

**Appendix I**  
**Cascade Road Conceptual Design Report**

# **Cascade Road Conceptual Design Report**

## **Utoy Springs Road to Shanter Trail**

**Prepared for:**

**Fulton County Department of Public Works  
October 30, 2015**

# **Cascade Road Conceptual Design Report**

## **Utoy Springs Road to Shanter Trail**



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## Background

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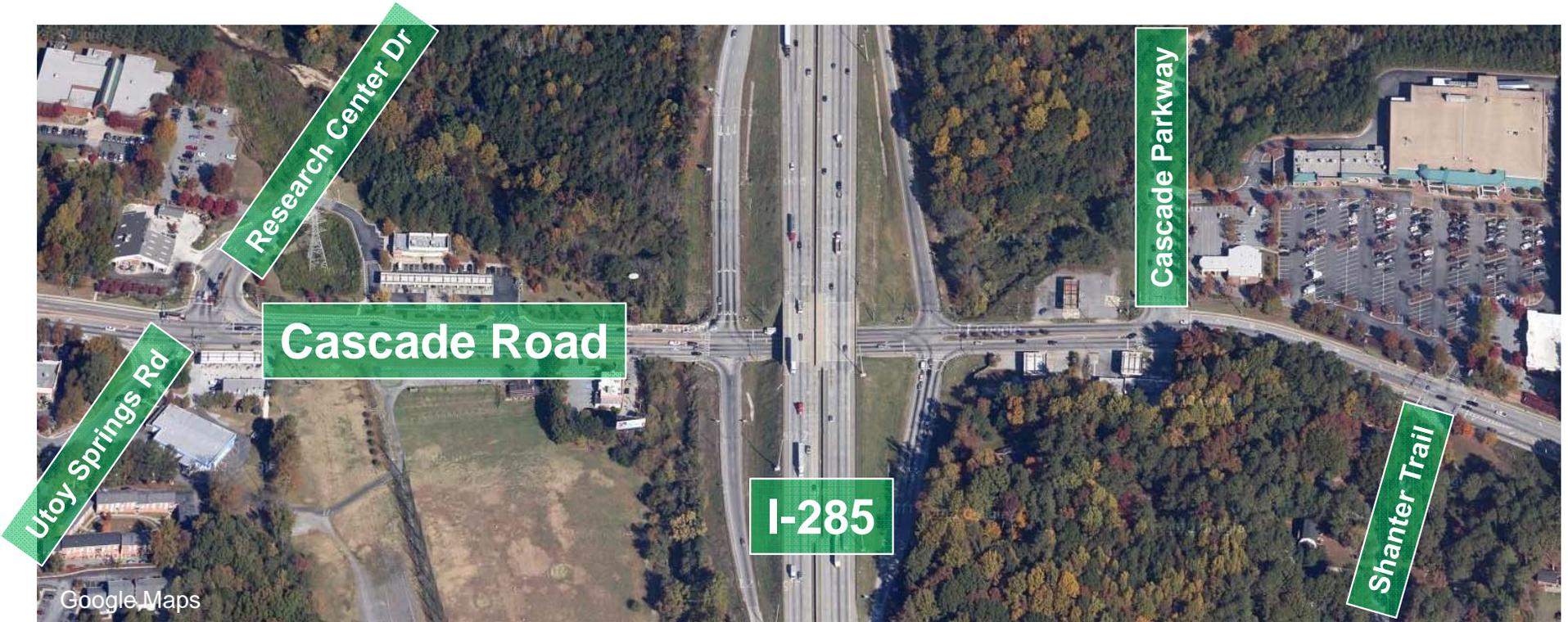
Ayres Associates was retained by Fulton County to complete a conceptual design report for the I-285 interchange with Cascade Road to identify alternatives to alleviate the high degree of vehicular congestion at the ramp terminals and adjacent intersections. This report examines the existing traffic conditions and those anticipated in the design year 2030 at the following five existing traffic signal controlled intersections along Cascade Road:

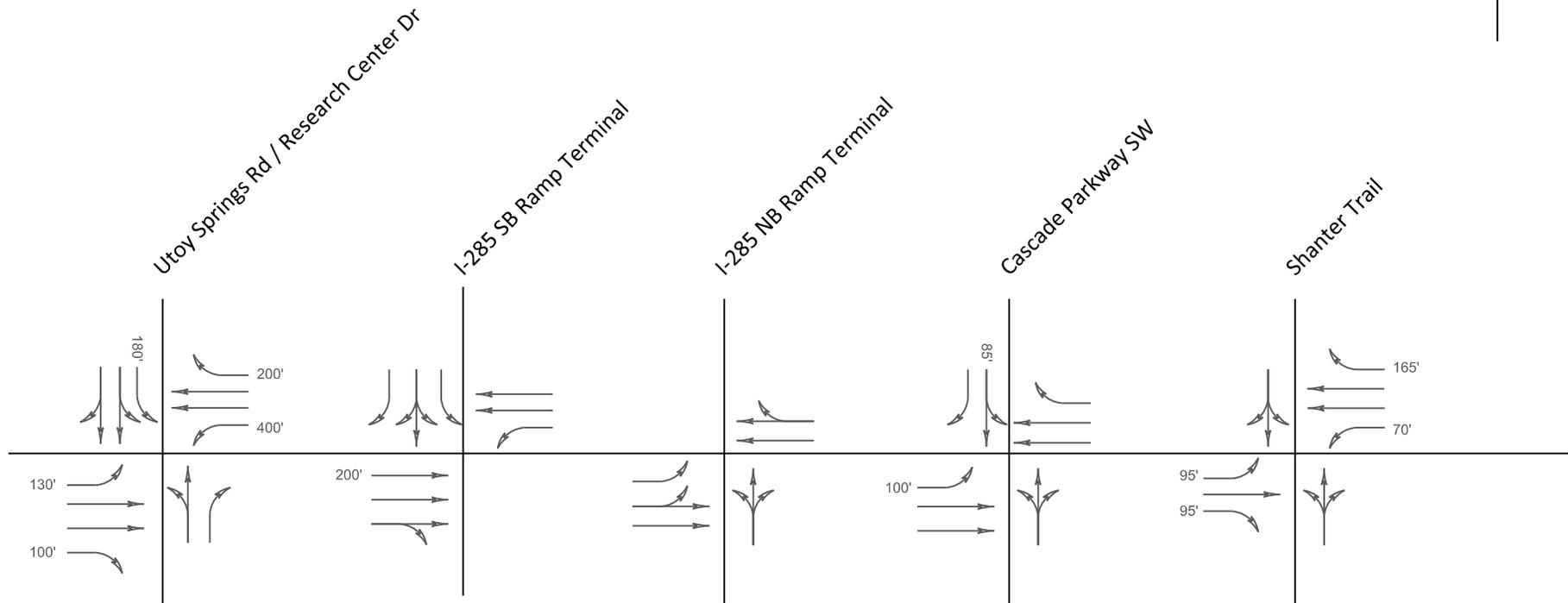
- Southbound I-285 ramp terminal
- Northbound I-285 ramp terminal
- Cascade Parkway
- Shanter Trail

The project corridor is shown in **Figure 1**. The lane designations for each intersection under the existing roadway is shown in **Figure 2**.

