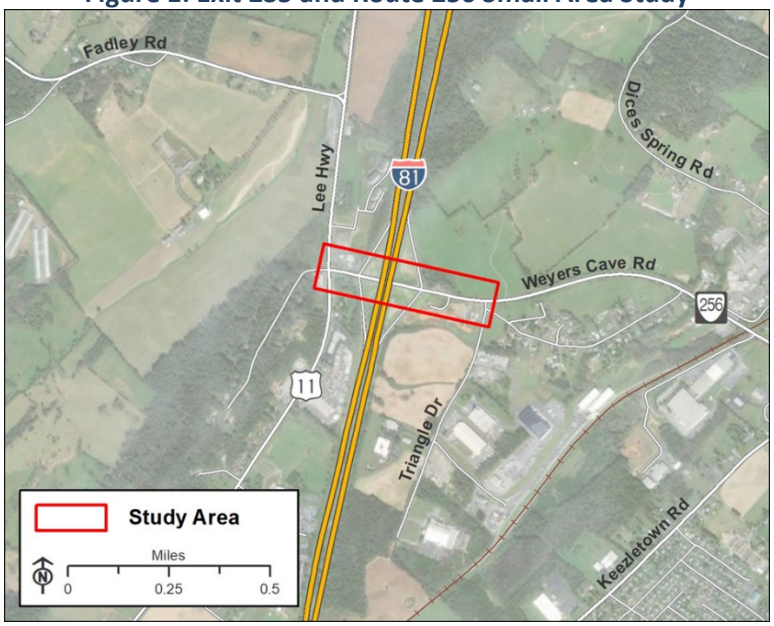
Purpose

The purpose of this memorandum is to document the base year volumes and future growth rate development for the Exit 235 and Route 256 Small Area Study.

Study Area:

The study area for the Exit 235 and Route 256 Small Area Study as shown in Figure 1 is located in Augusta County along Route 256 between US 11 and the Triangle Drive.

Figure 1: Exit 235 and Route 256 Small Area Study



The intersections along Route 256 that will be analyzed as part of the study area are as follows:

- US 11 and Route 256
- Route 256 and I-81 Southbound Ramp
- Route 256 and I-81 Northbound Ramp
- Route 256 and Triangle Drive

Base Year Development

In response to IIM TMPD 7.0, base year volumes were developed for the study intersections due to COVID-19 traffic impacts. Traffic counts for the following intersections were collected on November 14th, 2017:

- US 11 and Route 256
- Route 256 and I-81 Southbound Ramp
- Route 256 and I-81 Northbound Ramp

Traffic counts were collected for Route 256 and Triangle Drive on April 13, 2021.

Figure 2 shows the unbalanced turning movement counts for the study area

Figure 2: Unbalanced Turning Movement Counts

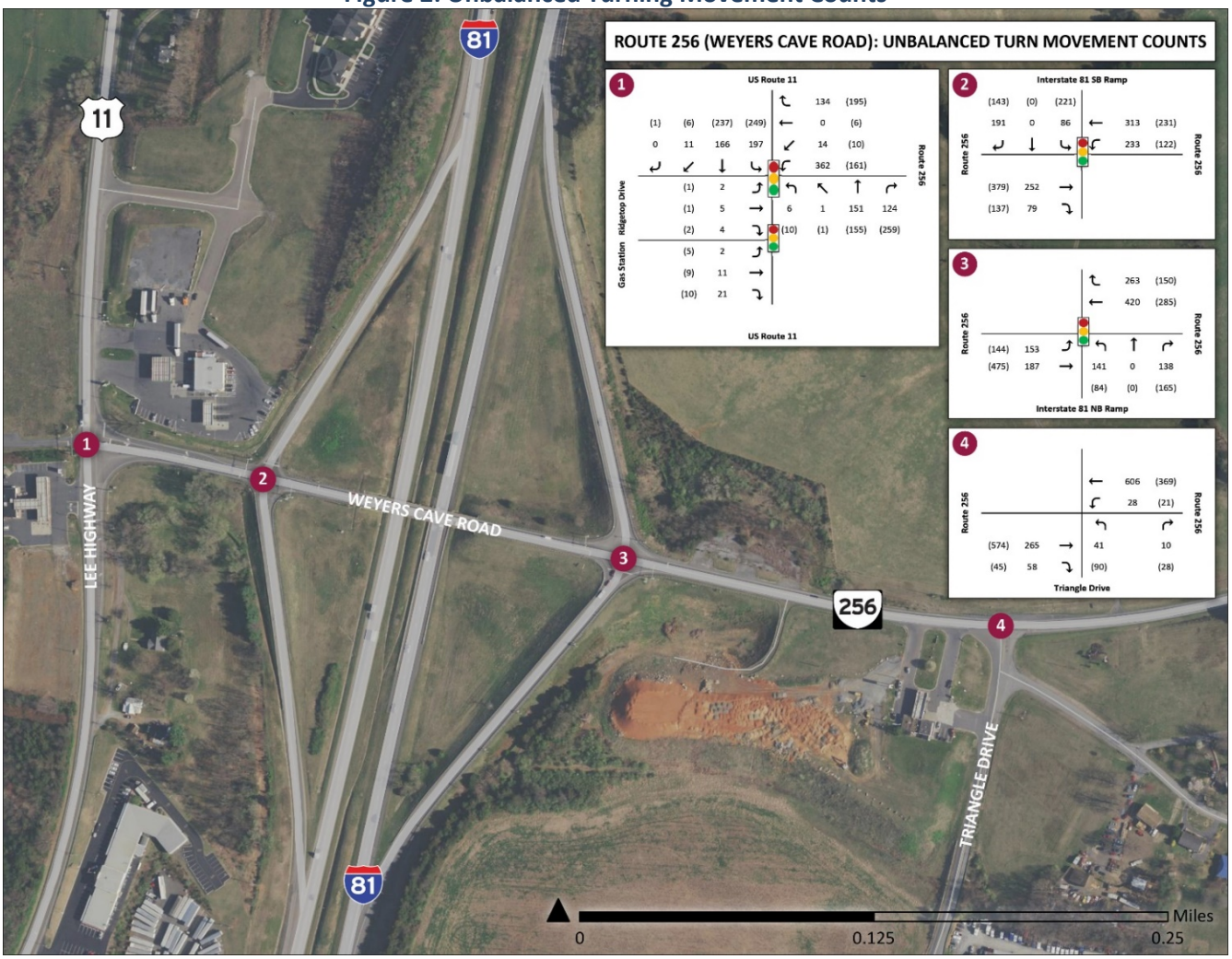


Table 1 summarizes the Statewide Planning System (SPS) historical data for each segment.

Table 1: SPS AADT Data

Roadway	From	To	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
US 11	Rockingham County Line	Sidney Gap Road	5,683	5,840	5,557	5,722	5,370	4,646	4,584	4,606	5,513	5,624	5,860	5,542	5,666	5,643	6,466
Route 256	US 11	I-81	9,009	9,257	7,209	7,423	6,967	7,100	7,005	7,038	8,849	9,028	9,406	8,267	8,452	8,087	8,097
Route 256	I-81	SR 2002	9,568	9,831	9,216	8,769	8,762	8,804	8,969	9,136	9,332	9,215	9,261	9,908	10,156	10,166	10,221
Route 256	SR 2002	Route 276	9,568	9,831	9,216	8,769	8,762	8,804	8,969	9,136	9,332	9,215	9,261	9,908	10,156	10,166	10,221
I-81	Toll Gate Road	Route 256	49,048	49,674	49,466	45,782	46,275	47,533	47,117	48,239	48,820	50,115	52,736	55,198	56,310	54,755	56,542
I-81	Route 256	Rockingham County Line	47,975	50,059	50,089	47,488	48,473	49,202	48,120	49,221	49,802	50,340	53,549	56,061	56,931	55,510	56,660

Table 2 summarizes the available Continuous Count Station data for Route 256 east of Route 276, and the I-81 stations north and south of the Route 256 interchange. This is real-time data that can be used determine regional effects.

Table 2: SPS AADT Data

Continous Count Station Data: Average Annual Vehicles Per Day						
Road Name	Location	Station ID	2017	2018	2019	2020
Route 256	East of Route 276	80128	5,981	5,969	6,172	5,736
I-81 Southbound	North of Route 256	180027	27,833	26,763	28,079	23,623
I-81 Northbound	South of Route 256	80299	29,417	28,069	28,667	24,291

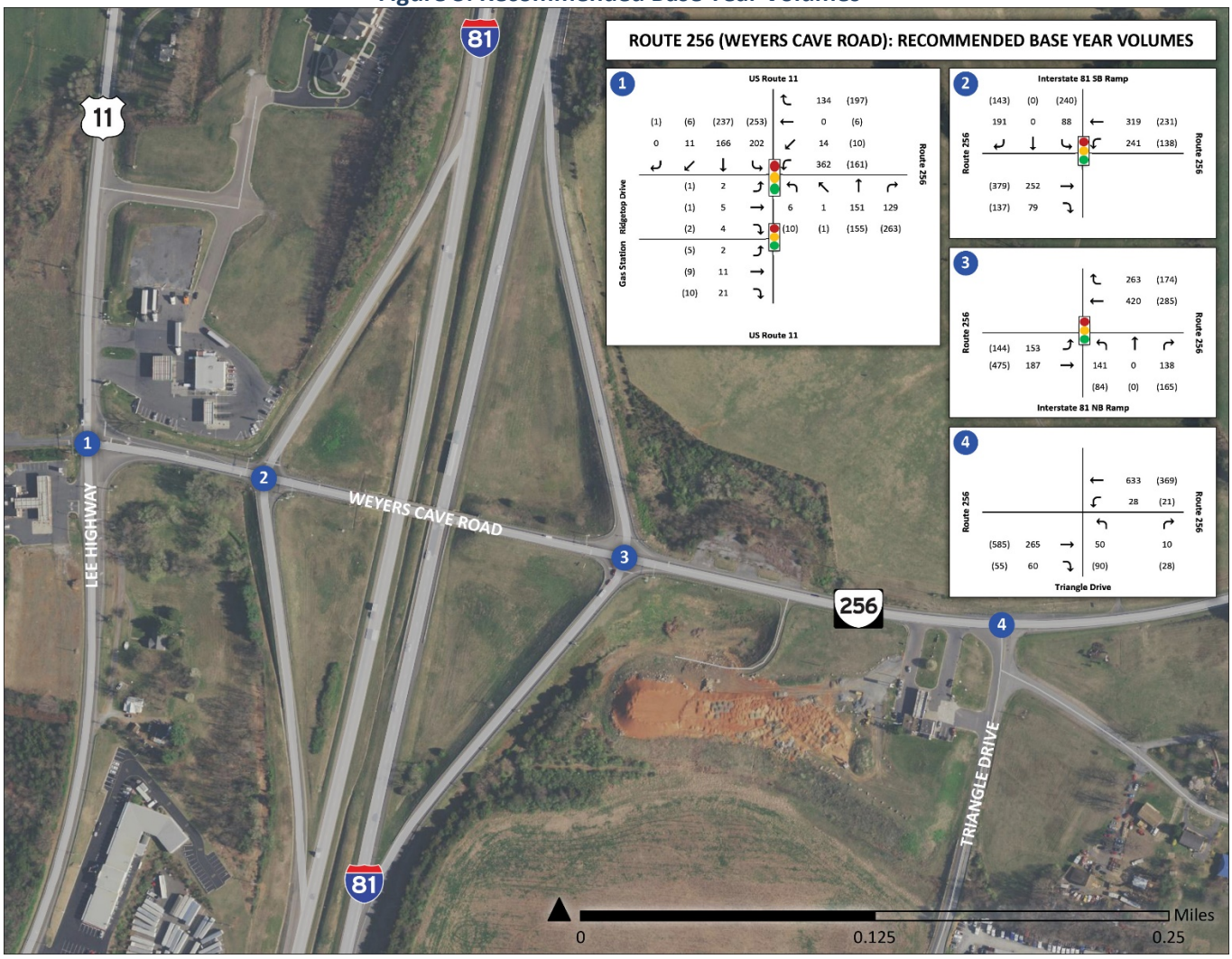
Based on the Continuous Count Station data for Route 256, COVID did impact the volumes along the segment, however the 2017 and 2019 volumes remain relatively unchanged. The SPS data also confirms that Route 256 has seen minimal increases in traffic since 2017. Furthermore, based on the assumption that November 2017 is a reasonable base year, the April 2021 turn movement counts compared to the November 2017 turn movement counts are within a reasonable margin of each other. Although seasonality is an aspect, it may also signify that volumes are returning to pre-COVID conditions.

Although no Continuous Count Stations are present on the I-81 ramps, the stations north and south of the Route 256 interchange also show that COVID-19 did impact volumes. Similar to Route 256, the difference between the 2017 traffic volumes and the 2019 traffic volumes are within a reasonable margin of each other.

Finally, the only available data on US 11 is the SPS data. The AADT along US 11 does increase from 5,700 vehicles per day in 2017 to about 6,500 vehicles per day by 2019. However, looking back to previous years, the AADT has remained relatively unchanged. Although the slight increase could be due to other outside causes, a review of aerial imagery along the US 11 SPS segment does not show any changes.

Therefore, it is recommended to use the turning movement volumes from the November 2017 traffic counts. The base year traffic volumes for the study use these to balance the turning movements at the intersection of Route 256 and Triangle Drive (collected in April, 2021). Figure 3 shows the resulting base year volumes to be used for the Exit 235 and Route 256 Small Area Study.

Figure 3: Recommended Base Year Volumes



Growth Rate Development

The following sources of data were reviewed to determine growth rates to apply to the existing traffic volumes to forecast to 2045:

- Statewide Planning System Data from Table 1
- Staunton-Augusta-Waynesboro MPO Model
- March 2021 - I-81 Weyers Cave Truck Climbing Lane Traffic Growth and Forecast Memo
- August 2015 Airport Road Traffic Impact Analysis

Table 3 summarizes the SPS linear growth rates for each segment within the study corridor.

Table 3: SPS Linear Growth Rates

Roadway	From	To	SPS Growth Rate
US 11	Rockingham County Line	Sideny Road	0.53%
Route 256	US 11	I-81	1.55%
Route 256	I-81	SR 2002	1.74%
Route 256	SR 2002	Route 276	0.67%
I-81	Toll Gate Road	Route 256	1.18%
I-81	Route 256	Rockingham County Line	1.77%

Table 4 summarizes the SAWMPO Model outputs for 2018 and 2045, with the linear growth rates.

Table 3: SAWMPO Model: Linear Growth Rates

LINK_ID	Description	2018	2045	Growth Rate
169307	US 11 North of Route 256	8110	10029.88	0.88%
169306	US 11 South of Route 256	7091	12060.66	2.60%
169314	I-81 SB on Route 256	3507.75	5937.9	2.57%
169308	I-81 SB off Route 256	5189.55	3879.26	-0.94%
169303	I-81 NB on Route 256	5130.69	4151.59	-0.71%
169312	I-81 SB off Route 256	3499.53	4949	1.53%
127826	Route 256 east of Triangle Drive	12228.82	12675.63	0.14%

The March 2021 I-81 Weyers Cave Truck Climbing Lane Traffic Growth and Forecast Memo summarizes the growth rates for mainline I-81 and the ramps within the study area. Since the ramp termini are associated with the Exit 235 and Route 256 Small Area Study, the memo recommends a 2.00% linear growth rate be applied to a daily ramp volume estimate by dividing the 2017, 12-hour turning movement counts by 0.75.

Finally, the August 2015 Airport Road Traffic Impact Analysis used a 0.5% annual linear background growth rate for all turning movements. The memo also summarizes the anticipated growth from the expansion. The outlined growth is aggressive, however based on feedback from August County and the Central Shenandoah Planning District Commission, the airport has seen increased air traffic prior to COVID-19. The region is actively interested in promoting the airport and expanding, therefore, the 2.00% linear growth rate methodology for the ramps and 1% background linear growth rate will provide reasonable growth expectations on the Route 256 segment heading east towards the airport from I-81.

After reviewing the following data with Staunton District, Augusta County, and Central Shenandoah Planning District Commission on May 10, 2021, the following agreed upon linear annual growth rates will be applied to the existing turning movements to forecast the 2045 volumes for the Exit 235 and Route 256 Small Area Study:

- 1% background linear growth rate applied to Route 256.
- Apply the same methodology for the I-81 ramp Volumes as the March 2021 Memo.
    - 2.00% linear growth rate be applied to the daily ramp volume estimate by dividing the 2017, 12-hour turning movement counts by 0.75.
    - The additional volume will be carried back towards the east on Route 256 to account for the higher growth associated with the airport and planned improvements to the east.
- 1% linear growth rate applied to US 11.
- Zero or no growth for the northbound approach of Triangle Drive.
- Site Traffic ITE Calculation for the funded Park and Ride Lot entrance at Triangle Drive using ITE Trip Generation Code 090 – Park and Ride Lot with Bus or Light Rail.
- Site Traffic ITE Calculation for the Landings Drive Weyers Caver Apartment Complex using the highest of the two ITE Trip Generation Codes 221 – Multifamily Housing (Mid-Rise) or 231 – Mid Rise with 1st Floor Commercial.