As a part of the recommendation process, the following alternatives will be evaluated for the I-285 at Cascade Road Interchange:

- Conventional tight diamond interchange with traffic signal control
- Conventional diamond interchange with roundabout control
- Diverging diamond interchange (DDI) with traffic signal control





**LEGEND**

- LANE DESIGNATION
- ###' TURN BAY LENGTHS

## Executive Summary

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Based on the results of the traffic analysis, costs associated with the reconstruction of the interchange, real estate impacts, and public acceptance, it is recommended that the diverging diamond interchange and its associated intersection improvements stand as the chosen alternative.

The following improvements are recommended for the design of each of the intersections to attain a Level-of-Service "D" or above for the 2030 design year:

### Utoy Springs Road/Research Center Drive Improvements

- Extend the westbound left-turn lane, make the existing right-turn lane a through lane, and construct a new right-turn lane
  - Three westbound through lanes will be carried to Fairburn Road
- Realign the southbound approach, extend the dual southbound left-turn lanes, and construct a separated southbound right-turn lane
- Adjust the northbound right-turn movement to operate as protected/overlap under the traffic signal
- Extend the right turn lane and left turn lane on the eastbound approach
- Construct sidewalk in all quadrants of the intersection. It should be noted that sidewalk will not extend on the north side of the road to I-285 in the eastbound direction.
- Provide crosswalks on all approaches of the intersection
- Provide bicycle lanes on the westbound and eastbound approaches of the intersection

### I-285 Southbound Ramp Diverging Diamond Traffic Signal Improvements

- Construct dual right-turn lanes and one left-turn lane on the southbound approach
- Construct two eastbound through lanes and a free flow-right-turn lane
- Construct two westbound through lanes; the left lane will provide entrance to southbound I-285
- Construct sidewalk on the south side of the intersection
- Provide crosswalks on the south leg of the intersection to accommodate the proposed sidewalk
- No bicycle lanes are provided in the intersection. It is anticipated that bicyclists will share the through lanes with westbound and eastbound traffic or utilize the sidewalk to safely cross their bicycles.

### I-285 Northbound Ramp Diverging Diamond Traffic Signal Improvements

- Construct one right-turn lane and dual left-turn lanes on the northbound approach
- Construct two westbound through lanes and a right-turn lane
- Construct two eastbound through lanes; the left lane will provide entrance to northbound I-285
- Construct sidewalk on the south side of the intersection
- Provide crosswalks on the south leg of the intersection to accommodate the proposed sidewalk
- No bicycle lanes are provided in the intersection. It is anticipated that bicyclists will share the through lanes with westbound and eastbound traffic or utilize the sidewalk to safely cross their bicycles.

### Cascade Parkway SW Traffic Signal Improvements

- Minor intersection realignment/safety adjustments (crosswalks, median).
- Construct sidewalk on all approaches of the intersection
- Provide crosswalks on the all approaches of the intersection to accommodate the proposed sidewalk
- Provide a bicycle lane on the westbound approach of the intersection and the eastbound exit to the intersection
  - Bicyclists must either travel with traffic in the through lanes west of the intersection or reenter the roadway from the sidewalk

### Shanter Trail Traffic Signal Improvements

- Construct an additional shared through/right-turn lane on the eastbound approach
  - Right lane becomes a right turn only lane at Melbenan Drive SW
- Construct sidewalk in all quadrants of the intersection
- Provide crosswalks on all approaches of the intersection
- Provide bicycle lanes on the westbound and eastbound approaches of the intersection

## Analysis Methodology

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The study area intersections were analyzed for the peak hour weekday morning and evening traffic volumes for the 2015 existing year and the 2030 design year using the procedures published in the 2010 Highway Capacity Manual (HCM). Each intersection was analyzed to determine its Level-of-Service (LOS), queuing and delay under the existing roadway geometrics.

### LOS and Delay Criteria

Fulton County and the Georgia Department of Transportation (GDOT) recognize LOS 'D' or better as acceptable LOS for the proposed traffic operations on Cascade Road. The analysis results were used to identify locations where traffic operations fell below LOS 'D' for the design year 2030 and to determine recommended roadway improvements.

The HCM LOS and definitions are included in **Table 1**.

**Table 1: HCM LOS and Delay Criteria**

Alpha LOS	Signalized Delay (sec/veh)	Unsignalized Delay (sec/veh)	Description
A	< 10	< 10	No Congestion
B	> 10 - 20	> 10 - 15	No Congestion
C	> 20 - 35	> 15 - 25	Minimal Congestion
D	> 35 - 55	> 25 - 35	Moderate Congestion
E	> 55 - 80	> 35 - 50	Severe Congestion
F	> 80	> 50	Extreme Congestion

LOS 'A' requires minimal driver interaction. This allows speed and vehicle path decisions to be unaffected by other roadway users resulting in no congestion and minimal delay. In comparison, LOS 'F' requires constant driver interaction. Speed and vehicle paths are totally dictated by interaction with other users resulting in high congestion levels and delay.

### Traffic Volumes and Forecasts

Weekday turning movement traffic counts were collected by A&R Engineering in May 2015 at the study area intersections. Traffic forecasts for a design year of 2035 were developed based on historical background trends of traffic volumes along the Cascade Road corridor and discussions with Fulton County. The initial traffic forecast was based on the following annual growth rates:

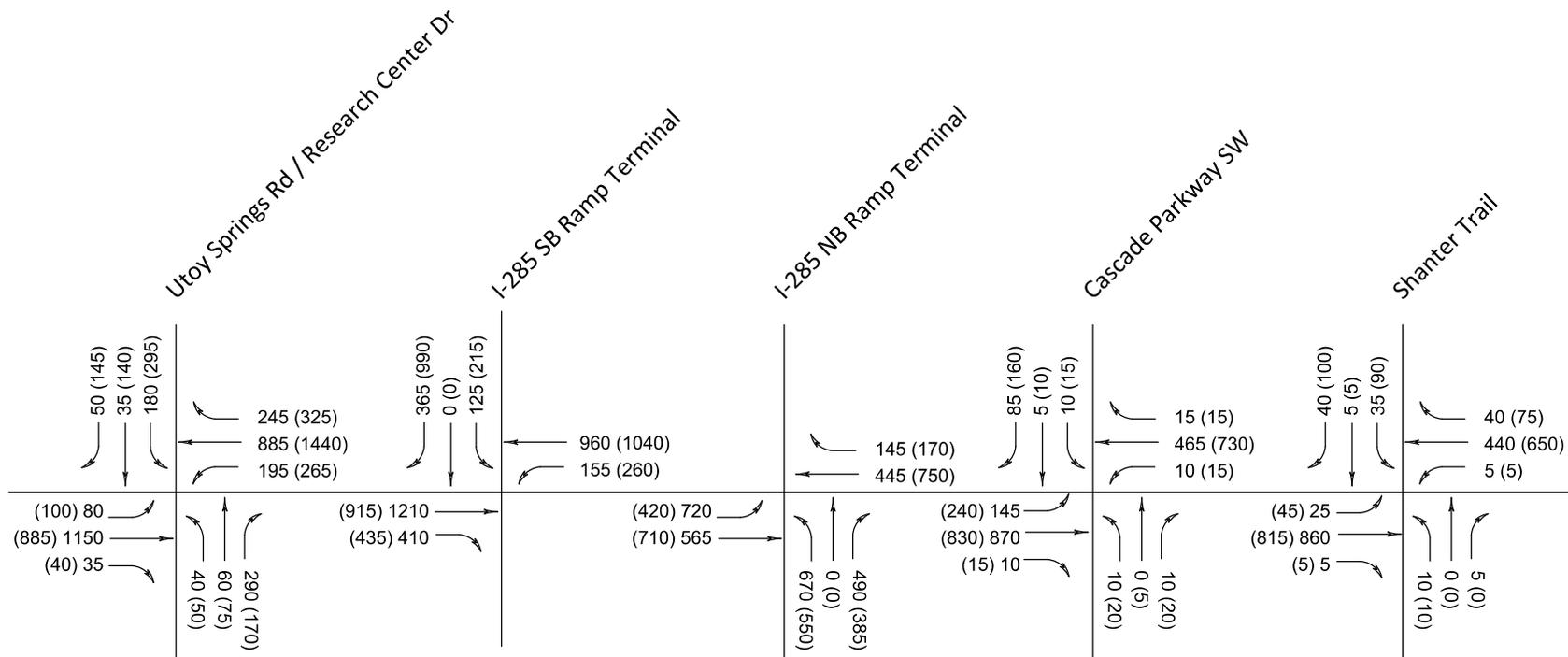
- 2% growth (0 – 5 years)
- 0.5% growth (5 – 20 years)

Following subsequent meetings with Fulton County and GDOT staff, it was determined that the existing I-285 bridge structure over Cascade Road should remain. Based on the original traffic growth

percentages discussed above, any improvements to the Cascade Road corridor that maintained the existing bridge structure would only operate at a LOS 'D' or better through 2020.

As such, it became appropriate to revisit the annual growth rate and design year. Based on an analysis of the operationally controlling intersection of Utoy Springs Road/Research Center Drive, it was determined that an annual growth rate of 0.5% would provide acceptable operations of LOS 'D' or better through 2030 while still maintaining the existing bridge structure.

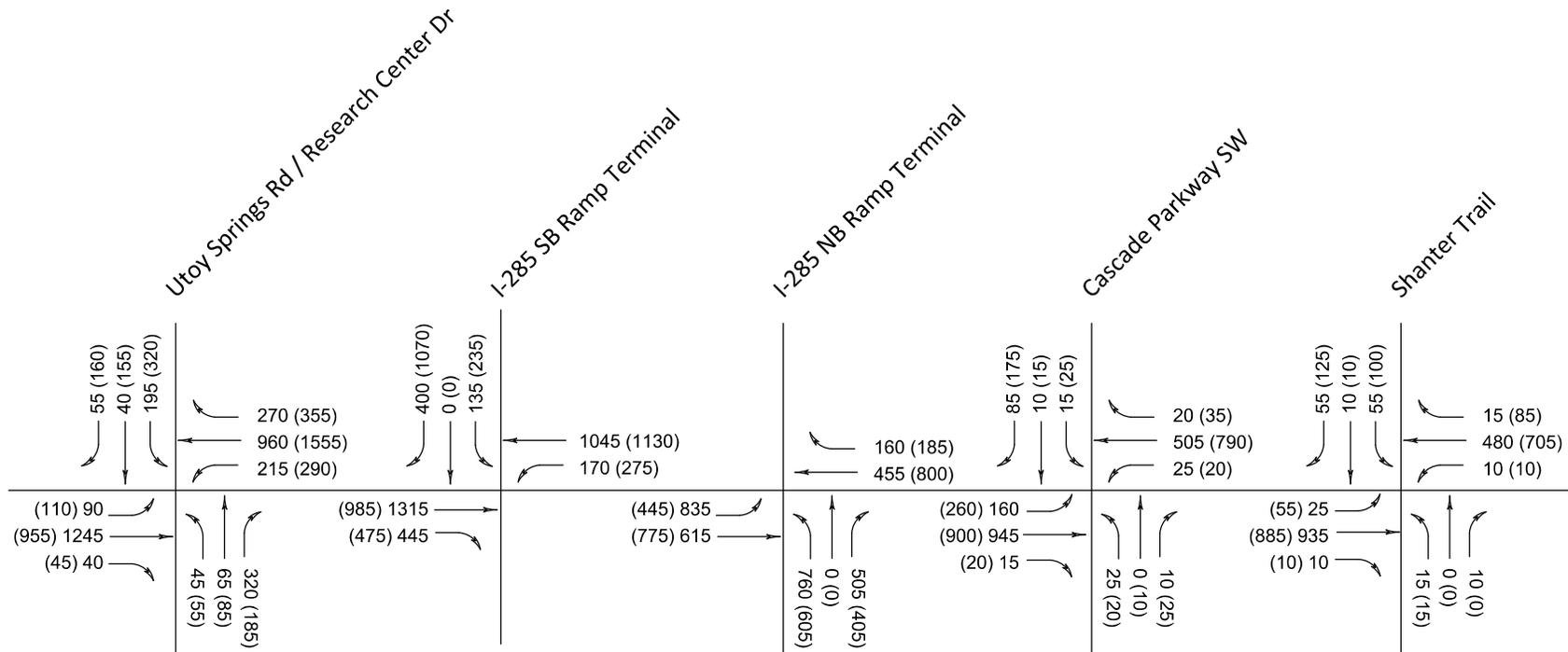
The 2015 existing traffic count data for the intersections on the Cascade Road corridor is included in **Figure 3** for the existing year. The 2030 design year traffic count data for the intersections on the Cascade Road corridor is included in **Figure 4**.