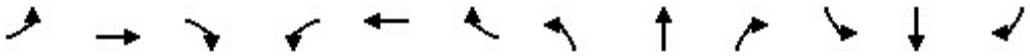
2. Appendix B: Synchro Report - Existing Conditions

Movement	EBL	EBT	EBR	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	2	5	4	362	14	0	134	6	1	151	129	202
Future Volume (vph)	2	5	4	362	14	0	134	6	1	151	129	202
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.1				7.1	7.1		10.2	10.2	10.2	10.2
Lane Util. Factor		1.00				1.00	1.00		1.00	1.00	1.00	1.00
Frt		0.95				1.00	0.85		1.00	1.00	0.85	1.00
Flt Protected		0.99				0.95	1.00		0.95	1.00	1.00	0.95
Satd. Flow (prot)		1788				1722	1524		1805	1810	1524	1703
Flt Permitted		0.95				0.75	1.00		0.63	1.00	1.00	0.41
Satd. Flow (perm)		1710				1358	1524		1197	1810	1524	741
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	2	6	5	416	16	0	154	7	1	174	148	232
RTOR Reduction (vph)	0	0	0	0	0	0	101	0	0	0	121	0
Lane Group Flow (vph)	0	13	0	0	0	432	53	0	8	174	27	232
Heavy Vehicles (%)	0%	0%	0%	5%	0%	0%	6%	0%	0%	5%	6%	6%
Turn Type	Perm	NA		Perm	Perm	NA	Perm	Perm	Perm	NA	Perm	pm+pt
Protected Phases		4				4				2		1
Permitted Phases	4			4	4		4	2	2		2	6
Actuated Green, G (s)		34.3				34.3	34.3		18.0	18.0	18.0	36.0
Effective Green, g (s)		34.3				34.3	34.3		18.0	18.0	18.0	36.0
Actuated g/C Ratio		0.34				0.34	0.34		0.18	0.18	0.18	0.36
Clearance Time (s)		7.1				7.1	7.1		10.2	10.2	10.2	10.2
Vehicle Extension (s)		3.0				3.0	3.0		4.0	4.0	4.0	3.0
Lane Grp Cap (vph)		586				465	522		215	325	274	341
v/s Ratio Prot										0.10		c0.05
v/s Ratio Perm		0.01				c0.32	0.03		0.01		0.02	c0.19
v/c Ratio		0.02				0.93	0.10		0.04	0.54	0.10	0.68
Uniform Delay, d1		21.7				31.7	22.4		33.8	37.2	34.2	26.3
Progression Factor		1.00				0.96	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.0				18.2	0.1		0.3	6.2	0.7	5.5
Delay (s)		21.8				48.6	22.4		34.2	43.4	34.9	31.8
Level of Service		C				D	C		C	D	C	C
Approach Delay (s)		21.8				41.7				39.4		
Approach LOS		C				D				D		

Intersection Summary			
HCM 2000 Control Delay	37.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	36.9
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

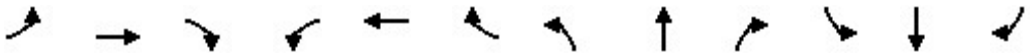
Movement	SBT	SBR	NEL	NER	NER2
Lane Configurations					
Traffic Volume (vph)	166	11	2	11	21
Future Volume (vph)	166	11	2	11	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	10.2		9.4		9.4
Lane Util. Factor	1.00		1.00		0.95
Frt	0.99		0.86		0.85
Flt Protected	1.00		1.00		1.00
Satd. Flow (prot)	1788		1615		1461
Flt Permitted	1.00		1.00		1.00
Satd. Flow (perm)	1788		1615		1461
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	191	13	2	13	24
RTOR Reduction (vph)	0	0	19	0	18
Lane Group Flow (vph)	204	0	1	0	1
Heavy Vehicles (%)	5%	9%	0%	0%	5%
Turn Type	NA		Perm		Perm
Protected Phases	6				
Permitted Phases			3		3
Actuated Green, G (s)	36.0		3.0		3.0
Effective Green, g (s)	36.0		3.0		3.0
Actuated g/C Ratio	0.36		0.03		0.03
Clearance Time (s)	10.2		9.4		9.4
Vehicle Extension (s)	4.0		2.0		2.0
Lane Grp Cap (vph)	643		48		43
v/s Ratio Prot	0.11				
v/s Ratio Perm			0.00		c0.00
v/c Ratio	0.32		0.01		0.01
Uniform Delay, d1	23.1		47.1		47.1
Progression Factor	1.00		1.00		1.00
Incremental Delay, d2	1.3		0.0		0.0
Delay (s)	24.4		47.1		47.1
Level of Service	C		D		D
Approach Delay (s)	28.4		47.1		
Approach LOS	C		D		

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	252	95	242	319	0	0	0	0	88	0	191
Future Volume (vph)	0	252	95	242	319	0	0	0	0	88	0	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.6			7.6						5.2	
Lane Util. Factor		1.00			1.00						1.00	
Frt		0.96			1.00						0.91	
Flt Protected		1.00			0.98						0.98	
Satd. Flow (prot)		1743			1752						1603	
Flt Permitted		1.00			0.61						0.98	
Satd. Flow (perm)		1743			1088						1603	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	286	108	275	362	0	0	0	0	100	0	217
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	110	0
Lane Group Flow (vph)	0	381	0	0	638	0	0	0	0	0	207	0
Heavy Vehicles (%)	0%	5%	5%	9%	4%	0%	0%	0%	0%	10%	0%	4%
Turn Type		NA		pm+pt	NA					Perm	NA	
Protected Phases		6		5	2						4	
Permitted Phases				2						4		
Actuated Green, G (s)		49.9			69.9						17.3	
Effective Green, g (s)		49.9			69.9						17.3	
Actuated g/C Ratio		0.50			0.70						0.17	
Clearance Time (s)		7.6			7.6						5.2	
Vehicle Extension (s)		5.0			5.0						5.0	
Lane Grp Cap (vph)		869			842						277	
v/s Ratio Prot		0.22			c0.09							
v/s Ratio Perm					c0.44						0.13	
v/c Ratio		0.44			0.76						0.75	
Uniform Delay, d1		16.1			9.6						39.3	
Progression Factor		0.96			1.47						1.00	
Incremental Delay, d2		1.4			2.4						12.5	
Delay (s)		16.8			16.6						51.7	
Level of Service		B			B						D	
Approach Delay (s)		16.8			16.6			0.0			51.7	
Approach LOS		B			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	24.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.4
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	153	187	0	0	420	263	141	0	138	0	0	0
Future Volume (vph)	153	187	0	0	420	263	141	0	138	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			6.1			5.3				
Lane Util. Factor		1.00			1.00			1.00				
Frt		1.00			0.95			0.93				
Flt Protected		0.98			1.00			0.98				
Satd. Flow (prot)		1760			1696			1624				
Flt Permitted		0.31			1.00			0.98				
Satd. Flow (perm)		562			1696			1624				
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	172	210	0	0	472	296	158	0	155	0	0	0
RTOR Reduction (vph)	0	0	0	0	22	0	0	82	0	0	0	0
Lane Group Flow (vph)	0	382	0	0	746	0	0	231	0	0	0	0
Heavy Vehicles (%)	5%	6%	0%	0%	7%	5%	4%	0%	9%	0%	0%	0%
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6						4					
Actuated Green, G (s)		70.5			55.5			18.1				
Effective Green, g (s)		70.5			55.5			18.1				
Actuated g/C Ratio		0.70			0.56			0.18				
Clearance Time (s)		6.1			6.1			5.3				
Vehicle Extension (s)		5.0			5.0			5.0				
Lane Grp Cap (vph)		502			941			293				
v/s Ratio Prot		c0.07			0.44							
v/s Ratio Perm		c0.47						0.14				
v/c Ratio		0.76			0.79			0.79				
Uniform Delay, d1		9.4			17.7			39.1				
Progression Factor		0.62			1.00			1.00				
Incremental Delay, d2		5.8			6.8			15.0				
Delay (s)		11.6			24.5			54.2				
Level of Service		B			C			D				
Approach Delay (s)		11.6			24.5			54.2			0.0	
Approach LOS		B			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	27.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	265	60	28	633	50	10
Future Volume (Veh/h)	265	60	28	633	50	10
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	298	67	31	711	56	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	899					
pX, platoon unblocked						
vC, conflicting volume			365		1104	332
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			365		1104	332
tC, single (s)			4.1		6.8	6.7
tC, 2 stage (s)						
tF (s)			2.2		3.9	3.8
p0 queue free %			97		71	98
cM capacity (veh/h)			1183		192	613

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	365	742	67
Volume Left	0	31	56
Volume Right	67	0	11
cSH	1700	1183	216
Volume to Capacity	0.21	0.03	0.31
Queue Length 95th (ft)	0	2	32
Control Delay (s)	0.0	0.7	29.0
Lane LOS		A	D
Approach Delay (s)	0.0	0.7	29.0
Approach LOS			D

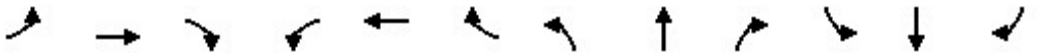
Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	1	1	2	161	10	6	197	10	1	155	263	253
Future Volume (vph)	1	1	2	161	10	6	197	10	1	155	263	253
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.1				7.1	7.1		10.2	10.2	10.2	10.2
Lane Util. Factor		1.00				1.00	1.00		1.00	1.00	1.00	1.00
Frt		0.93				1.00	0.85		1.00	1.00	0.85	1.00
Flt Protected		0.99				0.95	1.00		0.95	1.00	1.00	0.95
Satd. Flow (prot)		1750				1780	1442		1805	1881	1583	1703
Flt Permitted		0.92				0.73	1.00		0.60	1.00	1.00	0.40
Satd. Flow (perm)		1636				1363	1442		1141	1881	1583	716
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1	1	2	169	11	6	207	11	1	163	277	266
RTOR Reduction (vph)	0	0	0	0	0	0	167	0	0	0	222	0
Lane Group Flow (vph)	0	4	0	0	0	186	40	0	12	163	55	266
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%	12%	0%	0%	1%	2%	6%
Turn Type	Perm	NA		Perm	Perm	NA	Perm	Perm	Perm	NA	Perm	pm+pt
Protected Phases		4				4				2		1
Permitted Phases	4			4	4		4	2	2		2	6
Actuated Green, G (s)		15.6				15.6	15.6		16.0	16.0	16.0	35.7
Effective Green, g (s)		15.6				15.6	15.6		16.0	16.0	16.0	35.7
Actuated g/C Ratio		0.19				0.19	0.19		0.20	0.20	0.20	0.45
Clearance Time (s)		7.1				7.1	7.1		10.2	10.2	10.2	10.2
Vehicle Extension (s)		3.0				3.0	3.0		4.0	4.0	4.0	3.0
Lane Grp Cap (vph)		319				265	281		228	376	316	436
v/s Ratio Prot										0.09		c0.07
v/s Ratio Perm		0.00				c0.14	0.03		0.01		0.03	c0.20
v/c Ratio		0.01				0.70	0.14		0.05	0.43	0.18	0.61
Uniform Delay, d1		26.0				30.0	26.7		25.9	28.0	26.5	15.4
Progression Factor		1.00				1.07	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.0				5.7	0.2		0.4	3.6	1.2	2.5
Delay (s)		26.0				37.7	26.8		26.3	31.6	27.7	17.9
Level of Service		C				D	C		C	C	C	B
Approach Delay (s)		26.0				32.0				29.1		
Approach LOS		C				C				C		

Intersection Summary			
HCM 2000 Control Delay	25.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	36.9
Intersection Capacity Utilization	73.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

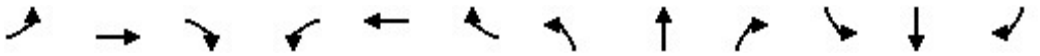
Movement	SBT	SBR	SBR2	NEL	NER	NER2
Lane Configurations						
Traffic Volume (vph)	237	6	1	5	9	10
Future Volume (vph)	237	6	1	5	9	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.2			9.4		9.4
Lane Util. Factor	1.00			1.00		0.95
Frt	1.00			0.90		0.85
Flt Protected	1.00			0.98		1.00
Satd. Flow (prot)	1821			1578		1534
Flt Permitted	1.00			0.98		1.00
Satd. Flow (perm)	1821			1578		1534
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	249	6	1	5	9	11
RTOR Reduction (vph)	0	0	0	15	0	10
Lane Group Flow (vph)	256	0	0	0	0	0
Heavy Vehicles (%)	4%	0%	0%	0%	11%	0%
Turn Type	NA			Perm		Perm
Protected Phases	6					
Permitted Phases				3		3
Actuated Green, G (s)	35.7			2.0		2.0
Effective Green, g (s)	35.7			2.0		2.0
Actuated g/C Ratio	0.45			0.02		0.02
Clearance Time (s)	10.2			9.4		9.4
Vehicle Extension (s)	4.0			2.0		2.0
Lane Grp Cap (vph)	812			39		38
v/s Ratio Prot	0.14					
v/s Ratio Perm				c0.00		0.00
v/c Ratio	0.32			0.01		0.01
Uniform Delay, d1	14.3			38.0		38.0
Progression Factor	1.00			1.00		1.00
Incremental Delay, d2	1.0			0.0		0.0
Delay (s)	15.3			38.1		38.1
Level of Service	B			D		D
Approach Delay (s)	16.6			38.1		
Approach LOS	B			D		

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	379	147	138	231	0	0	0	0	240	0	143
Future Volume (vph)	0	379	147	138	231	0	0	0	0	240	0	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.6			7.6						5.2	
Lane Util. Factor		1.00			1.00						1.00	
Frt		0.96			1.00						0.95	
Flt Protected		1.00			0.98						0.97	
Satd. Flow (prot)		1751			1735						1645	
Flt Permitted		1.00			0.39						0.97	
Satd. Flow (perm)		1751			685						1645	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.88	0.88	0.88	0.93	0.93	0.93
Adj. Flow (vph)	0	408	158	148	248	0	0	0	0	258	0	154
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	129	0
Lane Group Flow (vph)	0	549	0	0	396	0	0	0	0	0	283	0
Heavy Vehicles (%)	0%	3%	8%	10%	6%	0%	0%	0%	0%	6%	0%	7%
Turn Type		NA		pm+pt	NA					Perm	NA	
Protected Phases		6		5	2						4	
Permitted Phases				2						4		
Actuated Green, G (s)		29.5			49.5						17.7	
Effective Green, g (s)		29.5			49.5						17.7	
Actuated g/C Ratio		0.37			0.62						0.22	
Clearance Time (s)		7.6			7.6						5.2	
Vehicle Extension (s)		5.0			5.0						5.0	
Lane Grp Cap (vph)		645			586						363	
v/s Ratio Prot		c0.31			c0.10							
v/s Ratio Perm					0.31						0.17	
v/c Ratio		0.85			0.68						0.78	
Uniform Delay, d1		23.2			10.0						29.3	
Progression Factor		1.24			1.29						1.00	
Incremental Delay, d2		12.2			2.4						11.7	
Delay (s)		41.0			15.3						41.0	
Level of Service		D			B						D	
Approach Delay (s)		41.0			15.3			0.0			41.0	
Approach LOS		D			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	33.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.4
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	144	475	0	0	285	174	84	0	165	0	0	0
Future Volume (vph)	144	475	0	0	285	174	84	0	165	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			6.1			5.3				
Lane Util. Factor		1.00			1.00			1.00				
Frt		1.00			0.95			0.91				
Flt Protected		0.99			1.00			0.98				
Satd. Flow (prot)		1792			1703			1625				
Flt Permitted		0.61			1.00			0.98				
Satd. Flow (perm)		1101			1703			1625				
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	155	511	0	0	306	187	90	0	177	0	0	0
RTOR Reduction (vph)	0	0	0	0	25	0	0	102	0	0	0	0
Lane Group Flow (vph)	0	666	0	0	468	0	0	165	0	0	0	0
Heavy Vehicles (%)	1%	6%	0%	0%	7%	4%	6%	0%	4%	0%	0%	0%
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6						4					
Actuated Green, G (s)		53.9			33.9			14.7				
Effective Green, g (s)		53.9			33.9			14.7				
Actuated g/C Ratio		0.67			0.42			0.18				
Clearance Time (s)		6.1			6.1			5.3				
Vehicle Extension (s)		5.0			5.0			5.0				
Lane Grp Cap (vph)		861			721			298				
v/s Ratio Prot		c0.13			0.27							
v/s Ratio Perm		c0.39						0.10				
v/c Ratio		0.77			0.65			0.55				
Uniform Delay, d1		8.9			18.3			29.7				
Progression Factor		0.48			1.00			1.00				
Incremental Delay, d2		2.4			4.5			3.8				
Delay (s)		6.7			22.8			33.4				
Level of Service		A			C			C				
Approach Delay (s)		6.7			22.8			33.4			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	17.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	88.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	585	55	21	369	90	28
Future Volume (Veh/h)	585	55	21	369	90	28
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	650	61	23	410	100	31
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)	899					
pX, platoon unblocked			0.88		0.88	0.88
vC, conflicting volume			711		1136	680
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			600		1085	565
tC, single (s)			4.3		6.5	6.2
tC, 2 stage (s)						
tF (s)			2.4		3.6	3.3
p0 queue free %			97		49	93
cM capacity (veh/h)			788		194	456

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	711	433	131
Volume Left	0	23	100
Volume Right	61	0	31
cSH	1700	788	225
Volume to Capacity	0.42	0.03	0.58
Queue Length 95th (ft)	0	2	82
Control Delay (s)	0.0	0.9	41.2
Lane LOS		A	E
Approach Delay (s)	0.0	0.9	41.2
Approach LOS			E

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		

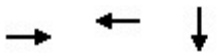
Lane Group	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	NEL	NER2
Lane Group Flow (vph)	13	432	154	8	174	148	232	204	20	19
v/c Ratio	0.02	0.93	0.22	0.03	0.44	0.28	0.63	0.29	0.06	0.06
Control Delay	25.8	54.6	0.7	31.4	38.0	1.3	30.4	21.9	0.4	0.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0
Total Delay	25.8	54.6	0.7	31.4	38.0	1.4	30.9	21.9	0.4	0.4
Queue Length 50th (ft)	6	~329	0	4	97	0	101	87	0	0
Queue Length 95th (ft)	20	#483	m0	16	155	0	155	136	0	0
Internal Link Dist (ft)	467	317			841			1001	128	
Turn Bay Length (ft)			240	185		185	365			
Base Capacity (vph)	585	465	714	260	394	534	369	711	382	369
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	36	16	0	8	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.93	0.22	0.03	0.44	0.30	0.66	0.29	0.05	0.05

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBT	WBT	SBT
Lane Group Flow (vph)	394	638	317
v/c Ratio	0.45	0.76	0.82
Control Delay	16.9	23.5	40.1
Queue Delay	2.5	0.0	0.0
Total Delay	19.3	23.5	40.1
Queue Length 50th (ft)	205	284	111
Queue Length 95th (ft)	302	359	#222
Internal Link Dist (ft)	317	724	874
Turn Bay Length (ft)			
Base Capacity (vph)	881	842	424
Starvation Cap Reductn	354	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.75	0.76	0.75

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	WBT	NBT
Lane Group Flow (vph)	382	768	313
v/c Ratio	0.76	0.80	0.83
Control Delay	19.8	24.9	46.4
Queue Delay	0.0	0.0	0.0
Total Delay	19.8	24.9	46.4
Queue Length 50th (ft)	99	362	131
Queue Length 95th (ft)	m#159	536	#257
Internal Link Dist (ft)	724	819	951
Turn Bay Length (ft)			
Base Capacity (vph)	502	963	400
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.76	0.80	0.78

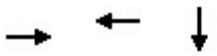
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	NEL	NER2
Lane Group Flow (vph)	4	186	207	12	163	277	266	256	15	10
v/c Ratio	0.01	0.70	0.36	0.04	0.32	0.42	0.55	0.27	0.04	0.02
Control Delay	24.8	42.1	2.3	28.2	29.0	4.3	20.2	14.5	0.1	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0
Total Delay	24.8	42.1	2.3	28.2	29.0	4.6	20.4	14.5	0.1	0.1
Queue Length 50th (ft)	2	79	0	4	65	0	64	61	0	0
Queue Length 95th (ft)	9	m130	m12	20	136	42	#176	149	0	0
Internal Link Dist (ft)	467	317			841			1001	128	
Turn Bay Length (ft)			240	185		185	365			
Base Capacity (vph)	332	277	584	309	509	664	486	941	467	463
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	81	22	0	87	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.67	0.35	0.04	0.32	0.48	0.57	0.27	0.04	0.02

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBT	WBT	SBT
Lane Group Flow (vph)	566	396	412
v/c Ratio	0.85	0.67	0.84
Control Delay	42.1	25.1	33.5
Queue Delay	3.8	0.0	0.0
Total Delay	45.8	25.1	33.5
Queue Length 50th (ft)	284	147	114
Queue Length 95th (ft)	#471	185	#255
Internal Link Dist (ft)	317	724	874
Turn Bay Length (ft)			
Base Capacity (vph)	663	587	532
Starvation Cap Reductn	48	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.92	0.67	0.77

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	WBT	NBT
Lane Group Flow (vph)	666	493	267
v/c Ratio	0.77	0.66	0.67
Control Delay	11.2	23.4	23.8
Queue Delay	0.0	0.0	0.0
Total Delay	11.2	23.4	23.8
Queue Length 50th (ft)	63	174	64
Queue Length 95th (ft)	m#108	#347	132
Internal Link Dist (ft)	724	819	951
Turn Bay Length (ft)			
Base Capacity (vph)	861	746	494
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.77	0.66	0.54

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

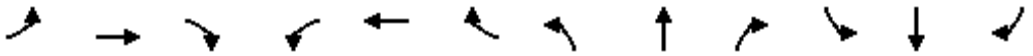
3. Appendix C: Synchro Report - Future No-Build Conditions