**LEGEND**

→ LANE DESIGNATION

### AM (PM) PEAK HOUR TRAFFIC DATA



**LEGEND**

- LANE DESIGNATION
- ### AM (PM) PEAK HOUR TRAFFIC DATA



# 2015 Existing Year Traffic Analysis Results

## Year 2015 Existing Traffic Analysis Results

The 2015 existing traffic analysis is based on the 2015 traffic count volumes with the existing intersection geometrics and traffic control at each of the study area intersections. The 2015 existing traffic operational analyses of the study intersections are summarized in Tables 2 through 6.

The 2015 existing traffic operation results at the intersection of Cascade Road and Utoy Springs Road/Research Center Drive is summarized in **Table 2**.

**Table 2: 2015 Existing Traffic Operation at Utoy Springs Road/Research Center Drive**

<i>2015 Traffic Operation Analysis (Existing Roadway)</i>														
			Eastbound			Westbound			Northbound			Southbound		
			L	T	R	L	T	R	L	T	R	L	T	R
<b>Cascade Rd &amp; Utoy Springs Rd / Research Center Dr</b>														
Traffic Signal	AM	LOS	B	C	A	C	C	A	D	E	E	C		
		Queue (ft)	75'	500'	0'	275'	350'	50'	150'	300'	125'	100'		
		Delay (s)	14.6	25.2	0.0	25.7	20.4	0.0	46.2	65.8	58.1	30.9		
		Approach LOS	C			C			E			D		
		Approach Delay (s)	24.5			21.4			57.8			49.4		
		Intersection Delay (s)	30.0											
	PM	LOS	C	C	A	B	C	A	D	D	D	D		
		Queue (ft)	150'	450'	0'	225'	725'	175'	200'	75'	200'	275'		
		Delay (s)	24.6	24.1	0.0	19.2	27.9	0.0	50.4	48.0	52.4	35.6		
		Approach LOS	C			C			D			D		
		Approach Delay (s)	24.2			26.5			49.4			44.1		
		Intersection Delay (s)	30.5											

As shown in **Table 2**, all movements at the intersection of Cascade Road and Utoy Springs Road/Research Center Drive will operate at LOS 'D' or better with the exception of the following:

- Southbound dual left-turn lanes
- Northbound right-turn lane

The 2015 existing traffic operation results at the intersection of Cascade Road and the I-285 Southbound Ramp Terminal is summarized in **Table 3**.

**Table 3: 2015 Existing Traffic Operation at I-285 Southbound Ramp Terminal**

<b>2015 Traffic Operation Analysis (Existing Roadway)</b>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	TH/RT	L	T	R	L	T	R	L	LTR	R	
<b>Cascade Rd &amp; I-285 SB Ramps</b>														
Traffic Signal	AM	LOS	--	B	B	B	A	--	--	--	--	D	--	D
		Queue (ft)	--	325'	175'	175'	175'	--	--	--	--	175'	--	75'
		Delay (s)	--	11.7	12.1	15.9	4.2	--	--	--	--	44.7	--	51.9
		Approach LOS	B			A			--			D		
		Approach Delay (s)	11.8			5.9			--			50.3		
		Intersection Delay (s)	14.4											
	PM	LOS	--	D	D	E	C	--	--	--	--	C	--	D
		Queue (ft)	--	500'	375'	375'	450'	--	--	--	--	225'	--	750'
		Delay (s)	--	41.5	46.1	55.1	23.3	--	--	--	--	25.4	--	45.9
		Approach LOS	D			C			--			D		
		Approach Delay (s)	43.0			29.6			--			43.5		
		Intersection Delay (s)	38.7											

As shown in **Table 3**, all movements at the intersection of Cascade Road and the I-285 Southbound Ramp Terminal will operate at LOS 'D' or better with the exception of the following:

- Westbound left-turn lane

The 2015 existing traffic operation results at the intersection of Cascade Road and the I-285 Northbound Ramp Terminal is summarized in **Table 4**.

**Table 4: 2015 Existing Traffic Operation at I-285 Northbound Ramp Terminal**

<b>2015 Traffic Operation Analysis (Existing Roadway)</b>													
		Eastbound			Westbound			Northbound		Southbound			
		L	T	R	L	T	R	LT/TH	R	L	T	R	
<b>Cascade Rd &amp; I-285 NB Ramps</b>													
Traffic Signal	AM	LOS	B	B	--	--	C	C	F	--	--	--	
		Queue (ft)	225'	175'	--	--	250'	575'	325'	--	--	--	
		Delay (s)	13.8	10.1	--	--	24.1	30.2	168.9	--	--	--	
		Approach LOS	B			C			F		--		
		Approach Delay (s)	12.2			24.1			88.5		--		
		Intersection Delay (s)	43.1										
	PM	LOS	C	B	--	--	C	C	D	--	--	--	
		Queue (ft)	300'	275'	--	--	525'	375'	575'	--	--	--	
		Delay (s)	28.7	11.5	--	--	33.8	30.5	43.6	--	--	--	
		Approach LOS	17.1			33.9			35.9		--		
		Approach Delay (s)	B			C			D		--		
		Intersection Delay (s)	28.2										

As shown in **Table 4**, all movements at the intersection of Cascade Road and the I-285 Northbound Ramp Terminal will operate at LOS 'D' or better with the exception of the following:

- Northbound right-turn lane

**NOTE:** It should be noted that the northbound right-turn was analyzed in the Synchro software as a stop only movement without the allowance of right turn on red operation to calibrate with field conditions.

The 2015 existing conditions traffic operation results at the intersection of Cascade Road and Cascade Parkway SW is summarized in **Table 5**.

**Table 5: 2015 Existing Traffic Operation at Cascade Parkway SW**

<b>2015 Traffic Operation Analysis (Existing Roadway)</b>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; Cascade Pkwy SW</b>														
Traffic Signal	AM	LOS	A	A	A	A		B			B	C		
		Queue (ft)	50'	75'		100'	0'		25'			25'	25'	
		Delay (s)	5.2	3.6		9.3	7.8		19.6			19.2	23.6	
		Approach LOS	A			A			B			C		
		Approach Delay (s)	3.8			9.2			19.6			22.5		
		Intersection Delay (s)	6.4											
	PM	LOS	A	A		B	A		C			C	C	
		Queue (ft)	50'	75'		150'	0'		50'			50'	75'	
		Delay (s)	6.8	3.6		10.1	7.7		21.5			20.9	31.2	
		Approach LOS	A			B			C			C		
		Approach Delay (s)	4.3			10.2			21.5			28.7		
		Intersection Delay (s)	8.3											

As shown in **Table 5**, all movements at the intersection of Cascade Road and Cascade Parkway SW will operate at LOS 'C' or better in 2015.

The 2015 existing traffic operation results at the intersection of Cascade Road and Shanter Trail is summarized in **Table 6**.

**Table 6: 2015 Existing Traffic Operation at Shanter Trail**

<b>2015 Traffic Operation Analysis (Existing Roadway)</b>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; Shanter Trail</b>														
Traffic Signal	AM	LOS	A	A	A	B	A	A	B			C		
		Queue (ft)	25'	250'	0'	25'	50'	25'	25'			75'		
		Delay (s)	4.5	7.4	3.3	12.3	3.8	3.4	19.3			32.8		
		Approach LOS	A			A			B			C		
		Approach Delay (s)	7.3			3.9			19.3			32.8		
		Intersection Delay (s)	9.8											
	PM	LOS	A	A	A	B	A	A	B			C		
		Queue (ft)	25'	275'	25'	25'	75'	25'	25'			225'		
		Delay (s)	6.8	8.7	4.2	13.6	5.2	4.4	18.4			25.3		
		Approach LOS	A			A			B			C		
		Approach Delay (s)	8.5			5.2			18.4			25.3		
		Intersection Delay (s)	9.5											

As shown in **Table 6**, all movements at the intersection of Cascade Road and Shanter Trail will operate at LOS 'C' or better in 2015.

**Year 2030 Existing Traffic Analysis Results**

The 2030 existing traffic analysis is based on the 2030 forecasted traffic volumes with the existing intersection geometrics and traffic control at each of the study area intersections. The 2030 existing conditions traffic operational analysis results of the study intersections are summarized in **Tables 7** through **11**.

The 2030 existing traffic operation results at the intersection of Cascade Road and Utoy Springs Road/Research Center Drive are summarized in **Table 7**.

**Table 7: 2030 Existing Traffic Operation at Utoy Springs Road/Research Center Drive**

<i>2030 Traffic Operation Analysis (Existing Roadway)</i>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; Utoy Springs Rd / Research Center Dr</b>														
Traffic Signal	AM	LOS	B	C	A	D	C	A	D	F	E	C		
		Queue (ft)	75'	550'	0'	325'	375'	75'	175'	400'	150'	125'		
		Delay (s)	16.6	28.8	0.0	46.0	22.8	0.0	48.9	89.2	66.7	32.4		
		Approach LOS	C			C			E			E		
		Approach Delay (s)	28.0			27.0			73.6			55.5		
		Intersection Delay (s)	36.1											
	PM	LOS	D	C	A	C	D	A	D	D	D	D		
		Queue (ft)	175'	500'	0'	325'	900'	200'	250'	75'	225'	325'		
		Delay (s)	35.2	28.0	0.0	26.8	35.5	0.0	54.6	50.1	54.9	37.0		
		Approach LOS	C			C			D			D		
		Approach Delay (s)	28.7			34.1			52.7			46.0		
		Intersection Delay (s)	36.1											

As shown in **Table 7**, all movements at the intersection of Cascade Road and Utoy Springs Road/Research Center Drive will operate at LOS 'D' or better with the exception of the following:

- Southbound dual left-turn lanes
- Northbound right turn lane

The 2030 existing traffic operation results at the intersection of Cascade Road and the I-285 Southbound Ramp Terminal are summarized in **Table 8**.

**Table 8: 2030 Existing Traffic Operation at I-285 Southbound Ramp Terminal**

<b>2030 Traffic Operation Analysis (Existing Roadway)</b>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	TH/RT	L	T	R	L	T	R	L	LTR	R	
<b>Cascade Rd &amp; I-285 SB Ramps</b>														
Traffic Signal	AM	LOS	--	B	B	C	A	--	--	--	--	D	--	E
		Queue (ft)	--	375'	250'	250'	175'	--	--	--	--	200'	--	150'
		Delay (s)	--	12.9	13.7	26.4	4.8	--	--	--	--	47.1	--	59.6
		Approach LOS	B			A			--			E		
		Approach Delay (s)	13.2			7.8			--			57.0		
		Intersection Delay (s)	16.7											
	PM	LOS	--	D	E	F	C	--	--	--	--	C	--	E
		Queue (ft)	--	550'	425'	425'	500'	--	--	--	--	225'	--	850'
		Delay (s)	--	52.8	65.3	82.9	26.8	--	--	--	--	26.7	--	57.9
		Approach LOS	E			D			--			D		
		Approach Delay (s)	56.9			37.8			--			54.2		
		Intersection Delay (s)	49.6											

As shown in **Table 8**, all movements at the intersection of Cascade Road and the I-285 Southbound Ramp Terminal will operate at LOS 'D' or better with the exception of the following:

- Eastbound through/right-turn lane
- Southbound dual right-turn lanes
- Westbound left-turn lane

The 2030 existing traffic operation results at the intersection of Cascade Road and the I-285 Northbound Ramp Terminal are summarized in **Table 9**.