Movement	EBL	EBT	EBR	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	2	5	4	387	14	0	179	6	1	188	163	256
Future Volume (vph)	2	5	4	387	14	0	179	6	1	188	163	256
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.1				7.1	7.1		10.2	10.2	10.2	10.2
Lane Util. Factor		1.00				1.00	1.00		1.00	1.00	1.00	1.00
Frt		0.95				1.00	0.85		1.00	1.00	0.85	1.00
Flt Protected		0.99				0.95	1.00		0.95	1.00	1.00	0.95
Satd. Flow (prot)		1788				1722	1524		1805	1810	1524	1703
Flt Permitted		0.95				0.75	1.00		0.60	1.00	1.00	0.27
Satd. Flow (perm)		1709				1358	1524		1149	1810	1524	489
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	2	6	5	440	16	0	203	7	1	214	185	291
RTOR Reduction (vph)	0	0	0	0	0	0	130	0	0	0	164	0
Lane Group Flow (vph)	0	13	0	0	0	456	73	0	8	214	21	291
Heavy Vehicles (%)	0%	0%	0%	5%	0%	0%	6%	0%	0%	5%	6%	6%
Turn Type	Perm	NA		Perm	Perm	NA	Perm	Perm	Perm	NA	Perm	pm+pt
Protected Phases		4				4				2		1
Permitted Phases	4			4	4		4	2	2		2	6
Actuated Green, G (s)		36.1				36.1	36.1		11.1	11.1	11.1	34.2
Effective Green, g (s)		36.1				36.1	36.1		11.1	11.1	11.1	34.2
Actuated g/C Ratio		0.36				0.36	0.36		0.11	0.11	0.11	0.34
Clearance Time (s)		7.1				7.1	7.1		10.2	10.2	10.2	10.2
Vehicle Extension (s)		3.0				3.0	3.0		4.0	4.0	4.0	3.0
Lane Grp Cap (vph)		616				490	550		127	200	169	323
v/s Ratio Prot										0.12		c0.12
v/s Ratio Perm		0.01				c0.34	0.05		0.01		0.01	c0.19
v/c Ratio		0.02				0.93	0.13		0.06	1.07	0.12	0.90
Uniform Delay, d1		20.6				30.7	21.4		39.8	44.5	40.1	27.6
Progression Factor		1.00				0.89	1.02		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.0				3.5	0.0		1.0	83.4	1.5	26.6
Delay (s)		20.6				31.0	21.9		40.7	127.9	41.5	54.3
Level of Service		C				C	C		D	F	D	D
Approach Delay (s)		20.6				28.2				86.9		
Approach LOS		C				C				F		

Intersection Summary			
HCM 2000 Control Delay	47.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	36.9
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

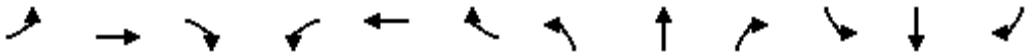
Movement	SBT	SBR	NEL	NER	NER2
Lane Configurations					
Traffic Volume (vph)	208	11	2	11	21
Future Volume (vph)	208	11	2	11	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	10.2		9.4		9.4
Lane Util. Factor	1.00		1.00		0.95
Frt	0.99		0.86		0.85
Flt Protected	1.00		1.00		1.00
Satd. Flow (prot)	1792		1615		1461
Flt Permitted	1.00		1.00		1.00
Satd. Flow (perm)	1792		1615		1461
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	236	12	2	12	24
RTOR Reduction (vph)	0	0	19	0	18
Lane Group Flow (vph)	249	0	1	0	1
Heavy Vehicles (%)	5%	9%	0%	0%	5%
Turn Type	NA		Perm		Perm
Protected Phases	6				
Permitted Phases			3		3
Actuated Green, G (s)	34.2		3.0		3.0
Effective Green, g (s)	34.2		3.0		3.0
Actuated g/C Ratio	0.34		0.03		0.03
Clearance Time (s)	10.2		9.4		9.4
Vehicle Extension (s)	4.0		2.0		2.0
Lane Grp Cap (vph)	612		48		43
v/s Ratio Prot	0.14				
v/s Ratio Perm			0.00		c0.00
v/c Ratio	0.41		0.01		0.01
Uniform Delay, d1	25.1		47.1		47.1
Progression Factor	1.00		1.00		1.00
Incremental Delay, d2	2.0		0.0		0.0
Delay (s)	27.1		47.1		47.1
Level of Service	C		D		D
Approach Delay (s)	41.8		47.1		
Approach LOS	D		D		

Intersection Summary



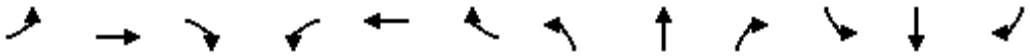
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	300	135	364	355	0	0	0	0	188	0	225
Future Volume (vph)	0	300	135	364	355	0	0	0	0	188	0	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.6	7.6		7.6						5.2	
Lane Util. Factor		1.00	1.00		1.00						1.00	
Frt		1.00	0.85		1.00						0.93	
Flt Protected		1.00	1.00		0.98						0.98	
Satd. Flow (prot)		1810	1538		1739						1613	
Flt Permitted		1.00	1.00		0.63						0.98	
Satd. Flow (perm)		1810	1538		1131						1613	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	341	153	414	403	0	0	0	0	214	0	256
RTOR Reduction (vph)	0	0	72	0	0	0	0	0	0	0	104	0
Lane Group Flow (vph)	0	341	81	0	817	0	0	0	0	0	366	0
Heavy Vehicles (%)	0%	5%	5%	9%	4%	0%	0%	0%	0%	10%	0%	4%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	
Protected Phases		6		5	2						4	
Permitted Phases			6	2						4		
Actuated Green, G (s)		52.8	52.8		65.4						21.8	
Effective Green, g (s)		52.8	52.8		65.4						21.8	
Actuated g/C Ratio		0.53	0.53		0.65						0.22	
Clearance Time (s)		7.6	7.6		7.6						5.2	
Vehicle Extension (s)		5.0	5.0		5.0						5.0	
Lane Grp Cap (vph)		955	812		770						351	
v/s Ratio Prot		0.19			c0.05							
v/s Ratio Perm			0.05		c0.64						0.23	
v/c Ratio		0.36	0.10		1.06						1.04	
Uniform Delay, d1		13.7	11.8		17.3						39.1	
Progression Factor		0.36	0.00		0.52						1.00	
Incremental Delay, d2		0.8	0.2		44.4						59.6	
Delay (s)		5.7	0.2		53.4						98.7	
Level of Service		A	A		D						F	
Approach Delay (s)		4.0			53.4			0.0			98.7	
Approach LOS		A			D			A			F	

Intersection Summary			
HCM 2000 Control Delay	51.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.4
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	285	0	0	544	413	175	0	238	0	0	0
Future Volume (vph)	203	285	0	0	544	413	175	0	238	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			6.1	6.1		5.3				
Lane Util. Factor		1.00			1.00	1.00		1.00				
Frt		1.00			1.00	0.85		0.92				
Flt Protected		0.98			1.00	1.00		0.98				
Satd. Flow (prot)		1763			1776	1538		1606				
Flt Permitted		0.43			1.00	1.00		0.98				
Satd. Flow (perm)		769			1776	1538		1606				
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	228	320	0	0	611	464	197	0	267	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	214	0	76	0	0	0	0
Lane Group Flow (vph)	0	548	0	0	611	250	0	388	0	0	0	0
Heavy Vehicles (%)	5%	6%	0%	0%	7%	5%	4%	0%	9%	0%	0%	0%
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6					2	4					
Actuated Green, G (s)		64.9			53.8	53.8		23.7				
Effective Green, g (s)		64.9			53.8	53.8		23.7				
Actuated g/C Ratio		0.65			0.54	0.54		0.24				
Clearance Time (s)		6.1			6.1	6.1		5.3				
Vehicle Extension (s)		5.0			5.0	5.0		5.0				
Lane Grp Cap (vph)		548			955	827		380				
v/s Ratio Prot		c0.05			0.34							
v/s Ratio Perm		c0.60				0.16		0.24				
v/c Ratio		1.00			0.64	0.30		1.02				
Uniform Delay, d1		17.5			16.3	12.7		38.1				
Progression Factor		0.67			1.00	1.00		1.00				
Incremental Delay, d2		34.1			3.3	0.9		51.4				
Delay (s)		45.8			19.6	13.7		89.6				
Level of Service		D			B	B		F				
Approach Delay (s)		45.8			17.0			89.6			0.0	
Approach LOS		D			B			F			A	

Intersection Summary			
HCM 2000 Control Delay	40.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	7	456	60	28	905	10	50	0	10	2	0	2
Future Volume (Veh/h)	7	456	60	28	905	10	50	0	10	2	0	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	8	512	67	31	1017	11	56	0	11	2	0	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		885										
pX, platoon unblocked												
vC, conflicting volume	1028			579			1609	1618	512	1624	1680	1022
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1028			579			1609	1618	512	1624	1680	1022
tC, single (s)	4.1			4.1			7.5	6.5	6.7	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.9	4.0	3.8	3.5	4.0	3.3
p0 queue free %	99			97			14	100	98	97	100	99
cM capacity (veh/h)	676			985			65	99	478	79	92	289

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	SB 1
Volume Total	8	512	67	31	1028	67	4
Volume Left	8	0	0	31	0	56	2
Volume Right	0	0	67	0	11	11	2
cSH	676	1700	1700	985	1700	76	124
Volume to Capacity	0.01	0.30	0.04	0.03	0.60	0.88	0.03
Queue Length 95th (ft)	1	0	0	2	0	112	2
Control Delay (s)	10.4	0.0	0.0	8.8	0.0	164.1	35.1
Lane LOS	B			A		F	E
Approach Delay (s)	0.1			0.3		164.1	35.1
Approach LOS						F	E

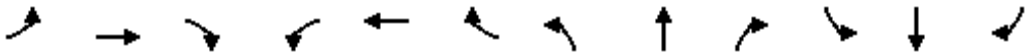
Intersection Summary				
Average Delay	6.7			
Intersection Capacity Utilization	60.3%	ICU Level of Service	B	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL2	WBL	WBT	WBR	NBL2	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (vph)	1	1	2	189	10	6	254	10	1	194	327	317
Future Volume (vph)	1	1	2	189	10	6	254	10	1	194	327	317
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.1				7.1	7.1		10.2	10.2	10.2	10.2
Lane Util. Factor		1.00				1.00	1.00		1.00	1.00	1.00	1.00
Frt		0.93				1.00	0.85		1.00	1.00	0.85	1.00
Flt Protected		0.99				0.95	1.00		0.95	1.00	1.00	0.95
Satd. Flow (prot)		1750				1779	1442		1805	1881	1583	1703
Flt Permitted		0.94				0.73	1.00		0.57	1.00	1.00	0.50
Satd. Flow (perm)		1665				1361	1442		1078	1881	1583	890
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1	1	2	199	11	6	267	11	1	204	344	334
RTOR Reduction (vph)	0	0	0	0	0	0	213	0	0	0	233	0
Lane Group Flow (vph)	0	4	0	0	0	216	54	0	12	204	111	334
Heavy Vehicles (%)	0%	0%	0%	2%	0%	0%	12%	0%	0%	1%	2%	6%
Turn Type	Perm	NA		Perm	Perm	NA	Perm	Perm	Perm	NA	Perm	pm+pt
Protected Phases		4				4				2		1
Permitted Phases	4			4	4		4	2	2		2	6
Actuated Green, G (s)		24.1				24.1	24.1		38.8	38.8	38.8	66.2
Effective Green, g (s)		24.1				24.1	24.1		38.8	38.8	38.8	66.2
Actuated g/C Ratio		0.20				0.20	0.20		0.32	0.32	0.32	0.55
Clearance Time (s)		7.1				7.1	7.1		10.2	10.2	10.2	10.2
Vehicle Extension (s)		3.0				3.0	3.0		4.0	4.0	4.0	3.0
Lane Grp Cap (vph)		334				273	289		348	608	511	607
v/s Ratio Prot										0.11		c0.08
v/s Ratio Perm		0.00				c0.16	0.04		0.01		0.07	c0.22
v/c Ratio		0.01				0.79	0.19		0.03	0.34	0.22	0.55
Uniform Delay, d1		38.4				45.6	39.8		27.8	30.8	29.6	15.6
Progression Factor		1.00				0.96	0.89		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.0				1.5	0.0		0.2	1.5	1.0	1.1
Delay (s)		38.4				45.2	35.7		28.0	32.3	30.5	16.7
Level of Service		D				D	D		C	C	C	B
Approach Delay (s)		38.4				39.9				31.1		
Approach LOS		D				D				C		

Intersection Summary			
HCM 2000 Control Delay	28.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	36.9
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

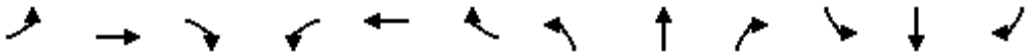
Movement	SBT	SBR	SBR2	NEL	NER	NER2
Lane Configurations						
Traffic Volume (vph)	295	6	1	5	9	10
Future Volume (vph)	295	6	1	5	9	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.2			9.4		9.4
Lane Util. Factor	1.00			1.00		0.95
Frt	1.00			0.90		0.85
Flt Protected	1.00			0.98		1.00
Satd. Flow (prot)	1822			1578		1534
Flt Permitted	1.00			0.98		1.00
Satd. Flow (perm)	1822			1578		1534
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	311	6	1	5	9	11
RTOR Reduction (vph)	0	0	0	15	0	10
Lane Group Flow (vph)	318	0	0	0	0	0
Heavy Vehicles (%)	4%	0%	0%	0%	11%	0%
Turn Type	NA			Perm		Perm
Protected Phases	6					
Permitted Phases				3		3
Actuated Green, G (s)	66.2			3.0		3.0
Effective Green, g (s)	66.2			3.0		3.0
Actuated g/C Ratio	0.55			0.02		0.02
Clearance Time (s)	10.2			9.4		9.4
Vehicle Extension (s)	4.0			2.0		2.0
Lane Grp Cap (vph)	1005			39		38
v/s Ratio Prot	0.17					
v/s Ratio Perm				c0.00		0.00
v/c Ratio	0.32			0.01		0.01
Uniform Delay, d1	14.6			57.1		57.0
Progression Factor	1.00			1.00		1.00
Incremental Delay, d2	0.8			0.0		0.0
Delay (s)	15.4			57.1		57.1
Level of Service	B			E		E
Approach Delay (s)	16.1			57.1		
Approach LOS	B			E		

Intersection Summary



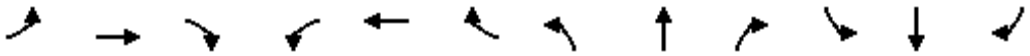
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	472	182	241	270	0	0	0	0	378	0	189
Future Volume (vph)	0	472	182	241	270	0	0	0	0	378	0	189
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.6	7.6		7.6						5.2	
Lane Util. Factor		1.00	1.00		1.00						1.00	
Frt		1.00	0.85		1.00						0.95	
Flt Protected		1.00	1.00		0.98						0.97	
Satd. Flow (prot)		1845	1495		1721						1651	
Flt Permitted		1.00	1.00		0.46						0.97	
Satd. Flow (perm)		1845	1495		817						1651	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.88	0.88	0.88	0.93	0.93	0.93
Adj. Flow (vph)	0	508	196	259	290	0	0	0	0	406	0	203
RTOR Reduction (vph)	0	0	100	0	0	0	0	0	0	0	78	0
Lane Group Flow (vph)	0	508	96	0	549	0	0	0	0	0	531	0
Heavy Vehicles (%)	0%	3%	8%	10%	6%	0%	0%	0%	0%	6%	0%	7%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	
Protected Phases		6		5	2						4	
Permitted Phases			6	2						4		
Actuated Green, G (s)		58.8	58.8		71.4						35.8	
Effective Green, g (s)		58.8	58.8		71.4						35.8	
Actuated g/C Ratio		0.49	0.49		0.60						0.30	
Clearance Time (s)		7.6	7.6		7.6						5.2	
Vehicle Extension (s)		5.0	5.0		5.0						5.0	
Lane Grp Cap (vph)		904	732		523						492	
v/s Ratio Prot		0.28			c0.04							
v/s Ratio Perm			0.06		c0.58						0.32	
v/c Ratio		0.56	0.13		1.05						1.08	
Uniform Delay, d1		21.5	16.7		24.3						42.1	
Progression Factor		0.62	0.18		0.83						1.00	
Incremental Delay, d2		2.3	0.3		50.2						63.7	
Delay (s)		15.7	3.3		70.5						105.8	
Level of Service		B	A		E						F	
Approach Delay (s)		12.3			70.5			0.0			105.8	
Approach LOS		B			E			A			F	

Intersection Summary			
HCM 2000 Control Delay	60.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.4
Intersection Capacity Utilization	101.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	183	667	0	0	397	288	114	0	255	0	0	0
Future Volume (vph)	183	667	0	0	397	288	114	0	255	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			6.1	6.1		5.3				
Lane Util. Factor		1.00			1.00	1.00		1.00				
Frt		1.00			1.00	0.85		0.91				
Flt Protected		0.99			1.00	1.00		0.98				
Satd. Flow (prot)		1792			1776	1553		1622				
Flt Permitted		0.72			1.00	1.00		0.98				
Satd. Flow (perm)		1296			1776	1553		1622				
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	197	717	0	0	427	310	123	0	274	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	122	0	67	0	0	0	0
Lane Group Flow (vph)	0	914	0	0	427	188	0	330	0	0	0	0
Heavy Vehicles (%)	1%	6%	0%	0%	7%	4%	6%	0%	4%	0%	0%	0%
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6					2	4					
Actuated Green, G (s)		83.9			72.8	72.8		24.7				
Effective Green, g (s)		83.9			72.8	72.8		24.7				
Actuated g/C Ratio		0.70			0.61	0.61		0.21				
Clearance Time (s)		6.1			6.1	6.1		5.3				
Vehicle Extension (s)		5.0			5.0	5.0		5.0				
Lane Grp Cap (vph)		926			1077	942		333				
v/s Ratio Prot		c0.04			0.24							
v/s Ratio Perm		c0.65				0.12		0.20				
v/c Ratio		0.99			0.40	0.20		0.99				
Uniform Delay, d1		17.5			12.2	10.6		47.5				
Progression Factor		0.69			1.00	1.00		1.00				
Incremental Delay, d2		19.5			1.1	0.5		47.1				
Delay (s)		31.6			13.3	11.0		94.6				
Level of Service		C			B	B		F				
Approach Delay (s)		31.6			12.4			94.6			0.0	
Approach LOS		C			B			F			A	

Intersection Summary			
HCM 2000 Control Delay	36.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	102.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	865	55	21	588	3	90	0	28	10	0	7
Future Volume (Veh/h)	2	865	55	21	588	3	90	0	28	10	0	7
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.90	0.90	0.90	0.90	0.92	0.90	0.92	0.90	0.92	0.92	0.92
Hourly flow rate (vph)	2	961	61	23	653	3	100	0	31	11	0	8
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		878										
pX, platoon unblocked				0.72			0.72	0.72	0.72	0.72	0.72	
vC, conflicting volume	656			1022			1672	1667	961	1696	1726	654
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	656			841			1737	1730	757	1771	1812	654
tC, single (s)	4.1			4.3			7.2	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.4			3.6	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			0	100	89	73	100	98
cM capacity (veh/h)	931			526			44	61	293	41	54	466

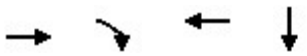
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	SB 1
Volume Total	2	961	61	23	656	131	19
Volume Left	2	0	0	23	0	100	11
Volume Right	0	0	61	0	3	31	8
cSH	931	1700	1700	526	1700	55	66
Volume to Capacity	0.00	0.57	0.04	0.04	0.39	2.37	0.29
Queue Length 95th (ft)	0	0	0	3	0	330	26
Control Delay (s)	8.9	0.0	0.0	12.2	0.0	783.3	80.4
Lane LOS	A			B		F	F
Approach Delay (s)	0.0			0.4		783.3	80.4
Approach LOS						F	F

Intersection Summary				
Average Delay	56.4			
Intersection Capacity Utilization	61.2%	ICU Level of Service	B	
Analysis Period (min)	15			

Lane Group	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	NEL	NER2
Lane Group Flow (vph)	13	456	203	8	214	185	291	249	20	19
v/c Ratio	0.02	0.93	0.28	0.05	0.80	0.41	0.85	0.37	0.06	0.06
Control Delay	21.8	33.9	0.5	39.0	65.0	4.1	51.8	25.7	0.3	0.4
Queue Delay	0.0	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.8	40.2	0.5	39.0	65.0	4.1	51.8	25.7	0.3	0.4
Queue Length 50th (ft)	5	262	0	5	136	0	147	121	0	0
Queue Length 95th (ft)	18	m241	m0	18	#261	13	#265	186	0	0
Internal Link Dist (ft)	467	317			841			1001	128	
Turn Bay Length (ft)			200	130		130	350			
Base Capacity (vph)	616	489	736	170	268	446	342	680	334	326
Starvation Cap Reductn	0	21	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.97	0.28	0.05	0.80	0.41	0.85	0.37	0.06	0.06

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBT	EBR	WBT	SBT
Lane Group Flow (vph)	341	153	817	470
v/c Ratio	0.36	0.17	1.06	1.03
Control Delay	5.8	0.3	58.2	80.0
Queue Delay	0.6	0.0	0.0	26.5
Total Delay	6.4	0.3	58.2	106.5
Queue Length 50th (ft)	45	1	~155	~251
Queue Length 95th (ft)	m52	m0	m#675	#431
Internal Link Dist (ft)	317		737	874
Turn Bay Length (ft)		250		
Base Capacity (vph)	955	884	770	455
Starvation Cap Reductn	295	0	0	0
Spillback Cap Reductn	0	0	0	119
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.52	0.17	1.06	1.40

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	WBT	WBR	NBT
Lane Group Flow (vph)	548	611	464	464
v/c Ratio	1.00	0.64	0.45	1.02
Control Delay	50.7	20.1	2.6	77.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	50.7	20.1	2.6	77.8
Queue Length 50th (ft)	~96	260	0	~252
Queue Length 95th (ft)	m#252	372	43	#451
Internal Link Dist (ft)	737	805		951
Turn Bay Length (ft)				
Base Capacity (vph)	548	955	1041	456
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	1.00	0.64	0.45	1.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

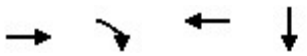
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT	NEL	NER2
Lane Group Flow (vph)	4	216	267	12	204	344	334	318	15	10
v/c Ratio	0.01	0.79	0.53	0.03	0.31	0.44	0.53	0.30	0.05	0.04
Control Delay	35.2	45.4	4.5	35.5	34.9	6.0	18.8	16.0	0.4	0.2
Queue Delay	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.2	45.4	4.6	35.5	34.9	6.0	18.8	16.0	0.4	0.2
Queue Length 50th (ft)	2	152	0	7	129	0	149	138	0	0
Queue Length 95th (ft)	12	m135	m0	24	215	78	231	214	0	0
Internal Link Dist (ft)	467	317			841			1001	128	
Turn Bay Length (ft)			200	130		130	350			
Base Capacity (vph)	400	328	549	382	667	783	666	1063	279	277
Starvation Cap Reductn	0	0	31	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.66	0.52	0.03	0.31	0.44	0.50	0.30	0.05	0.04

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBT	EBR	WBT	SBT
Lane Group Flow (vph)	508	196	549	609
v/c Ratio	0.56	0.24	1.05	1.07
Control Delay	16.1	1.0	74.2	90.9
Queue Delay	0.5	0.0	0.0	0.0
Total Delay	16.5	1.0	74.2	90.9
Queue Length 50th (ft)	145	0	~275	~458
Queue Length 95th (ft)	152	5	m#476	#686
Internal Link Dist (ft)	317		742	874
Turn Bay Length (ft)		250		
Base Capacity (vph)	904	832	523	570
Starvation Cap Reductn	113	0	0	0
Spillback Cap Reductn	10	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.64	0.24	1.05	1.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

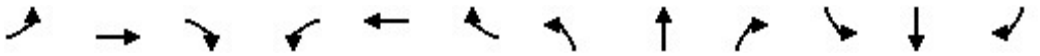
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	WBT	WBR	NBT
Lane Group Flow (vph)	914	427	310	397
v/c Ratio	0.99	0.40	0.29	0.99
Control Delay	34.1	13.6	1.8	81.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	34.1	13.6	1.8	81.2
Queue Length 50th (ft)	253	161	0	253
Queue Length 95th (ft)	m#371	229	35	#461
Internal Link Dist (ft)	742	798		951
Turn Bay Length (ft)				
Base Capacity (vph)	927	1077	1064	400
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.99	0.40	0.29	0.99

Intersection Summary

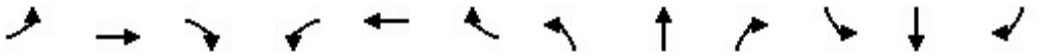
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

4. Appendix D: Synchro Report - Future Build Conditions



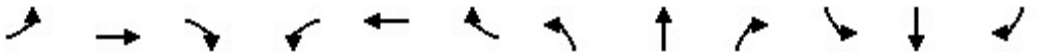
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	16	4	401	0	179	1	188	174	256	219	0
Future Volume (vph)	4	16	4	401	0	179	1	188	174	256	219	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.1			7.1	7.1	7.7	7.7	7.7	9.1	9.1	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.98			1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.99			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1838			1770	1524	1805	1810	1524	1703	1810	
Flt Permitted		0.92			0.74	1.00	0.60	1.00	1.00	0.36	1.00	
Satd. Flow (perm)		1713			1377	1524	1149	1810	1524	645	1810	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	5	18	5	456	0	203	1	214	198	291	249	0
RTOR Reduction (vph)	0	3	0	0	0	127	0	0	158	0	0	0
Lane Group Flow (vph)	0	25	0	0	456	76	1	214	40	291	249	0
Heavy Vehicles (%)	0%	0%	0%	2%	0%	6%	0%	5%	6%	6%	5%	0%
Turn Type	Perm	NA		Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4			4		4	2		2	6		
Actuated Green, G (s)		29.9			29.9	29.9	17.0	16.0	16.0	33.9	25.2	
Effective Green, g (s)		29.9			29.9	29.9	17.0	16.0	16.0	33.9	25.2	
Actuated g/C Ratio		0.37			0.37	0.37	0.21	0.20	0.20	0.42	0.31	
Clearance Time (s)		7.1			7.1	7.1	7.7	7.7	7.7	9.1	9.1	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)		640			514	569	252	362	304	408	570	
v/s Ratio Prot							0.00	0.12		c0.09	0.14	
v/s Ratio Perm		0.01			c0.33	0.05	0.00		0.03	c0.21		
v/c Ratio		0.04			0.89	0.13	0.00	0.59	0.13	0.71	0.44	
Uniform Delay, d1		15.9			23.5	16.5	24.8	29.0	26.3	16.9	21.8	
Progression Factor		1.00			1.11	1.38	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.0			14.6	0.1	0.0	6.9	0.9	5.8	2.4	
Delay (s)		15.9			40.6	22.9	24.8	36.0	27.2	22.7	24.2	
Level of Service		B			D	C	C	D	C	C	C	
Approach Delay (s)		15.9			35.1			31.7			23.4	
Approach LOS		B			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	30.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	23.9
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	300	135	364	355	0	0	0	0	188	0	225
Future Volume (vph)	0	300	135	364	355	0	0	0	0	188	0	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.6	7.6	7.6	7.6						5.2	
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	
Frt		1.00	0.85	1.00	1.00						0.93	
Flt Protected		1.00	1.00	0.95	1.00						0.98	
Satd. Flow (prot)		1810	1538	1656	1827						1613	
Flt Permitted		1.00	1.00	0.46	1.00						0.98	
Satd. Flow (perm)		1810	1538	805	1827						1613	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	341	153	414	403	0	0	0	0	214	0	256
RTOR Reduction (vph)	0	0	106	0	0	0	0	0	0	0	123	0
Lane Group Flow (vph)	0	341	47	414	403	0	0	0	0	0	347	0
Heavy Vehicles (%)	0%	5%	5%	9%	4%	0%	0%	0%	0%	10%	0%	4%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	
Protected Phases		6		5	2						4	
Permitted Phases			6	2						4		
Actuated Green, G (s)		24.4	24.4	46.4	46.4						20.8	
Effective Green, g (s)		24.4	24.4	46.4	46.4						20.8	
Actuated g/C Ratio		0.30	0.30	0.58	0.58						0.26	
Clearance Time (s)		7.6	7.6	7.6	7.6						5.2	
Vehicle Extension (s)		5.0	5.0	3.0	5.0						5.0	
Lane Grp Cap (vph)		552	469	620	1059						419	
v/s Ratio Prot		0.19		c0.12	0.22							
v/s Ratio Perm			0.03	c0.27							0.22	
v/c Ratio		0.62	0.10	0.67	0.38						0.83	
Uniform Delay, d1		23.8	19.9	16.2	9.1						27.9	
Progression Factor		0.56	0.37	0.30	0.24						1.00	
Incremental Delay, d2		4.2	0.3	1.6	0.6						14.1	
Delay (s)		17.6	7.7	6.4	2.7						42.0	
Level of Service		B	A	A	A						D	
Approach Delay (s)		14.5			4.6			0.0			42.0	
Approach LOS		B			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	17.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.4
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	285	0	0	544	413	175	0	238	0	0	0
Future Volume (vph)	203	285	0	0	544	413	175	0	238	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1			6.1	6.1		5.3				
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00				
Frt	1.00	1.00			1.00	0.85		0.92				
Flt Protected	0.95	1.00			1.00	1.00		0.98				
Satd. Flow (prot)	1719	1792			1776	1538		1606				
Flt Permitted	0.26	1.00			1.00	1.00		0.98				
Satd. Flow (perm)	471	1792			1776	1538		1606				
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	228	320	0	0	611	464	197	0	267	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	257	0	92	0	0	0	0
Lane Group Flow (vph)	228	320	0	0	611	207	0	372	0	0	0	0
Heavy Vehicles (%)	5%	6%	0%	0%	7%	5%	4%	0%	9%	0%	0%	0%
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6					2	4					
Actuated Green, G (s)	47.7	47.7			35.7	35.7		20.9				
Effective Green, g (s)	47.7	47.7			35.7	35.7		20.9				
Actuated g/C Ratio	0.60	0.60			0.45	0.45		0.26				
Clearance Time (s)	6.1	6.1			6.1	6.1		5.3				
Vehicle Extension (s)	3.0	5.0			5.0	5.0		5.0				
Lane Grp Cap (vph)	372	1068			792	686		419				
v/s Ratio Prot	c0.05	0.18			c0.34							
v/s Ratio Perm	0.32					0.13		0.23				
v/c Ratio	0.61	0.30			0.77	0.30		0.89				
Uniform Delay, d1	21.1	7.9			18.7	14.2		28.4				
Progression Factor	0.49	0.28			1.00	1.00		1.00				
Incremental Delay, d2	2.1	0.5			7.2	1.1		20.9				
Delay (s)	12.5	2.7			25.9	15.3		49.3				
Level of Service	B	A			C	B		D				
Approach Delay (s)		6.8			21.3			49.3			0.0	
Approach LOS		A			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	23.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	28	456	203	1	214	198	291	249
v/c Ratio	0.04	0.89	0.29	0.00	0.59	0.43	0.72	0.35
Control Delay	13.2	43.9	4.6	15.0	38.1	7.9	30.5	21.4
Queue Delay	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.2	44.2	4.6	15.0	38.1	7.9	30.5	21.4
Queue Length 50th (ft)	7	240	7	0	101	0	103	84
Queue Length 95th (ft)	22	m#349	m24	3	#172	51	#168	178
Internal Link Dist (ft)	467	317			841			1001
Turn Bay Length (ft)			200	130		130	350	
Base Capacity (vph)	686	549	729	347	361	463	402	708
Starvation Cap Reductn	0	5	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.84	0.28	0.00	0.59	0.43	0.72	0.35

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	EBR	WBL	WBT	SBT
Lane Group Flow (vph)	341	153	414	403	470
v/c Ratio	0.62	0.27	0.67	0.38	0.87
Control Delay	18.5	2.5	8.3	3.0	35.7
Queue Delay	0.0	0.0	0.0	0.1	0.5
Total Delay	18.5	2.5	8.3	3.0	36.2
Queue Length 50th (ft)	153	11	43	40	142
Queue Length 95th (ft)	m164	m15	m50	m46	#287
Internal Link Dist (ft)	317			737	874
Turn Bay Length (ft)		250	225		
Base Capacity (vph)	551	575	619	1059	581
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	75	12
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.62	0.27	0.67	0.41	0.83

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBT	WBR	NBT
Lane Group Flow (vph)	228	320	611	464	464
v/c Ratio	0.61	0.30	0.77	0.49	0.91
Control Delay	12.9	2.9	27.4	3.5	44.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	12.9	2.9	27.4	3.5	44.7
Queue Length 50th (ft)	21	32	253	0	166
Queue Length 95th (ft)	m49	m36	#395	49	#334
Internal Link Dist (ft)		737	805		951
Turn Bay Length (ft)	215				
Base Capacity (vph)	373	1067	791	942	526
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.61	0.30	0.77	0.49	0.88

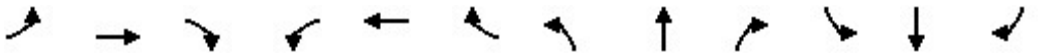
Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	19	215	267	1	204	344	334	318
v/c Ratio	0.05	0.75	0.51	0.00	0.38	0.49	0.57	0.31
Control Delay	21.8	46.9	10.5	24.0	27.4	5.9	14.3	10.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Total Delay	21.8	46.9	10.5	24.0	27.4	6.0	14.4	10.7
Queue Length 50th (ft)	6	106	27	0	88	0	90	83
Queue Length 95th (ft)	23	m146	m57	4	151	64	146	135
Internal Link Dist (ft)	467	317			841			1001
Turn Bay Length (ft)			200	130		130	350	
Base Capacity (vph)	412	332	559	308	537	698	603	1038
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	29	22	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.65	0.48	0.00	0.38	0.51	0.57	0.31

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



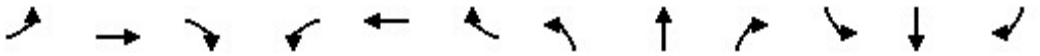
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	10	2	199	6	254	1	194	327	317	301	1
Future Volume (vph)	6	10	2	199	6	254	1	194	327	317	301	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.1			7.1	7.1	10.2	10.2	10.2	10.2	10.2	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt		0.99			1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.98			0.95	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1844			1777	1442	1805	1881	1583	1703	1826	
Flt Permitted		0.88			0.72	1.00	0.57	1.00	1.00	0.44	1.00	
Satd. Flow (perm)		1654			1339	1442	1078	1881	1583	781	1826	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	6	11	2	209	6	267	1	204	344	334	317	1
RTOR Reduction (vph)	0	2	0	0	0	210	0	0	246	0	0	0
Lane Group Flow (vph)	0	17	0	0	215	57	1	204	98	334	318	0
Heavy Vehicles (%)	0%	0%	0%	2%	0%	12%	0%	1%	2%	6%	4%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	
Protected Phases		4			4			2		1	6	
Permitted Phases	4			4		4	2		2	6		
Actuated Green, G (s)		17.2			17.2	17.2	22.9	22.9	22.9	45.5	45.5	
Effective Green, g (s)		17.2			17.2	17.2	22.9	22.9	22.9	45.5	45.5	
Actuated g/C Ratio		0.21			0.21	0.21	0.29	0.29	0.29	0.57	0.57	
Clearance Time (s)		7.1			7.1	7.1	10.2	10.2	10.2	10.2	10.2	
Vehicle Extension (s)		3.0			3.0	3.0	4.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)		355			287	310	308	538	453	587	1038	
v/s Ratio Prot								0.11		c0.09	0.17	
v/s Ratio Perm		0.01			c0.16	0.04	0.00		0.06	c0.24		
v/c Ratio		0.05			0.75	0.19	0.00	0.38	0.22	0.57	0.31	
Uniform Delay, d1		24.9			29.4	25.7	20.4	22.9	21.7	10.2	9.0	
Progression Factor		1.00			1.14	2.01	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.1			8.6	0.2	0.0	2.0	1.1	1.3	0.8	
Delay (s)		25.0			42.0	51.8	20.4	24.9	22.8	11.4	9.8	
Level of Service		C			D	D	C	C	C	B	A	
Approach Delay (s)		25.0			47.4			23.6			10.6	
Approach LOS		C			D			C			B	

Intersection Summary			
HCM 2000 Control Delay	25.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	27.5
Intersection Capacity Utilization	69.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	SBT
Lane Group Flow (vph)	508	196	259	290	609
v/c Ratio	0.80	0.30	0.72	0.31	0.95
Control Delay	28.3	1.9	19.9	3.6	47.0
Queue Delay	0.2	0.0	0.0	0.0	0.0
Total Delay	28.5	1.9	19.9	3.6	47.0
Queue Length 50th (ft)	228	1	33	28	224
Queue Length 95th (ft)	#370	7	m#109	m37	#438
Internal Link Dist (ft)	317			742	874
Turn Bay Length (ft)		250	225		
Base Capacity (vph)	638	645	361	934	645
Starvation Cap Reductn	8	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.81	0.30	0.72	0.31	0.94

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.