**Table 9: 2030 Existing Traffic Operation at I-285 Northbound Ramp Terminal**

<b>2030 Traffic Operation Analysis (Existing Roadway)</b>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; I-285 NB Ramps</b>														
Traffic Signal	AM	LOS	B	B	--	--	C	D	F	--	--	--	--	
		Queue (ft)	275'	200'	--	--	275'	750'	425'	--	--	--	--	
		Delay (s)	14.2	10.1	--	--	24.8	42.9	210.0	--	--	--	--	
		Approach LOS	B			C			F			--		
		Approach Delay (s)	12.5			24.8			109.6			--		
		Intersection Delay (s)	51.4											
	PM	LOS	C	A	--	--	C	D	F	--	--	--	--	
		Queue (ft)	300'	200'	--	--	475'	575'	800'	--	--	--	--	
		Delay (s)	27.4	8.5	--	--	27.2	39.8	131.6	--	--	--	--	
		Approach LOS	B			C			E			--		
		Approach Delay (s)	14.7			27.2			76.5			--		
		Intersection Delay (s)	38.2											

As shown in **Table 9**, all movements at the intersection of Cascade Road and the I-285 Northbound Ramp Terminal will operate at LOS 'D' or better with the exception of the following:

- Northbound right-turn lane

**NOTE:** It should be noted that the northbound right-turn was analyzed in the Synchro software as a stop only movement without the allowance of right turn on red operation to calibrate the movement to be similar to the field conditions.

The 2030 existing traffic operation results at the intersection of Cascade Road and Cascade Parkway SW are summarized in **Table 10**.

**Table 10: 2030 Existing Traffic Operation at Cascade Parkway SW**

<i>2030 Traffic Operation Analysis (Existing Roadway)</i>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; Cascade Pkwy SW</b>														
Traffic Signal	AM	LOS	A	A	A	A	C	C	C					
		Queue (ft)	50'	100'	100'	0'	50'	25'	25'					
		Delay (s)	5.5	3.7	9.4	7.7	21.7	20.6	23.8					
		Approach LOS	A			A			C			C		
		Approach Delay (s)	3.9			9.3			21.7			22.6		
		Intersection Delay (s)	6.7											
	PM	LOS	A	A	B	A	C	C	D					
		Queue (ft)	75'	75'	150'	0'	75'	50'	75'					
		Delay (s)	7.3	3.6	10.2	7.6	23.6	22.5	50.8					
		Approach LOS	A			B			C			D		
		Approach Delay (s)	4.4			10.2			23.6			42.4		
		Intersection Delay (s)	9.5											

As shown in **Table 10**, all movements at the intersection of Cascade Road and the I-285 Southbound Ramp Terminal will operate at LOS 'D' or better.

The 2030 existing traffic operation results at the intersection of Cascade Road and Shanter Drive are summarized in **Table 11**.

**Table 11: 2035 Existing Traffic Operation at Shanter Trail**

<i>2030 Traffic Operation Analysis (Existing Roadway)</i>													
		Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
<b>Cascade Rd &amp; Shanter Trail</b>													
Traffic Signal	AM	LOS	A	A	A	B	A	A	C			F	
		Queue (ft)	25'	300'	0'	25'	50'	25'	50'			125'	
		Delay (s)	4.3	8.3	3.0	13.6	3.6	3.1	21.5			152.1	
		Approach LOS	A			A			C			F	
		Approach Delay (s)	8.1			3.8			21.5			152.1	
		Intersection Delay (s)	32.4										
	PM	LOS	A	A	A	B	A	A	C			D	
		Queue (ft)	25'	325'	25'	25'	75'	25'	25'			275'	
		Delay (s)	6.7	9.5	4.0	14.8	5.0	4.1	20.5			39.6	
		Approach LOS	A			A			C			D	
		Approach Delay (s)	9.3			5.0			20.5			39.6	
		Intersection Delay (s)	12.0										

As shown in **Table 11**, all movements at the intersection of Cascade Road and Shanter Trail will operate at LOS 'D' or better with the exception of the following:

- Southbound shared left/through/right-turn lane

## 2030 Design Year Proposed Improvement Traffic Analysis

For the purpose of this study, LOS 'D' was used to define acceptable peak hour operating conditions. Improvements were proposed if specific traffic movements at the study intersections fell below a LOS 'D' during the 2030 design year. The following alternatives were investigated to resolve any substandard traffic operating conditions at the I-285 ramp terminals:

- Conventional tight diamond interchange with traffic signal control
- Conventional diamond interchange with roundabout control
- Diverging diamond interchange (DDI) with traffic signal control

The following alternatives were investigated to improve the LOS at the Cascade Road intersections with Utoy Springs Road/Research Center Drive, Cascade Parkway SW, and Shanter Trail:

- Adding through lanes
- Adding/lengthening turn lanes
- Revising signal timing and phasing to achieve system coordination
- Installing roundabouts

## Conventional Tight Diamond Interchange with Traffic Signal Control

The 2030 improved traffic analysis for the tight diamond alternative is based on minimizing the spacing between the I-285 ramp terminals on Cascade Road to improve the flow of traffic between the two ramp intersections. The traffic signals will thus operate under the use of one singular traffic signal controller ensuring coordination and uniformity between the two intersections. It is expected that the adjustments to the lane geometry and traffic signal timings will improve the LOS at the intersections to LOS 'D' or better. The proposed lane designations for the Cascade Road intersections are included in **Exhibit A in Appendix A**. The 2030 proposed conventional tight diamond interchange with traffic signals operational analysis of the study intersections are summarized in **Tables 12 through 16**.

## Utoy Springs Road/Research Center Drive with Traffic Signal Control

Recommendations for improvements for the intersection of Cascade Road and Utoy Springs Road/Research Center Drive are summarized as follows:

- Extend the westbound left-turn lane, make the existing right-turn lane a through lane, and construct a new right-turn lane
  - Three westbound through lanes will be carried to Fairburn Road
- Realign the southbound approach, extend the dual southbound left-turn lanes, and construct a separated southbound right-turn lane
- Adjust the northbound right-turn movement to operate as protected/overlap under the traffic signal
- Extend the right turn lane and left turn lane on the eastbound approach

The 2030 improved traffic operation results at the intersection of Cascade Road and Utoy Springs Road/Research Center Drive are summarized in **Table 12**.