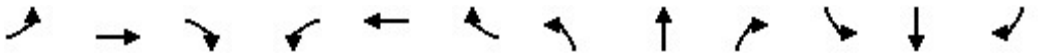
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	472	182	241	270	0	0	0	0	378	0	189
Future Volume (vph)	0	472	182	241	270	0	0	0	0	378	0	189
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.6	7.6	7.6	7.6						5.2	
Lane Util. Factor		1.00	1.00	1.00	1.00						1.00	
Frt		1.00	0.85	1.00	1.00						0.95	
Flt Protected		1.00	1.00	0.95	1.00						0.97	
Satd. Flow (prot)		1845	1495	1641	1792						1651	
Flt Permitted		1.00	1.00	0.30	1.00						0.97	
Satd. Flow (perm)		1845	1495	521	1792						1651	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.88	0.88	0.88	0.93	0.93	0.93
Adj. Flow (vph)	0	508	196	259	290	0	0	0	0	406	0	203
RTOR Reduction (vph)	0	0	128	0	0	0	0	0	0	0	113	0
Lane Group Flow (vph)	0	508	68	259	290	0	0	0	0	0	496	0
Heavy Vehicles (%)	0%	3%	8%	10%	6%	0%	0%	0%	0%	6%	0%	7%
Turn Type		NA	Perm	pm+pt	NA					Perm	NA	
Protected Phases		6		5	2						4	
Permitted Phases			6	2						4		
Actuated Green, G (s)		27.7	27.7	41.7	41.7						25.5	
Effective Green, g (s)		27.7	27.7	41.7	41.7						25.5	
Actuated g/C Ratio		0.35	0.35	0.52	0.52						0.32	
Clearance Time (s)		7.6	7.6	7.6	7.6						5.2	
Vehicle Extension (s)		5.0	5.0	3.0	5.0						5.0	
Lane Grp Cap (vph)		638	517	361	934						526	
v/s Ratio Prot		0.28		c0.06	0.16							
v/s Ratio Perm			0.05	c0.32							0.30	
v/c Ratio		0.80	0.13	0.72	0.31						0.94	
Uniform Delay, d1		23.6	17.9	23.7	10.9						26.5	
Progression Factor		0.76	0.27	0.44	0.25						1.00	
Incremental Delay, d2		8.8	0.5	5.6	0.7						26.2	
Delay (s)		26.8	5.3	16.1	3.5						52.8	
Level of Service		C	A	B	A						D	
Approach Delay (s)		20.8			9.4			0.0			52.8	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	27.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.4
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	NBT
Lane Group Flow (vph)	197	717	427	310	397
v/c Ratio	0.35	0.65	0.52	0.35	0.80
Control Delay	3.4	4.5	19.1	3.2	29.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	3.4	4.5	19.1	3.2	29.8
Queue Length 50th (ft)	13	81	148	0	118
Queue Length 95th (ft)	m22	m145	252	45	210
Internal Link Dist (ft)		742	798		951
Turn Bay Length (ft)	215				
Base Capacity (vph)	569	1103	827	889	580
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.65	0.52	0.35	0.68

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	183	667	0	0	397	288	114	0	255	0	0	0
Future Volume (vph)	183	667	0	0	397	288	114	0	255	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.1	6.1			6.1	6.1		5.3				
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00				
Frt	1.00	1.00			1.00	0.85		0.91				
Flt Protected	0.95	1.00			1.00	1.00		0.98				
Satd. Flow (prot)	1787	1792			1776	1553		1622				
Flt Permitted	0.43	1.00			1.00	1.00		0.98				
Satd. Flow (perm)	806	1792			1776	1553		1622				
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	197	717	0	0	427	310	123	0	274	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	165	0	108	0	0	0	0
Lane Group Flow (vph)	197	717	0	0	427	145	0	289	0	0	0	0
Heavy Vehicles (%)	1%	6%	0%	0%	7%	4%	6%	0%	4%	0%	0%	0%
Turn Type	pm+pt	NA			NA	Perm	Perm	NA				
Protected Phases	1	6			2			4				
Permitted Phases	6					2	4					
Actuated Green, G (s)	49.3	49.3			37.3	37.3		19.3				
Effective Green, g (s)	49.3	49.3			37.3	37.3		19.3				
Actuated g/C Ratio	0.62	0.62			0.47	0.47		0.24				
Clearance Time (s)	6.1	6.1			6.1	6.1		5.3				
Vehicle Extension (s)	3.0	5.0			5.0	5.0		5.0				
Lane Grp Cap (vph)	569	1104			828	724		391				
v/s Ratio Prot	0.03	c0.40			0.24							
v/s Ratio Perm	0.19					0.09		0.18				
v/c Ratio	0.35	0.65			0.52	0.20		0.74				
Uniform Delay, d1	11.3	9.8			15.0	12.6		28.0				
Progression Factor	0.27	0.27			1.00	1.00		1.00				
Incremental Delay, d2	0.2	1.4			2.3	0.6		8.7				
Delay (s)	3.2	4.1			17.3	13.2		36.7				
Level of Service	A	A			B	B		D				
Approach Delay (s)		3.9			15.6			36.7			0.0	
Approach LOS		A			B			D			A	

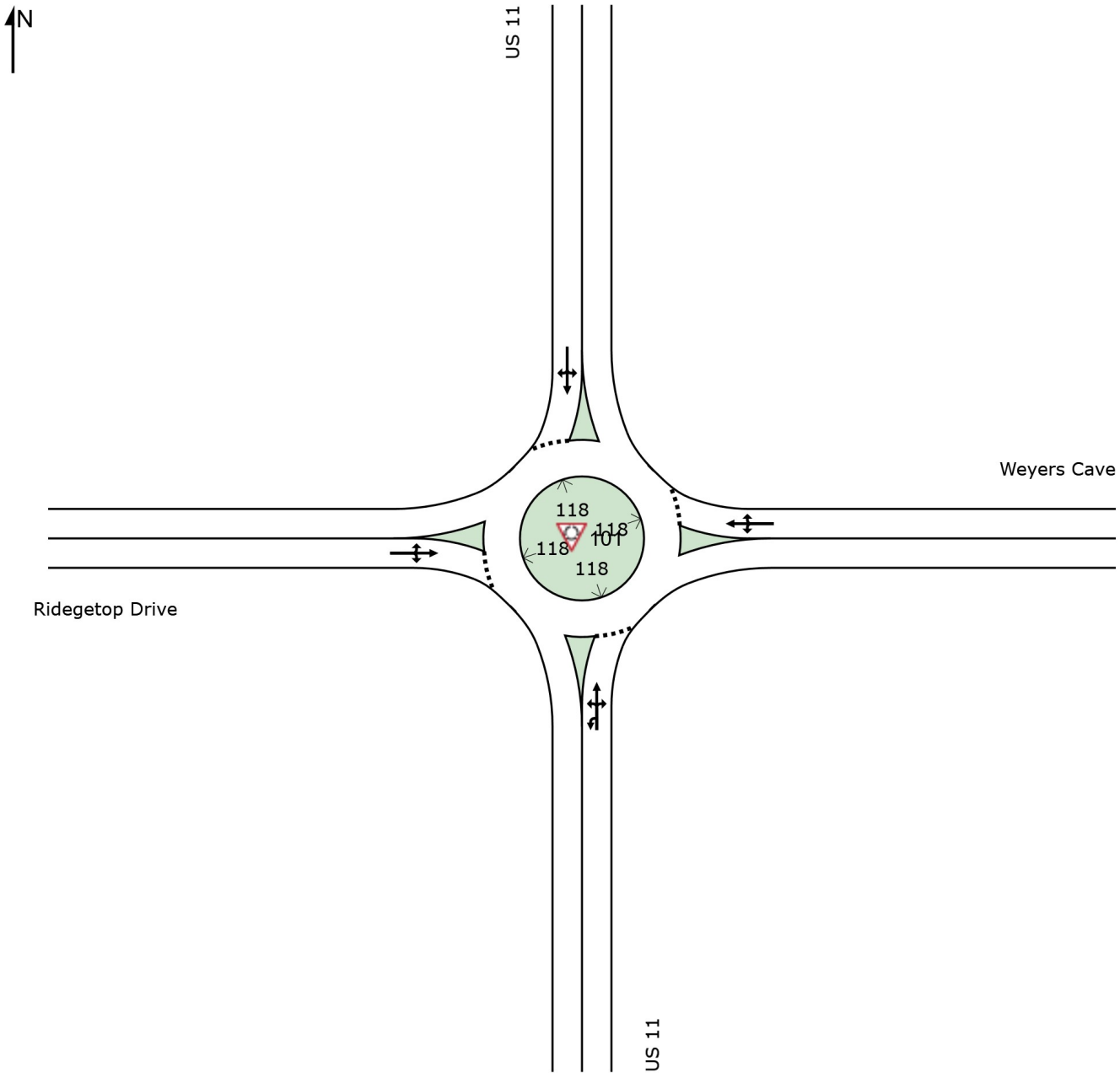
Intersection Summary			
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

5. Appendix E: SIDRA Report - Future Build Conditions

SITE LAYOUT

Site: 101 [US 11 - AM (No Reroute)]

New Site
Site Category: (None)
Roundabout



MOVEMENT SUMMARY

Site: 101 [US 11 - AM (No Reroute)]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: US 11												
3u	U	7	0.0	0.447	9.1	LOS A	3.2	83.0	0.67	0.54	0.67	34.4
3	L2	1	0.0	0.447	9.1	LOS A	3.2	83.0	0.67	0.54	0.67	23.3
8	T1	214	5.0	0.447	9.3	LOS A	3.2	83.0	0.67	0.54	0.67	33.3
18	R2	185	6.0	0.447	9.4	LOS A	3.2	83.0	0.67	0.54	0.67	21.1
Approach		407	5.4	0.447	9.3	LOS A	3.2	83.0	0.67	0.54	0.67	27.9
East: Weyers Cave												
1	L2	456	2.0	0.641	12.7	LOS B	7.5	192.2	0.71	0.60	0.84	26.4
6	T1	1	0.0	0.641	12.6	LOS B	7.5	192.2	0.71	0.60	0.84	11.6
16	R2	203	6.0	0.641	12.8	LOS B	7.5	192.2	0.71	0.60	0.84	25.2
Approach		660	3.2	0.641	12.7	LOS B	7.5	192.2	0.71	0.60	0.84	26.0
North: US 11												
7	L2	291	6.0	0.672	16.5	LOS B	9.0	235.0	0.88	1.02	1.37	20.4
4	T1	249	5.0	0.672	16.5	LOS B	9.0	235.0	0.88	1.02	1.37	29.1
14	R2	1	0.0	0.672	16.2	LOS B	9.0	235.0	0.88	1.02	1.37	20.4
Approach		541	5.5	0.672	16.5	LOS B	9.0	235.0	0.88	1.02	1.37	24.7
West: Ridegetop Drive												
5	L2	5	0.0	0.056	8.2	LOS A	0.4	9.0	0.86	0.71	0.86	31.2
2	T1	18	0.0	0.056	8.2	LOS A	0.4	9.0	0.86	0.71	0.86	9.5
12	R2	5	0.0	0.056	8.2	LOS A	0.4	9.0	0.86	0.71	0.86	29.4
Approach		27	0.0	0.056	8.2	LOS A	0.4	9.0	0.86	0.71	0.86	16.4
All Vehicles		1635	4.5	0.672	13.1	LOS B	9.0	235.0	0.76	0.73	0.97	25.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE DISTANCE (%ILE)

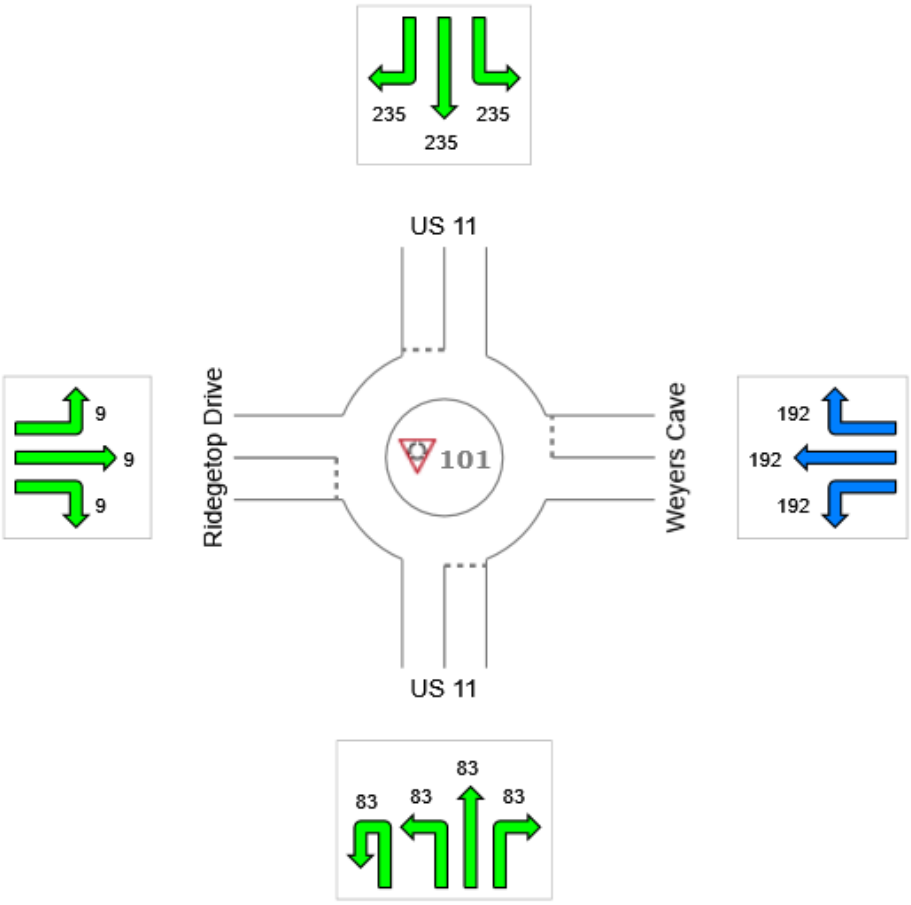
Largest 95% Back of Queue Distance for any lane used by vehicle movement (feet)

Site: 101 [US 11 - AM (No Reroute)]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Vehicle Queue (%ile)	83	192	235	9	235



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

DELAY (CONTROL)

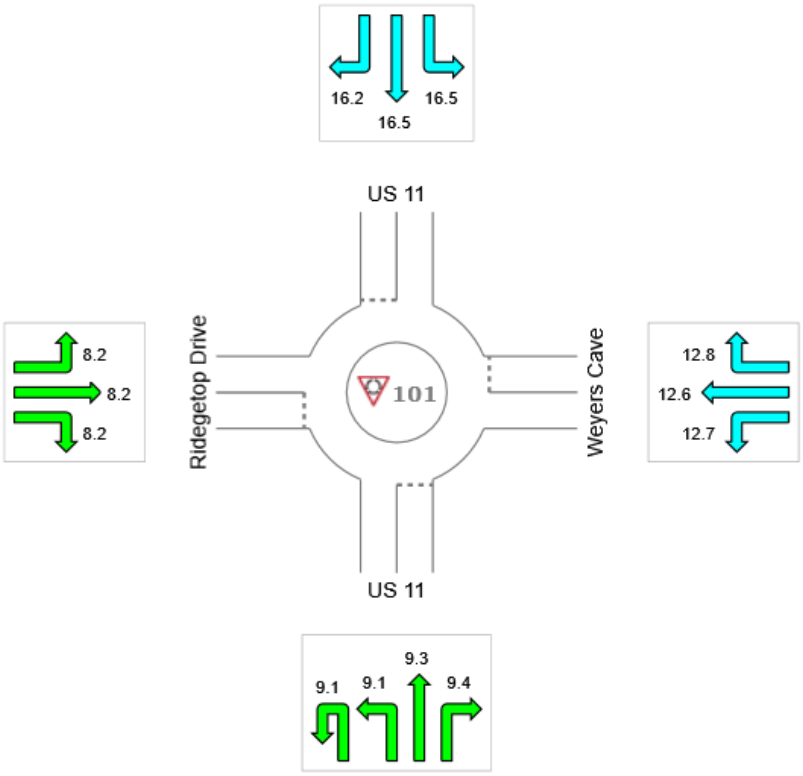
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 101 [US 11 - AM (No Reroute)]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	9.3	12.7	16.5	8.2	13.1
LOS	A	B	B	A	B



Colour code based on Level of Service

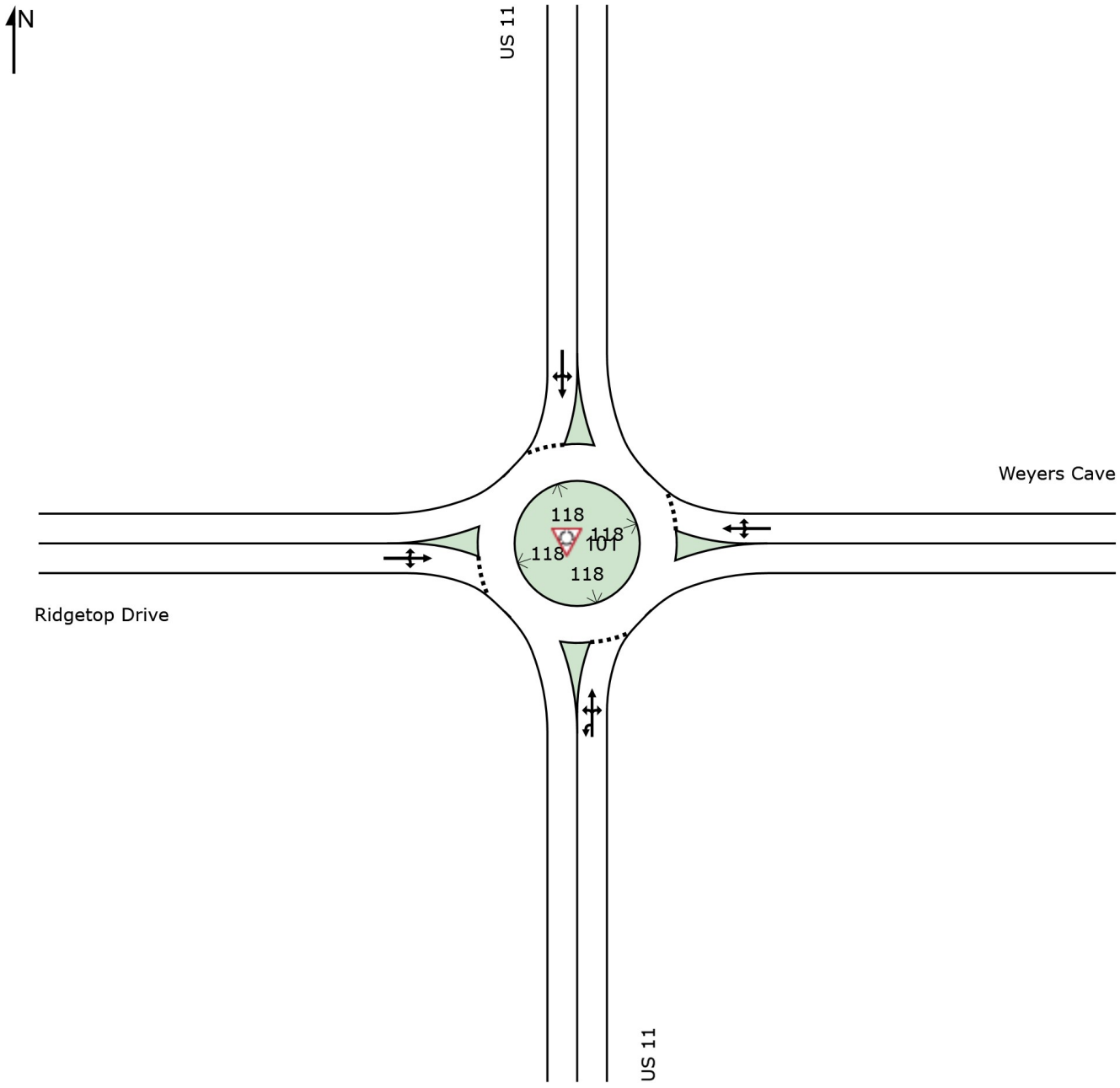
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Roundabout Level of Service Method: Same as Signalised Intersections
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

SITE LAYOUT

Site: 101 [US 11 - PM (No Reroute)]

New Site
Site Category: (None)
Roundabout



MOVEMENT SUMMARY

Site: 101 [US 11 - PM (No Reroute)]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: US 11												
3u	U	11	0.0	0.600	12.4	LOS B	6.7	169.7	0.77	0.76	1.00	32.8
3	L2	1	0.0	0.600	12.4	LOS B	6.7	169.7	0.77	0.76	1.00	22.0
8	T1	204	1.0	0.600	12.5	LOS B	6.7	169.7	0.77	0.76	1.00	31.8
18	R2	344	2.0	0.600	12.5	LOS B	6.7	169.7	0.77	0.76	1.00	20.1
Approach		560	1.6	0.600	12.5	LOS B	6.7	169.7	0.77	0.76	1.00	24.7
East: Weyers Cave												
1	L2	209	2.0	0.490	9.3	LOS A	3.7	98.4	0.60	0.44	0.60	28.8
6	T1	6	0.0	0.490	9.3	LOS A	3.7	98.4	0.60	0.44	0.60	12.6
16	R2	267	12.0	0.490	9.7	LOS A	3.7	98.4	0.60	0.44	0.60	27.1
Approach		483	7.5	0.490	9.6	LOS A	3.7	98.4	0.60	0.44	0.60	27.7
North: US 11												
7	L2	334	6.0	0.640	12.8	LOS B	7.4	191.2	0.70	0.59	0.82	21.6
4	T1	317	4.0	0.640	12.8	LOS B	7.4	191.2	0.70	0.59	0.82	30.6
14	R2	1	0.0	0.640	12.6	LOS B	7.4	191.2	0.70	0.59	0.82	21.6
Approach		652	5.0	0.640	12.8	LOS B	7.4	191.2	0.70	0.59	0.82	26.3
West: Ridgetop Drive												
5	L2	6	0.0	0.034	6.8	LOS A	0.2	5.2	0.80	0.61	0.80	31.5
2	T1	11	0.0	0.034	6.8	LOS A	0.2	5.2	0.80	0.61	0.80	9.9
12	R2	2	0.0	0.034	6.8	LOS A	0.2	5.2	0.80	0.61	0.80	29.7
Approach		19	0.0	0.034	6.8	LOS A	0.2	5.2	0.80	0.61	0.80	19.2
All Vehicles		1714	4.5	0.640	11.7	LOS B	7.4	191.2	0.70	0.60	0.82	26.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE DISTANCE (%ILE)

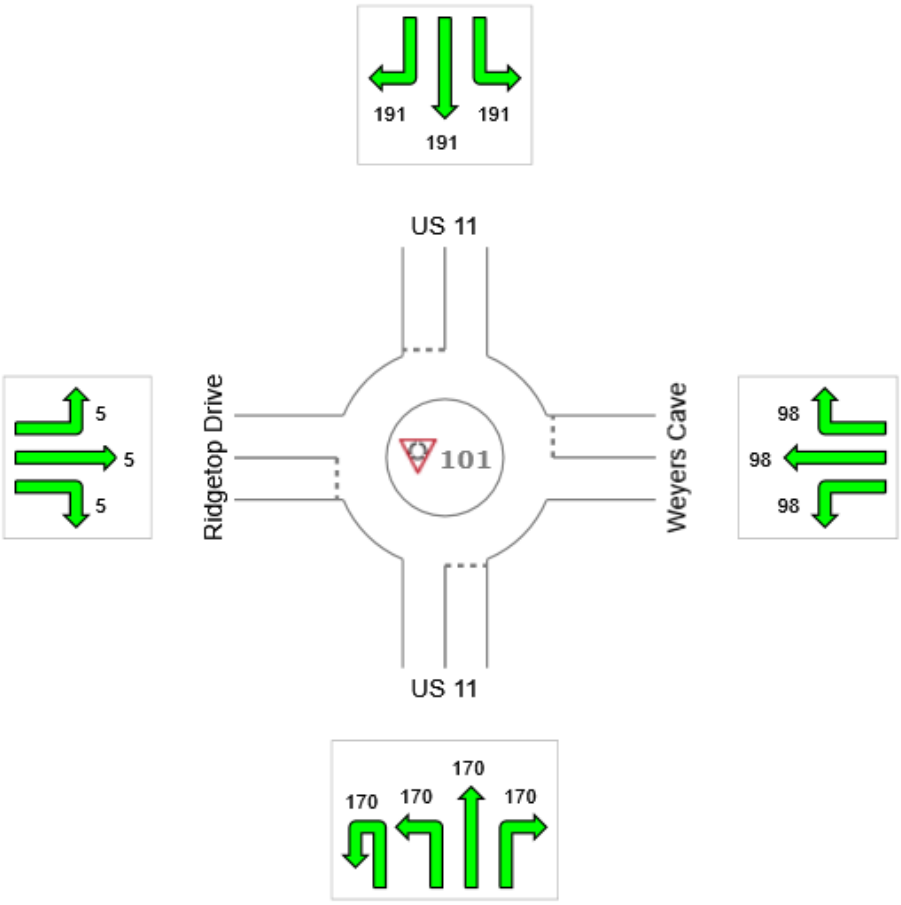
Largest 95% Back of Queue Distance for any lane used by vehicle movement (feet)

Site: 101 [US 11 - PM (No Reroute)]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Vehicle Queue (%ile)	170	98	191	5	191



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

DELAY (CONTROL)

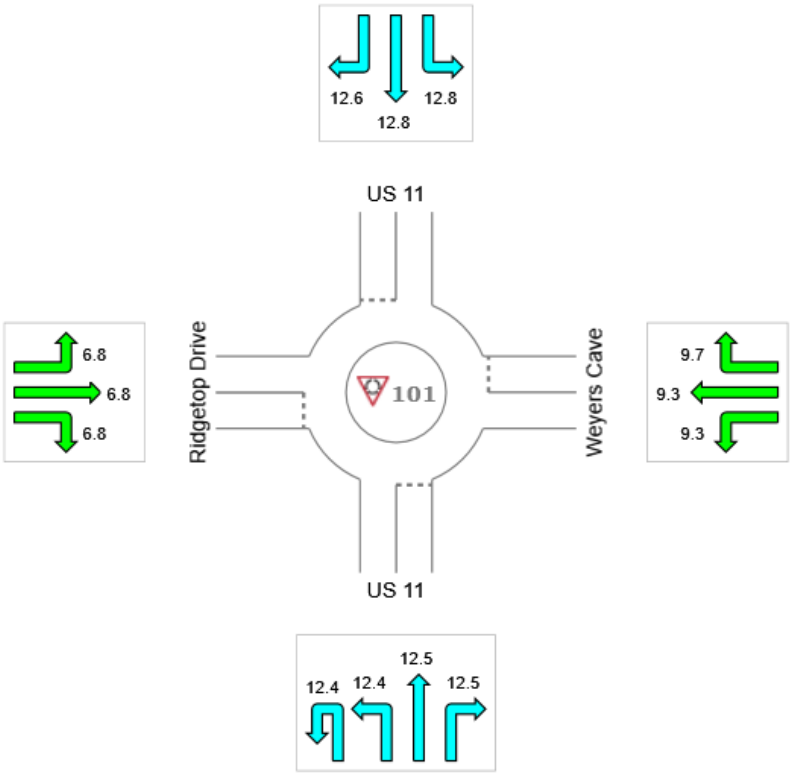
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 101 [US 11 - PM (No Reroute)]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Delay (Control)	12.5	9.6	12.8	6.8	11.7
LOS	B	A	B	A	B



Colour code based on Level of Service

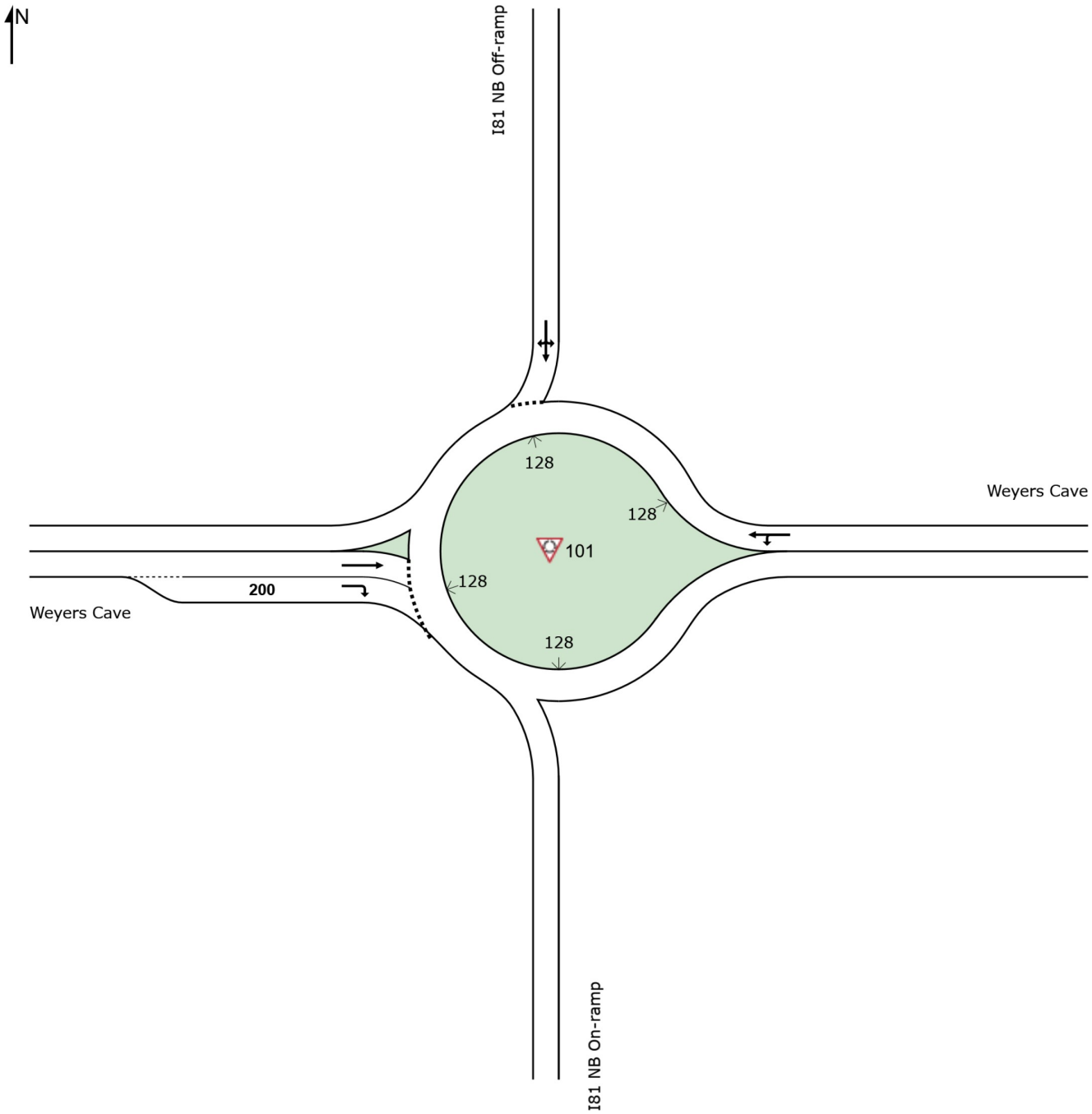
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Roundabout Level of Service Method: Same as Signalised Intersections
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

SITE LAYOUT

Site: 101 [I81 SB TERMINII - AM]

New Site
Site Category: (None)
Roundabout



MOVEMENT SUMMARY

Site: 101 [I81 SB TERMINII - AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
East: Weyers Cave												
1	L2	414	9.0	0.640	10.9	LOS B	0.0	0.0	0.00	0.00	0.00	36.1
6	T1	403	4.0	0.640	10.8	LOS B	0.0	0.0	0.00	0.00	0.00	26.8
Approach		817	6.5	0.640	10.9	LOS B	0.0	0.0	0.00	0.00	0.00	32.6
North: I81 NB Off-ramp												
7	L2	214	10.0	0.715	21.8	LOS C	8.7	228.6	0.94	1.22	1.68	24.1
4	T1	1	0.0	0.715	21.1	LOS C	8.7	228.6	0.94	1.22	1.68	27.5
14	R2	256	4.0	0.715	21.4	LOS C	8.7	228.6	0.94	1.22	1.68	21.4
Approach		470	6.7	0.715	21.6	LOS C	8.7	228.6	0.94	1.22	1.68	22.6
West: Weyers Cave												
2	T1	341	5.0	0.361	7.8	LOS A	2.5	65.4	0.76	0.67	0.76	26.3
12	R2	153	5.0	0.220	7.8	LOS A	1.3	33.1	0.71	0.64	0.71	29.7
Approach		494	5.0	0.361	7.8	LOS A	2.5	65.4	0.74	0.66	0.74	27.8
All Vehicles		1782	6.2	0.715	12.9	LOS B	8.7	228.6	0.45	0.50	0.65	27.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE DISTANCE (%ILE)

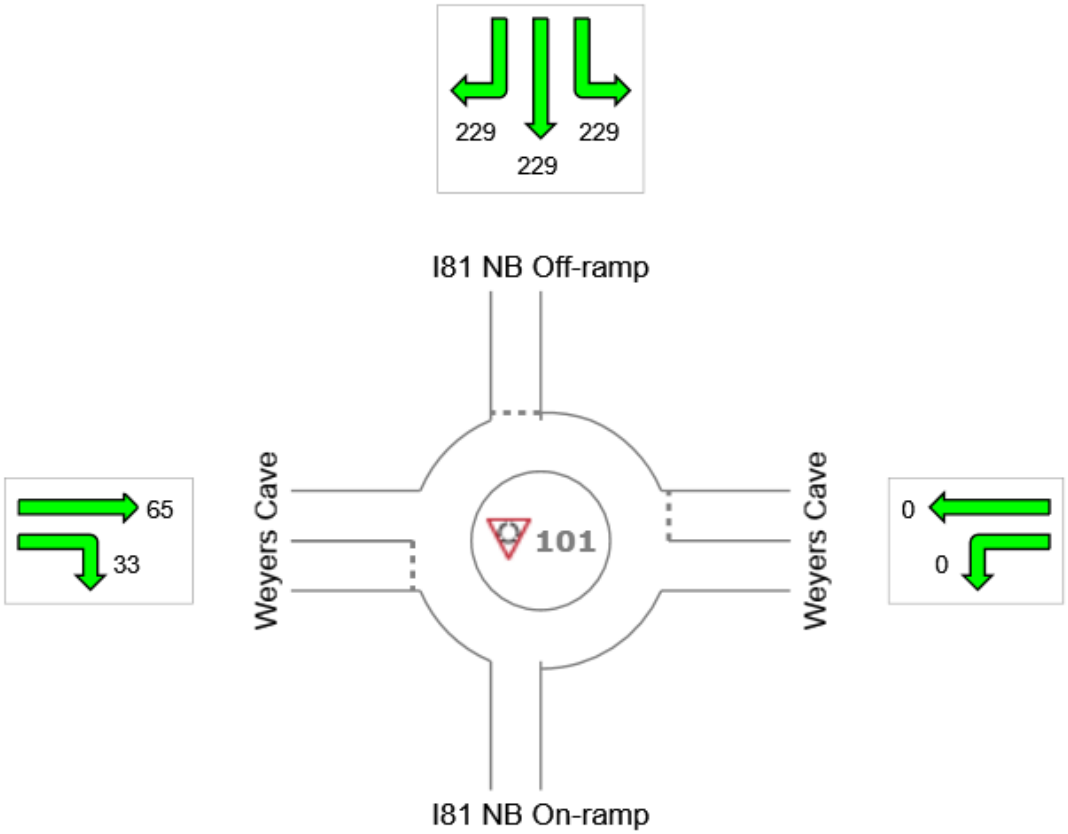
Largest 95% Back of Queue Distance for any lane used by vehicle movement (feet)

Site: 101 [I81 SB TERMINII - AM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Vehicle Queue (%ile)	0	229	65	229



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

DELAY (CONTROL)

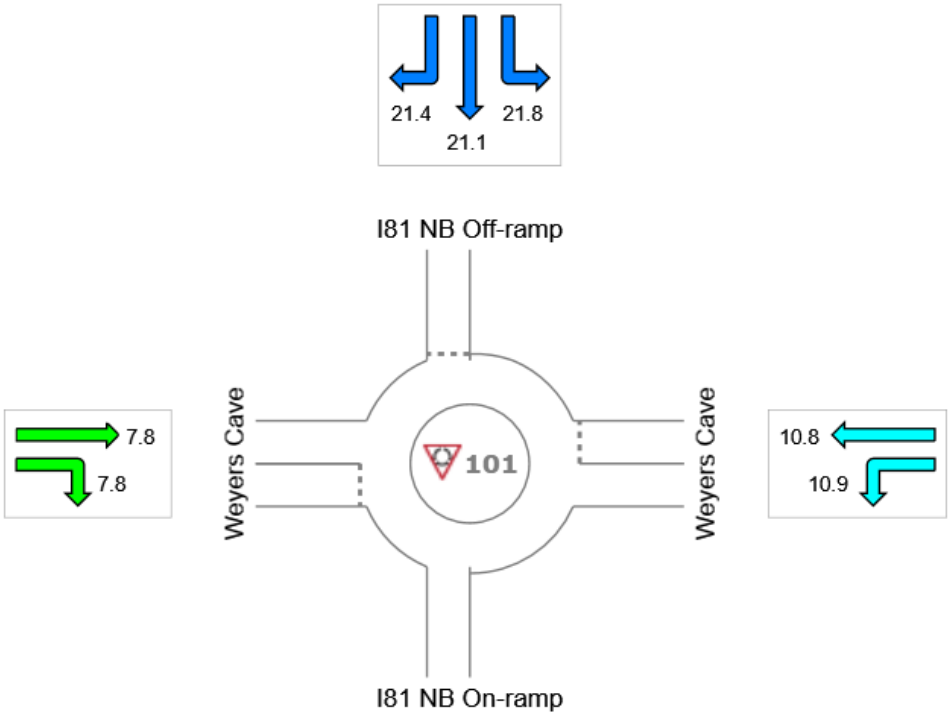
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 101 [I81 SB TERMINII - AM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Delay (Control)	10.9	21.6	7.8	12.9
LOS	B	C	A	B



Colour code based on Level of Service

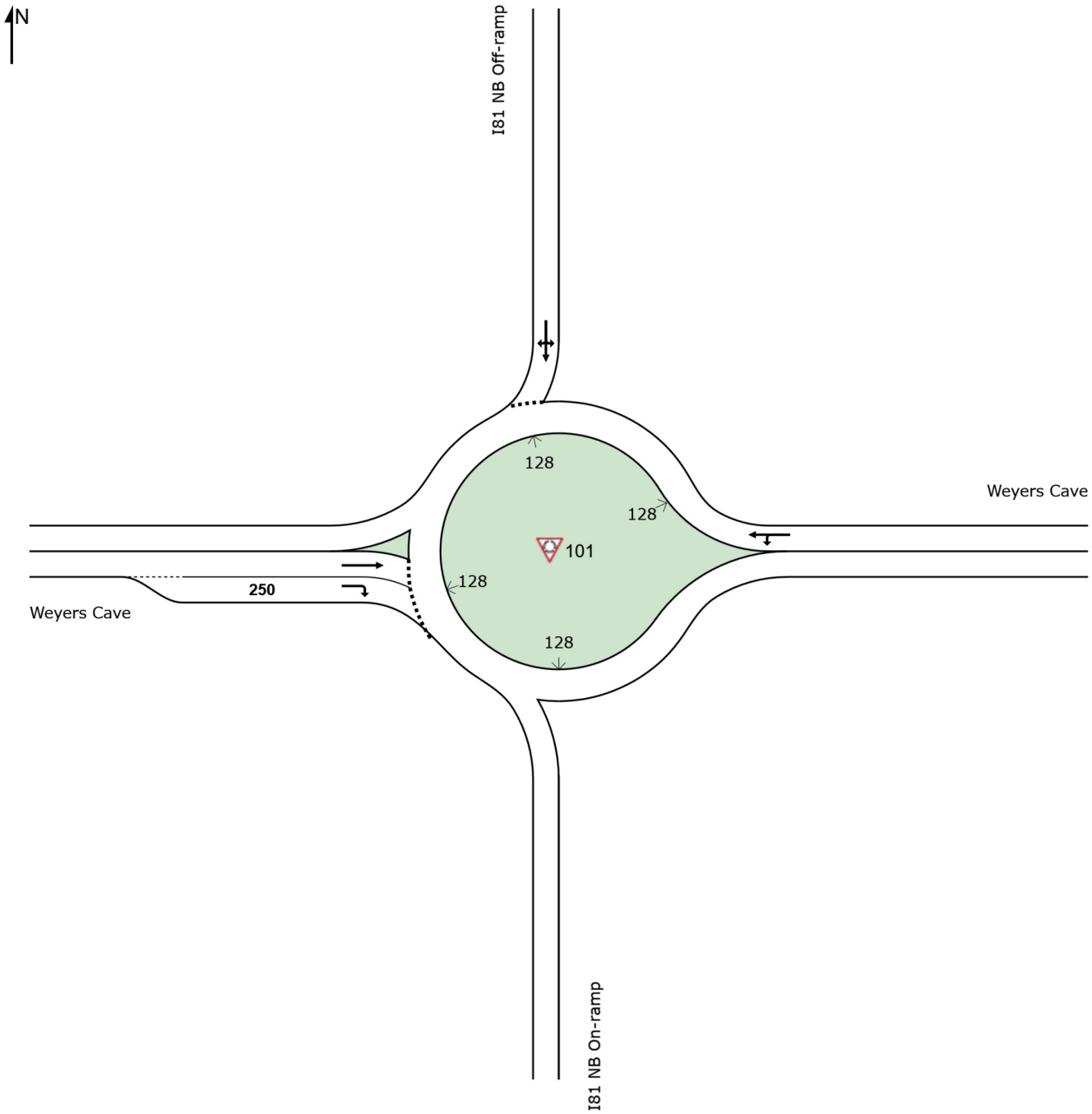
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Roundabout Level of Service Method: Same as Signalised Intersections
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