**Table 12: 2030 Improved Traffic Signal Operation at Utoy Springs Road/Research Center Drive**

<i>2030 Traffic Operation Analysis (Improved Roadway)</i>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; Utoy Springs Rd / Research Center Dr</b>														
Traffic Signal	AM	LOS	B	C	A	C	C	A	D	D	D	C	C	
		Queue (ft)	50'	575'	0'	225'	225'	225'	150'	250'	100'	50'	75'	
		Delay (s)	14.0	30.4	0.0	30.9	30.7	0.0	46.1	41.1	51.8	26.5	26.3	
		Approach LOS	C			C			D			D		
		Approach Delay (s)	29.3			30.8			43.0			45.5		
		Intersection Delay (s)	33.2											
	PM	LOS	D	C	A	D	C	A	D	C	D	C	C	
		Queue (ft)	125'	475'	0'	275'	350'	275'	175'	75'	175'	125'	150'	
		Delay (s)	35.8	34.7	0.0	40.5	31.1	0.0	45.7	27.5	50.4	26.0	24.8	
		Approach LOS	C			C			D			D		
		Approach Delay (s)	34.8			32.6			38.1			40.0		
		Intersection Delay (s)	34.8											

As shown in **Table 12**, all movements at the intersection of Cascade Road and Utoy Springs Road / Research Center Drive will operate at LOS 'D' or better during the 2030 design year.

### I-285 Southbound Ramp Terminal with Traffic Signal Control

- Construct dual left-turn lanes with a free-flow right-turn lane on the southbound approach
- Construct two through lanes, two look ahead left-turn lanes and a free-flow right turn lane on the eastbound approach
- Construct two through lanes and a left-turn lane on the westbound approach
- The traffic signals are expected to operate under one controller in coordination with the I-285 northbound ramps

The 2030 tight diamond traffic operation results at the intersection of Cascade Road and the I-285 Southbound Ramp Terminal are summarized in **Table 13**.

**Table 13: 2030 Improved Traffic Signal Operation at the I-285 Southbound Ramp Terminal (Tight Diamond)**

<i>2030 Traffic Operation Analysis (Tight Diamond)</i>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; I-285 SB Ramps</b>														
Traffic Signal	AM	LOS	--	C	A	D	A	--	--	--	--	D	D	A
		Queue (ft)	--	275'	0'	125'	50'	--	--	--	--	100'	100'	0'
		Delay (s)	--	30.7	0.3	37.2	0.8	--	--	--	--	45.6	45.7	0.4
		Approach LOS	C			A			--			B		
		Approach Delay (s)	23.0			5.9			--			11.8		
		Intersection Delay (s)	15.8											
	PM	LOS	--	B	A	C	A	--	--	--	--	D	D	A
		Queue (ft)	--	200'	0'	150'	75'	--	--	--	--	175'	175'	0'
		Delay (s)	--	19.5	0.3	25.4	1.0	--	--	--	--	48.7	48.8	3.2
		Approach LOS	B			A			--			B		
		Approach Delay (s)	13.2			5.8			--			11.4		
		Intersection Delay (s)	10.1											

As shown in **Table 13**, all movements at the intersection of Cascade Road and I-285 Southbound Ramp Terminal will operate at LOS 'D' or better during the 2030 design year. Queuing between the ramp intersections is limited to the spacing between the intersections, ensuring no back-ups down the corridor.

### I-285 Northbound Ramp Terminal with Traffic Signals Improvements

Recommendations for improvements for the intersection of Cascade Road and the I-285 Northbound Ramp Terminal are summarized as follows:

- Construct two through lanes and a separated right-turn lane on the westbound approach
- Construct two through lanes and dual left-turn lanes on the eastbound approach with protected only traffic signal phasing
- Construct dual left-turn lanes and a separate right-turn lane on the northbound approach

- The traffic signals are expected to operate under one controller in coordination with the I-285 southbound ramps

The 2030 tight diamond traffic operation results at the intersection of Cascade Road and the I-285 Northbound Ramp Terminal are summarized in **Table 14**.

**Table 14: 2030 Improved Traffic Signal Operation at the I-285 Northbound Ramp Terminal (Tight Diamond)**

<i>2030 Traffic Operation Analysis (Tight Diamond)</i>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; I-285 NB Ramps</b>														
Traffic Signal	AM	LOS	B	A	--	--	D	D	D	D	--	--	--	
		Queue (ft)	100'	25'	--	--	125'	50'	375'	375'	--	--	--	
		Delay (s)	17.3	1.8	--	--	41.0	54.4	35.9	36.2	--	--	--	
		Approach LOS	B			D			D			--		
		Approach Delay (s)	10.7			44.5			36			--		
		Intersection Delay (s)	26.3											
	PM	LOS	B	A	--	--	C	C	D	C	--	--	--	
		Queue (ft)	125'	25'	--	--	225'	200'	350'	75'	--	--	--	
		Delay (s)	11.4	0.4	--	--	33.3	34.4	40.7	29.3	--	--	--	
		Approach LOS	A			C			D			--		
		Approach Delay (s)	4.4			33.5			36.2			--		
		Intersection Delay (s)	23.4											

As shown in **Table 14**, all movements at the intersection of Cascade Road and the I-285 northbound ramp terminal will operate at LOS 'D' or better during the 2030 design year.

### **Cascade Parkway SW with Traffic Signal Control**

The intersection of Cascade Road and Cascade Parkway SW will be signal controlled, but due to its proximity to the I-285 northbound ramps, the intersection will be restricted to only allow eastbound left turns in, and right turns in and out.

The 2030 improved traffic operation results at the intersection of Cascade Road and Cascade Parkway SW are summarized in **Table 15**.

**Table 15: 2030 Improved Traffic Signal Operation at Cascade Parkway SW**

<i>2030 Traffic Operation Analysis (Improved Roadway)</i>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; Cascade Pkwy SW</b>														
Traffic Signal	AM	LOS	A	A	A	A	--	A	--	D				
		Queue (ft)	75'	225'	75'	0'	--	0'	--	0'				
		Delay (s)	3.6	0.5	16.0	11.5	--	0.0	--	48.9				
		Approach LOS	A			B			A			D		
		Approach Delay (s)	1.0			15.9			0			48.9		
		Intersection Delay (s)	6.5											
	PM	LOS	A	A	C	B	--	D	--	D				
		Queue (ft)	100'	150'	225'	25'	--	50'	--	0'				
		Delay (s)	1.6	0.6	29.0	17.2	--	43.7	--	53.2				
		Approach LOS	A			C			D			D		
		Approach Delay (s)	0.8			28.7			43.7			53.2		
		Intersection Delay (s)	14.4											

As shown in **Table 15**, all movements at the intersection of Cascade Road and Cascade Parkway SW will operate at LOS 'D' or better during the 2030 design year.