SITE LAYOUT

Site: 101 [I81 SB TERMINII - PM]

New Site
Site Category: (None)
Roundabout



MOVEMENT SUMMARY

Site: 101 [I81 SB TERMINII - PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
East: Weyers Cave												
1	L2	262	10.0	0.438	7.3	LOS A	0.0	0.0	0.00	0.00	0.00	36.2
6	T1	290	6.0	0.438	7.2	LOS A	0.0	0.0	0.00	0.00	0.00	26.9
Approach		552	7.9	0.438	7.3	LOS A	0.0	0.0	0.00	0.00	0.00	32.5
North: I81 NB Off-ramp												
7	L2	411	6.0	0.755	20.4	LOS C	11.5	302.4	0.90	1.21	1.69	24.3
4	T1	1	0.0	0.755	20.0	LOS C	11.5	302.4	0.90	1.21	1.69	27.5
14	R2	205	7.0	0.755	20.4	LOS C	11.5	302.4	0.90	1.21	1.69	21.5
Approach		617	6.3	0.755	20.4	LOS C	11.5	302.4	0.90	1.21	1.69	23.4
West: Weyers Cave												
2	T1	508	3.0	0.574	12.3	LOS B	6.3	160.8	0.91	0.96	1.20	22.7
12	R2	198	8.0	0.333	10.8	LOS B	2.1	55.5	0.80	0.77	0.80	27.7
Approach		705	4.4	0.574	11.9	LOS B	6.3	160.8	0.88	0.91	1.09	24.5
All Vehicles		1875	6.1	0.755	13.3	LOS B	11.5	302.4	0.63	0.74	0.97	25.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE DISTANCE (%ILE)

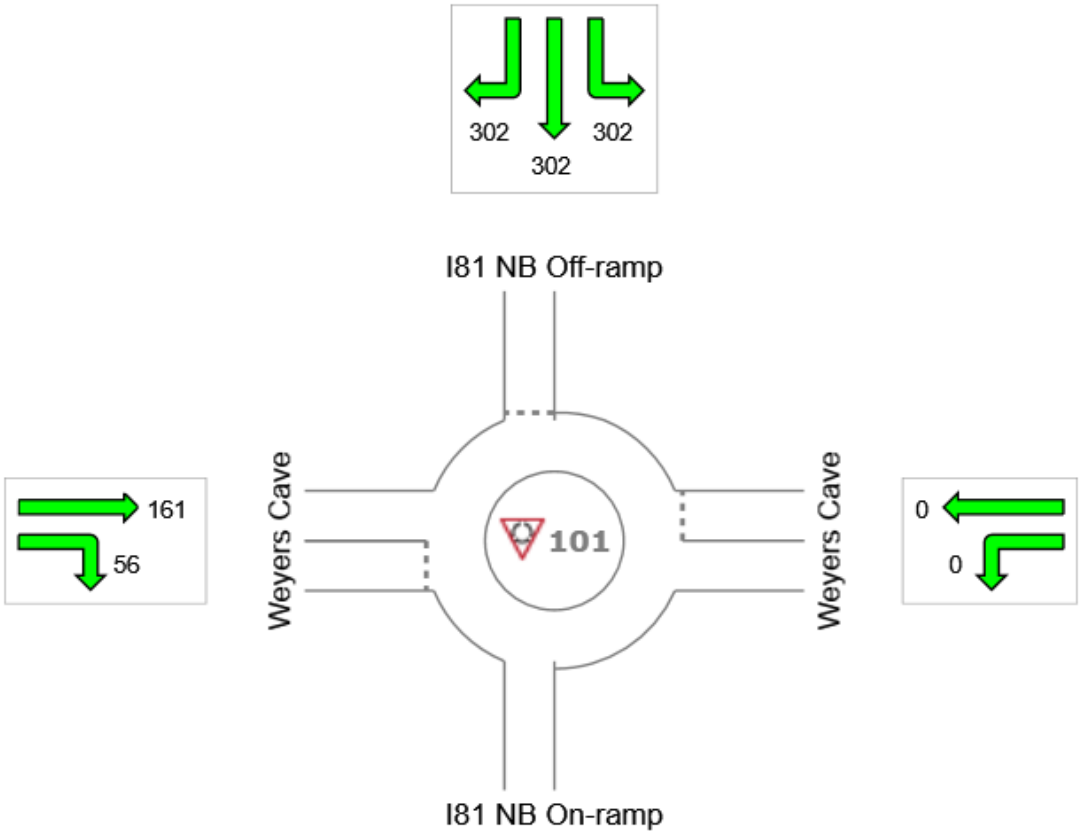
Largest 95% Back of Queue Distance for any lane used by vehicle movement (feet)

Site: 101 [I81 SB TERMINII - PM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Vehicle Queue (%ile)	0	302	161	302



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

DELAY (CONTROL)

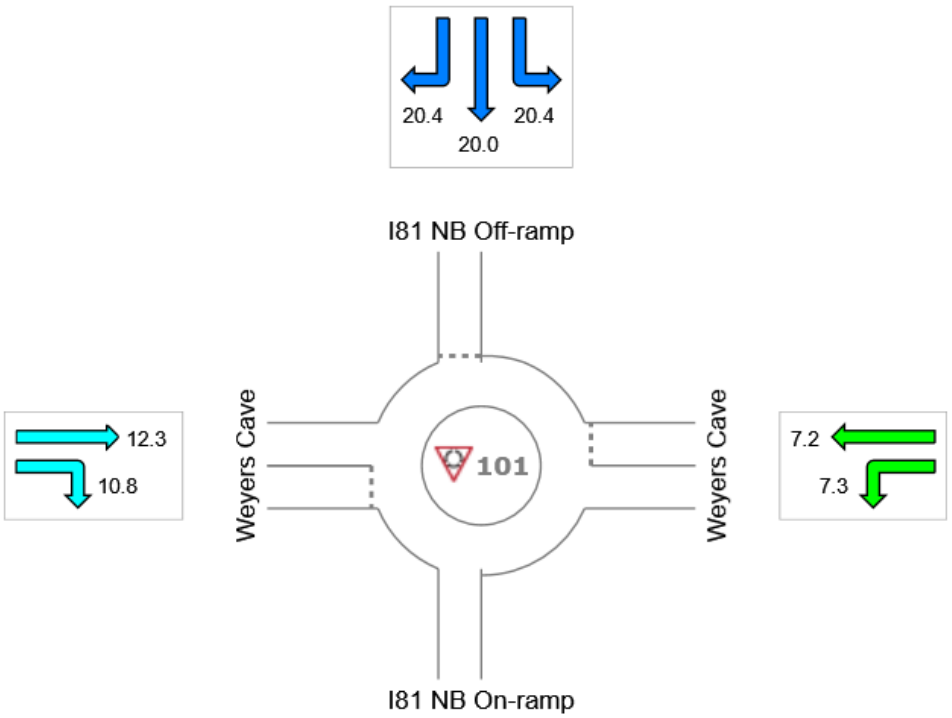
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 101 [I81 SB TERMINII - PM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches			Intersection
	East	North	West	
Delay (Control)	7.3	20.4	11.9	13.3
LOS	A	C	B	B



Colour code based on Level of Service

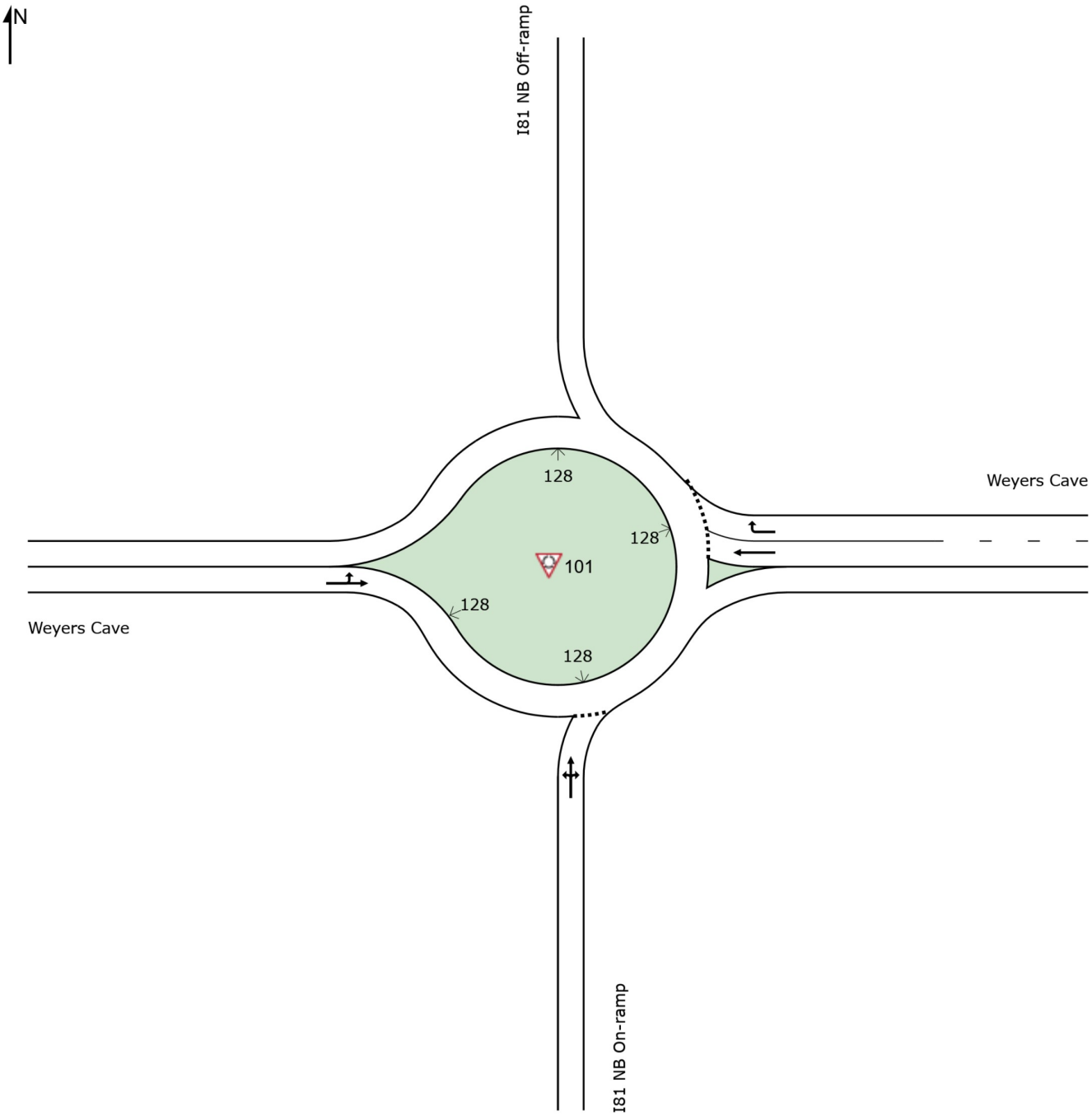
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Roundabout Level of Service Method: Same as Signalised Intersections
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

SITE LAYOUT

Site: 101 [I81 NB TERMINII - AM]

New Site
Site Category: (None)
Roundabout



MOVEMENT SUMMARY

Site: 101 [I81 NB TERMINII - AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: I81 NB On-ramp												
3	L2	197	4.0	0.565	12.5	LOS B	5.2	137.4	0.77	0.85	1.07	28.2
8	T1	1	0.0	0.565	12.3	LOS B	5.2	137.4	0.77	0.85	1.07	30.8
18	R2	267	9.0	0.565	12.8	LOS B	5.2	137.4	0.77	0.85	1.07	26.9
Approach		465	6.9	0.565	12.7	LOS B	5.2	137.4	0.77	0.85	1.07	27.5
East: Weyers Cave												
6	T1	611	7.0	0.558	10.2	LOS B	5.3	140.9	0.73	0.68	0.87	27.3
16	R2	464	5.0	0.499	10.2	LOS B	4.0	103.0	0.71	0.66	0.80	29.4
Approach		1075	6.1	0.558	10.2	LOS B	5.3	140.9	0.72	0.67	0.84	28.4
West: Weyers Cave												
5	L2	228	5.0	0.423	6.9	LOS A	0.0	0.0	0.00	0.00	0.00	36.7
2	T1	320	5.0	0.423	6.9	LOS A	0.0	0.0	0.00	0.00	0.00	34.2
Approach		548	5.0	0.423	6.9	LOS A	0.0	0.0	0.00	0.00	0.00	35.5
All Vehicles		2089	6.0	0.565	9.9	LOS A	5.3	140.9	0.54	0.53	0.67	29.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE DISTANCE (%ILE)

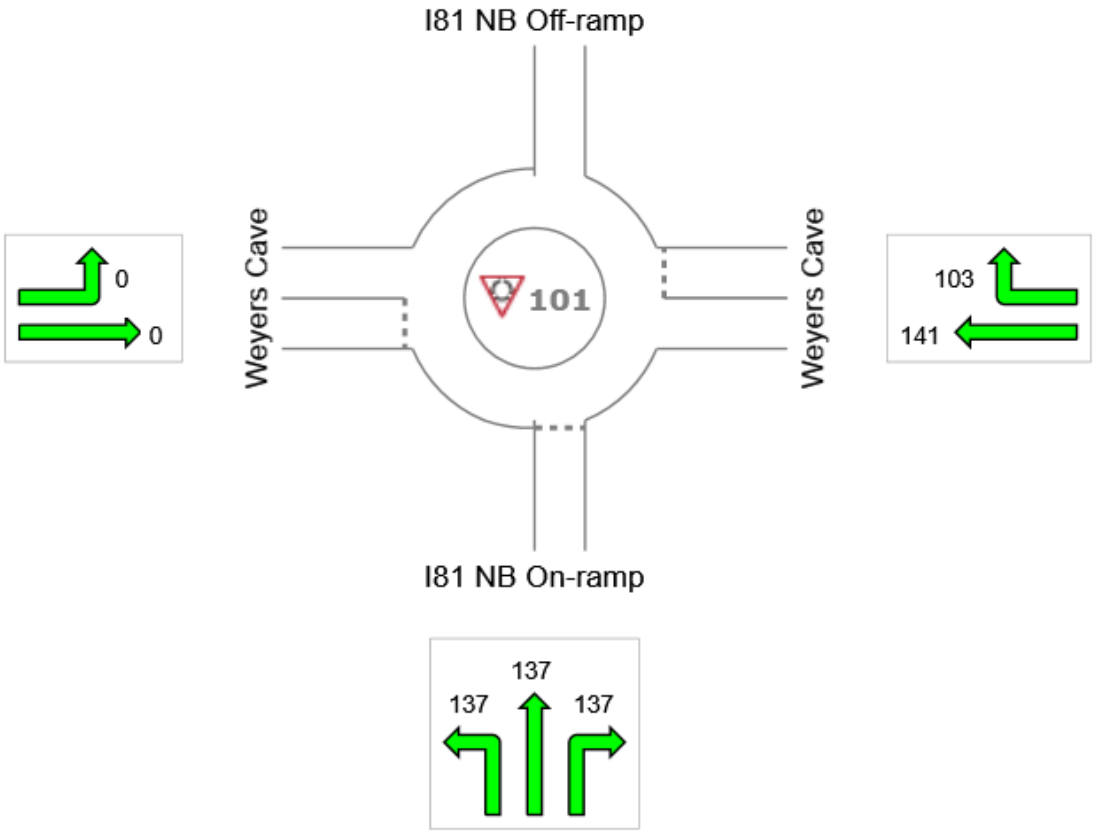
Largest 95% Back of Queue Distance for any lane used by vehicle movement (feet)

Site: 101 [I81 NB TERMINII - AM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches			Intersection
	South	East	West	
Vehicle Queue (%ile)	137	141	0	141



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

DELAY (CONTROL)

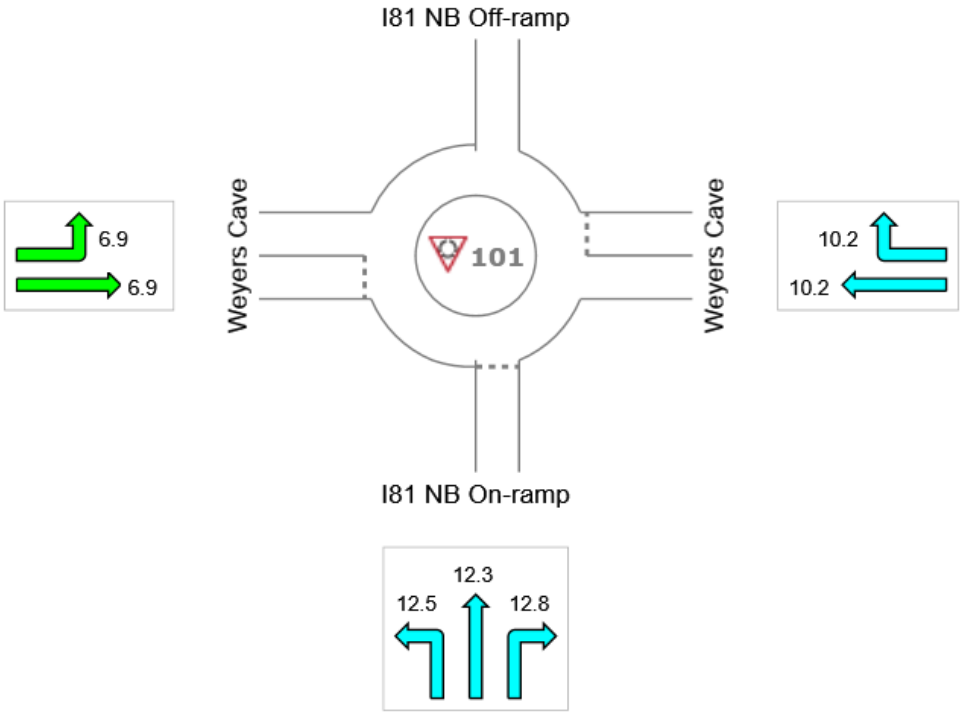
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 101 [I81 NB TERMINII - AM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches			Intersection
	South	East	West	
Delay (Control)	12.7	10.2	6.9	9.9
LOS	B	B	A	A



Colour code based on Level of Service

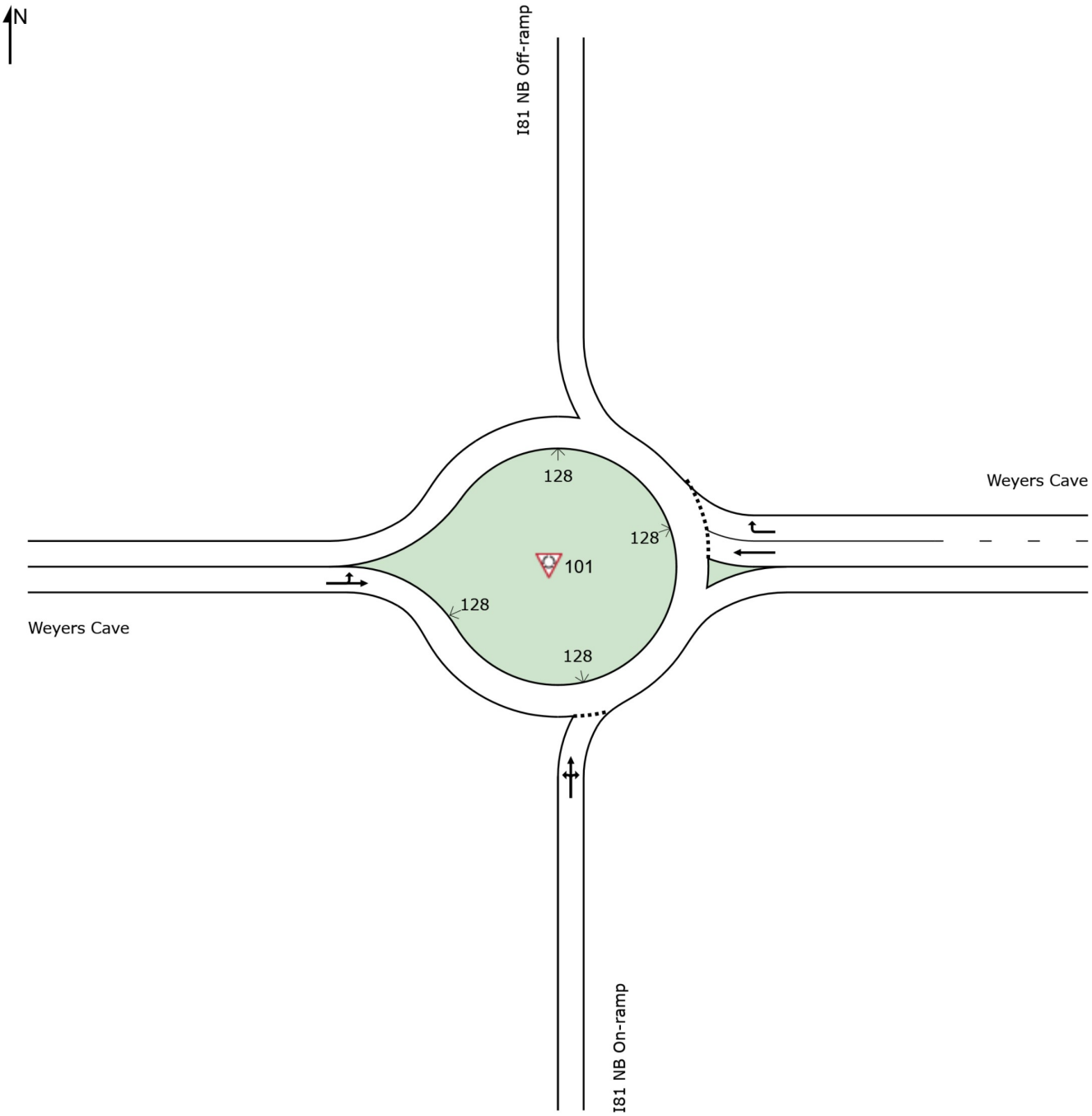
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Roundabout Level of Service Method: Same as Signalised Intersections
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

SITE LAYOUT

Site: 101 [I81 NB TERMINII - PM]

New Site
Site Category: (None)
Roundabout



MOVEMENT SUMMARY

Site: 101 [I81 NB TERMINII - PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: I81 NB On-ramp												
3	L2	123	6.0	0.637	18.6	LOS B	6.5	168.5	0.93	1.12	1.46	25.8
8	T1	1	0.0	0.637	18.1	LOS B	6.5	168.5	0.93	1.12	1.46	28.8
18	R2	274	4.0	0.637	18.5	LOS B	6.5	168.5	0.93	1.12	1.46	25.0
Approach		398	4.6	0.637	18.5	LOS B	6.5	168.5	0.93	1.12	1.46	25.3
East: Weyers Cave												
6	T1	427	7.0	0.359	6.5	LOS A	2.3	61.8	0.55	0.41	0.55	30.2
16	R2	310	4.0	0.301	6.5	LOS A	1.8	46.4	0.54	0.41	0.54	31.5
Approach		737	5.7	0.359	6.5	LOS A	2.3	61.8	0.55	0.41	0.55	30.9
West: Weyers Cave												
5	L2	197	1.0	0.705	12.5	LOS B	0.0	0.0	0.00	0.00	0.00	38.0
2	T1	717	6.0	0.705	12.7	LOS B	0.0	0.0	0.00	0.00	0.00	35.6
Approach		914	4.9	0.705	12.6	LOS B	0.0	0.0	0.00	0.00	0.00	36.3
All Vehicles		2048	5.2	0.705	11.6	LOS B	6.5	168.5	0.38	0.36	0.48	31.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

QUEUE DISTANCE (%ILE)

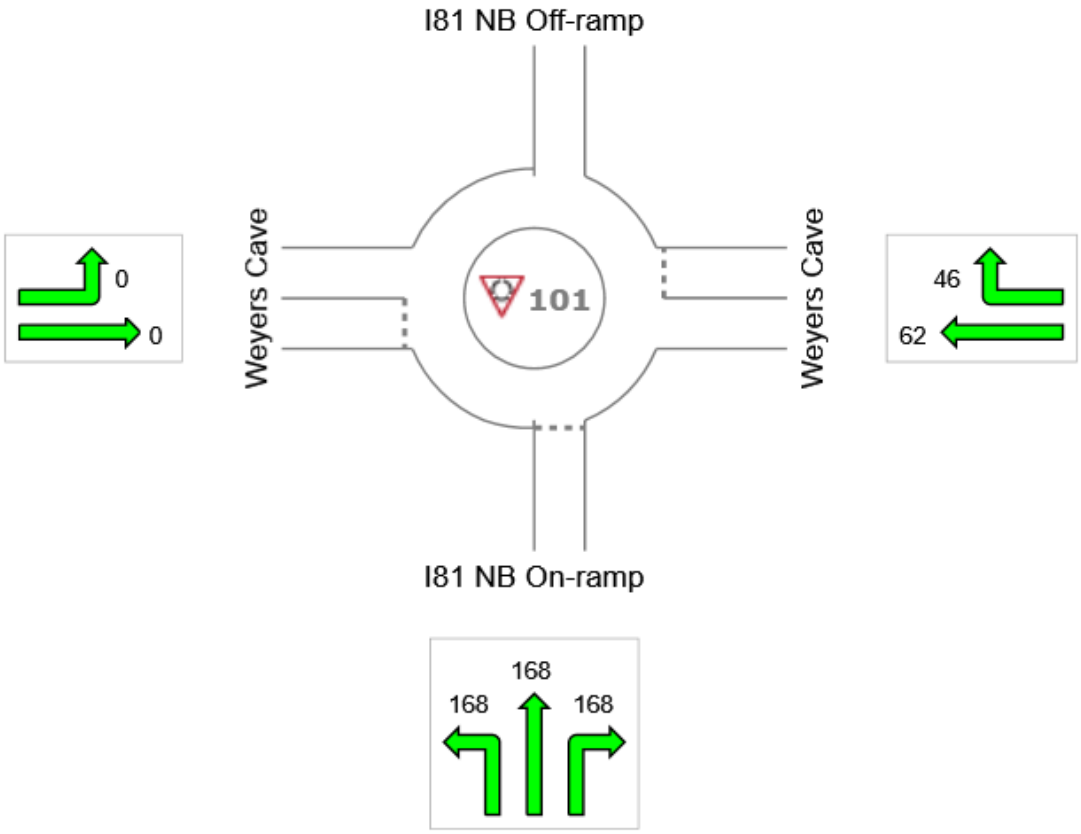
Largest 95% Back of Queue Distance for any lane used by vehicle movement (feet)

Site: 101 [I81 NB TERMINII - PM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches			Intersection
	South	East	West	
Vehicle Queue (%ile)	168	62	0	168



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

DELAY (CONTROL)

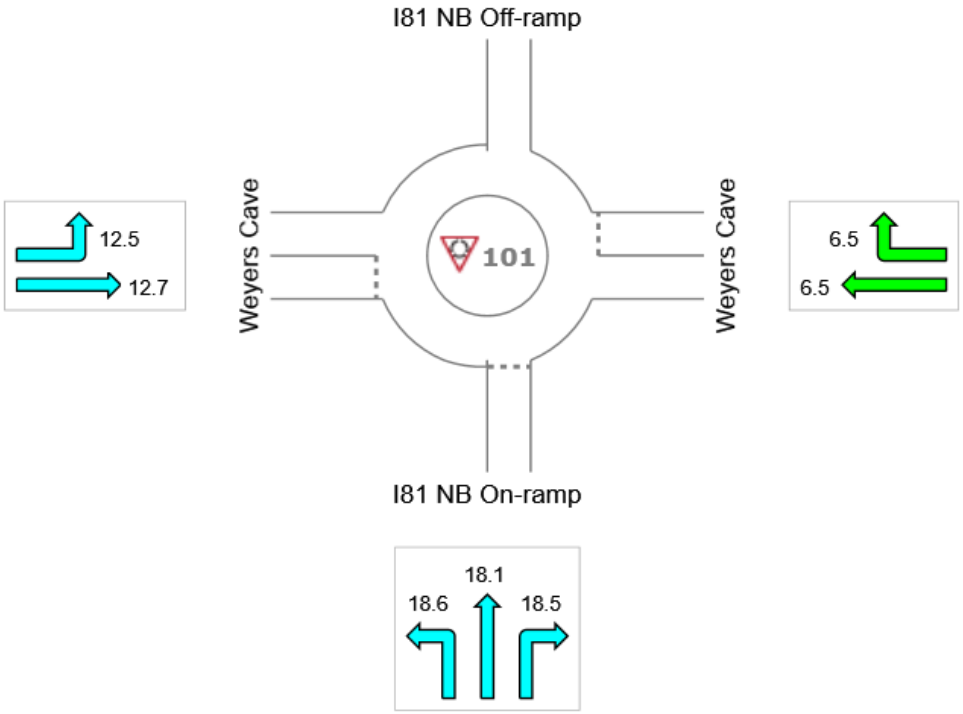
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 101 [I81 NB TERMINII - PM]

New Site
Site Category: (None)
Roundabout

All Movement Classes

	Approaches			Intersection
	South	East	West	
Delay (Control)	18.5	6.5	12.6	11.6
LOS	B	A	B	B



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Roundabout Level of Service Method: Same as Signalised Intersections
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

6. Appendix F: VJUST Results

VDOT Junction Screening Tool

Results Worksheet

VJuST
VDOT Junction Screening Tool

General Information	
Project Title:	Route 256 at Route 11 - AM Peak
EW Facility:	Route 256 (Weyers Cave Road)
NS Facility:	Route 11 (Lee Highway)
Date:	July 1, 2021

Volumes (veh/hr)	U-Turn / Left	Through	Right
Eastbound	2	11	21
Westbound	387	14	179
Northbound	6	188	163
Southbound	256	208	11

General Instructions: All intersection and interchange configurations have a default assumption of one exclusive lane per movement. No results shall be interpreted until the user has verified the lane configurations on each worksheet.

Intersection Results

Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Notes (Congestion / Pedestrian / Safety)
Conventional	-	0.57		48	Modeled after Existing Conditions.
Roundabout	-	0.57		8	Single-Lane roundabout w/ NBR Slip-Lane

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Interchange Results						
		Congestion	Pedestrian	Safety		Notes
Type	Dir	Maximum V/C	Accommodation Compared to Traditional Diamond	Weighted Total Conflict Points		

Information	
Congestion	The maximum v/c ratio represents the worst v/c of all zones that make up an intersection.
Pedestrian	Compares the potential of each design to accommodate pedestrians based on safety, wayfinding, and delay. Potential is qualitatively defined as better (+), similar (blank cell), or worse (-) than a conventional intersection or traditional diamond interchange.
Safety	Weighted Total = (2 x Crossing Conflicts) + Merging Conflicts + Diverging Conflicts

VDOT Junction Screening Tool

Results Worksheet

VJuST
VDOT Junction Screening Tool

General Information	
Project Title:	Route 256 at Route 11 - PM Peak
EW Facility:	Route 256 (Weyers Cave Road)
NS Facility:	Route 11 (Lee Highway)
Date:	July 1, 2021

Volumes (veh/hr)	U-Turn / Left	Through	Right
Eastbound	5	9	10
Westbound	189	10	254
Northbound	10	194	327
Southbound	317	295	6

General Instructions: All intersection and interchange configurations have a default assumption of one exclusive lane per movement. No results shall be interpreted until the user has verified the lane configurations on each worksheet.

Intersection Results

Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Notes (Congestion / Pedestrian / Safety)
Conventional	-	0.61		48	Modeled after Existing Conditions.
Roundabout	-	0.56		8	Single-Lane roundabout w/ NBR Slip-Lane

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Interchange Results						
		Congestion	Pedestrian	Safety		Notes
Type	Dir	Maximum V/C	Accommodation Compared to Traditional Diamond	Weighted Total Conflict Points		

Information	
Congestion	The maximum v/c ratio represents the worst v/c of all zones that make up an intersection.
Pedestrian	Compares the potential of each design to accommodate pedestrians based on safety, wayfinding, and delay. Potential is qualitatively defined as better (+), similar (blank cell), or worse (-) than a conventional intersection or traditional diamond interchange.
Safety	Weighted Total = (2 x Crossing Conflicts) + Merging Conflicts + Diverging Conflicts

VDOT Junction Screening Tool

Results Worksheet

VJuST
VDOT Junction Screening Tool

General Information	
Project Title:	Route 256 at I-81 (Exit 235) - AM Peak
EW Facility:	Route 256 (Weyers Cave Road)
NS Facility:	I-81 (Exit 235)
Date:	July 2, 2021

Volumes (veh/hr)	U-Turn / Left	Through	Right
Eastbound	203	97	135
Westbound	364	180	413
Northbound	175	0	238
Southbound	188	0	225

General Instructions: All intersection and interchange configurations have a default assumption of one exclusive lane per movement. No results shall be interpreted until the user has verified the lane configurations on each worksheet.

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Interchange Results

Type	Dir	Maximum V/C (Congestion)	Accommodation Compared to Traditional Diamond (Pedestrian)	Weighted Total Conflict Points (Safety)	Notes
Traditional Diamond	-	0.69		28	Turn lanes for all applicable movements.
Diverging Diamond	-	0.55	-	20	Turn lanes for all applicable movements.
Double Roundabout	-	0.69	+	16	gle-lane roundabout; NB Ramp features WBR Slip-L
Single Point	-	0.51	-	32	Turn lanes for all applicable movements.

Information

Congestion	The maximum v/c ratio represents the worst v/c of all zones that make up an intersection.
Pedestrian	Compares the potential of each design to accommodate pedestrians based on safety, wayfinding, and delay. Potential is qualitatively defined as better (+), similar (blank cell), or worse (-) than a conventional intersection or traditional diamond interchange.
Safety	Weighted Total = (2 x Crossing Conflicts) + Merging Conflicts + Diverging Conflicts

VDOT Junction Screening Tool

Results Worksheet

VJuST
VDOT Junction Screening Tool

General Information	
Project Title:	Route 256 at I-81 (Exit 235) - PM Peak
EW Facility:	Route 256 (Weyers Cave Road)
NS Facility:	I-81 (Exit 235)
Date:	July 2, 2021

Volumes (veh/hr)	U-Turn / Left	Through	Right
Eastbound	183	289	182
Westbound	241	156	288
Northbound	114	0	255
Southbound	378	0	189

General Instructions: All intersection and interchange configurations have a default assumption of one exclusive lane per movement. No results shall be interpreted until the user has verified the lane configurations on each worksheet.

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Interchange Results

Type	Dir	Maximum V/C (Congestion)	Accommodation Compared to Traditional Diamond (Pedestrian)	Weighted Total Conflict Points (Safety)	Notes
Traditional Diamond	-	0.75		28	Turn lanes for all applicable movements.
Diverging Diamond	-	0.71	-	20	Turn lanes for all applicable movements.
Double Roundabout	-	0.65	+	16	gle-lane roundabout; NB Ramp features WBR Slip-L
Single Point	-	0.64	-	32	Turn lanes for all applicable movements.

Information

Congestion	The maximum v/c ratio represents the worst v/c of all zones that make up an intersection.
Pedestrian	Compares the potential of each design to accommodate pedestrians based on safety, wayfinding, and delay. Potential is qualitatively defined as better (+), similar (blank cell), or worse (-) than a conventional intersection or traditional diamond interchange.
Safety	Weighted Total = (2 x Crossing Conflicts) + Merging Conflicts + Diverging Conflicts

VDOT Junction Screening Tool

Results Worksheet

VJuST
VDOT Junction Screening Tool

General Information	
Project Title:	Route 256 at Triangle Drive - AM Peak
EW Facility:	Route 256 (Weyers Cave Road)
NS Facility:	Triangle Drive
Date:	July 1, 2021

Volumes (veh/hr)	U-Turn / Left	Through	Right
Eastbound	7	456	60
Westbound	28	905	10
Northbound	50	0	10
Southbound	2	0	2

General Instructions: All intersection and interchange configurations have a default assumption of one exclusive lane per movement. No results shall be interpreted until the user has verified the lane configurations on each worksheet.

Intersection Results

Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Notes (Congestion / Pedestrian / Safety)
Conventional	-	0.67		48	Modeled after SmartScale application sketch.
Restricted Crossing U-Turn	-	0.68		20	
Roundabout	-	0.79		8	Single-Lane roundabout
Two-Way Stop Control	-	0.54		48	Modeled after SmartScale application sketch.

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Interchange Results						
		Congestion	Pedestrian	Safety		Notes
Type	Dir	Maximum V/C	Accommodation Compared to Traditional Diamond	Weighted Total Conflict Points		

Information	
Congestion	The maximum v/c ratio represents the worst v/c of all zones that make up an intersection.
Pedestrian	Compares the potential of each design to accommodate pedestrians based on safety, wayfinding, and delay. Potential is qualitatively defined as better (+), similar (blank cell), or worse (-) than a conventional intersection or traditional diamond interchange.
Safety	Weighted Total = (2 x Crossing Conflicts) + Merging Conflicts + Diverging Conflicts

VDOT Junction Screening Tool

Results Worksheet

VJuST
VDOT Junction Screening Tool

General Information	
Project Title:	Route 256 at Triangle Drive - PM Peak
EW Facility:	Route 256 (Weyers Cave Road)
NS Facility:	Triangle Drive
Date:	July 1, 2021

Volumes (veh/hr)	U-Turn / Left	Through	Right
Eastbound	2	865	55
Westbound	21	588	3
Northbound	90	0	28
Southbound	10	0	7

General Instructions: All intersection and interchange configurations have a default assumption of one exclusive lane per movement. No results shall be interpreted until the user has verified the lane configurations on each worksheet.

Intersection Results

Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Notes (Congestion / Pedestrian / Safety)
Conventional	-	0.66		48	Modeled after SmartScale application sketch.
Restricted Crossing U-Turn	-	0.60		20	
Roundabout	-	0.71		8	Single-Lane roundabout
Two-Way Stop Control	-	1.06		48	Modeled after SmartScale application sketch.

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Interchange Results						
		Congestion	Pedestrian	Safety		Notes
Type	Dir	Maximum V/C	Accommodation Compared to Traditional Diamond	Weighted Total Conflict Points		

Information	
Congestion	The maximum v/c ratio represents the worst v/c of all zones that make up an intersection.
Pedestrian	Compares the potential of each design to accommodate pedestrians based on safety, wayfinding, and delay. Potential is qualitatively defined as better (+), similar (blank cell), or worse (-) than a conventional intersection or traditional diamond interchange.
Safety	Weighted Total = (2 x Crossing Conflicts) + Merging Conflicts + Diverging Conflicts