### Shanter Trail with Traffic Signal Control

Recommendations for improvements for the intersection of Cascade Road and Shanter Trail are summarized as follows:

- Construct an additional through/right-turn lane on the eastbound approach
  - Right lane becomes a right turn only lane at Melbenan Drive SW

Due to the proximity of the I-285 Northbound ramps to Cascade Parkway SW under the proposed roadway geometrics, it is not feasible to allow left-turns to and from Cascade Parkway SW. As a result, the proposed layout of the intersection allows for right-in/right-out movements only. Consequently, the left-turns from Cascade Parkway SW have been redistributed to the southbound approach of Shanter Trail.

The 2030 improved traffic operation results at the intersection of Cascade Road and Shanter Trail are summarized in **Table 16**.

**Table 16: 2030 Improved Traffic Signal Operation at Shanter Trail**

<i>2030 Traffic Operation Analysis (Improved Roadway)</i>													
		Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
<b>Cascade Rd &amp; Shanter Trail</b>													
Traffic Signal	AM	LOS	A	A	B	A	A	C	D				
		Queue (ft)	50'	375'	25'	150'	25'	50'	100'				
		Delay (s)	5.8	6.0	11.8	9.4	8.0	26.7	39.6				
		Approach LOS	A			9.4			C	D			
		Approach Delay (s)	5.9			9.6			26.7	39.6			
		Intersection Delay (s)	13.6										
	PM	LOS	C	C	B	A	A	C	D				
		Queue (ft)	75'	300'	25'	200'	25'	25'	225'				
		Delay (s)	24.1	23.2	16.5	8.1	6.5	30.4	39.6				
		Approach LOS	C			A			C	D			
		Approach Delay (s)	23.2			8.1			30.4	39.6			
		Intersection Delay (s)	20.2										

As shown in **Table 16**, all movements at the intersection of Cascade Road and Shanter Trail will operate at LOS 'D' or better during the 2030 design year.

### Conventional Diamond Interchange with Roundabout Control

The roundabout analysis for the 2030 design year consists of at least dual lane roundabouts at all of the study area intersections. The roundabout analysis has been completed using the SIDRA 6.1 software in Standard Mode with a 1.1 environmental factor.

The proposed lane designations for study intersections are included in **Exhibit B** in **Appendix A**. The 2030 roundabout operational analysis results of the study intersections are summarized in Tables **19** through **22**.

### Utoy Springs Road/Research Center Drive with Traffic Signal Control

Based on meetings with Fulton County, GDOT, and the local stakeholder's, it was determined that a roundabout would not be studied at the intersection of Utoy Spring Road/Research Center Drive and Cascade Road due to the real estate impacts.

It was determined that the results and recommendations provided as a part of the traffic signal tight diamond alternative will be set forth as the recommendation for the proposed traffic signal at Utoy Springs Road/Research Center Drive.

### I-285 Southbound Ramp Terminal with Roundabout Control

The design of the I-285 southbound ramp terminal roundabout includes two circulating lanes and the following layouts on each approach:

- Two lane entry on the westbound approach (through/left and through)
- Two lane entry on the southbound approach (dual lefts) and a free flow right-turn lane
- Two lane entry on the eastbound approach (dual through) and a free flow right-turn lane

The 2030 roundabout traffic operation results at the intersection of Cascade Road and the I-285 Southbound Ramp Terminal are summarized in **Table 17**.

**Table 17: 2030 Roundabout Traffic Operation at the I-285 Southbound Ramp Terminal**

<i>2030 Traffic Operation Analysis (SIDRA Model)</i>											
		Eastbound			Westbound		Northbound		Southbound		
		TH	TH	RT	LT/TH	TH	--	--	LT	LT/TH	RT
<b>Cascade Rd &amp; I-285 SB Ramps</b>											
Roundabout	AM	LOS	A	A	A	A	A	--	B	B	A
		Queue (ft)	200'	100'	0'	0'	0'	--	25'	25'	0'
		Delay (s)	5.2	4.4	2.7	4.3	2.5	--	12.2	11.0	2.7
		v/c ratio	0.71	0.49	0.33	0.42	0.42	--	0.07	0.07	0.27
		Approach LOS	A			A		--	A		
		Approach Delay (s)	4.3			3.3		--	4.9		
		Intersection LOS	A								
	Intersection Delay (s)	4.1									
	PM	LOS	A	A	A	A	A	--	A	A	A
		Queue (ft)	75'	75'	0'	0'	0'	--	25'	25'	0'
		Delay (s)	5.2	4.4	2.7	5.0	2.5	--	9.4	7.9	0.8
		v/c ratio	0.44	0.44	0.30	0.49	0.49	--	0.14	0.14	0.75
		Approach LOS	A			A		--	A		
		Approach Delay (s)	4.1			3.7		--	2.2		
Intersection LOS		A									
Intersection Delay (s)	3.3										

As shown in **Table 17**, all movements at the intersection of Cascade Road and I-285 Southbound Ramp Terminal will operate at LOS 'C' or better during the 2030 design year.

A microsimulation of the roundabout corridor was developed in VISSIM. The simulation showed spillover queuing from the proposed traffic signal at the Utoy Springs Road created an issue where southbound right-turning vehicles from the I-285 southbound ramp could not freely enter onto Cascade Road. This is not immediately apparent in the traffic operation results for the intersection.

### **I-285 Northbound Ramp Terminal with Roundabout Control**

The design of the I-285 northbound ramp terminal roundabout includes the following layouts on each approach:

- Two lane entry on the eastbound approach (through/left and through)
- Two lane entry on the northbound approach (dual lefts) and a partial right-turn bypass lane
- Two lane entry on the westbound approach (dual through) and a free flow right-turn lane

The 2030 roundabout traffic operation results for the intersection of Cascade Road and the I-285 northbound ramp terminal is summarized in **Table 18**.

**Table 18: 2030 Roundabout Traffic Operation at the I-285 Northbound Ramp Terminal**

<i>2030 Traffic Operation Analysis (SIDRA Model)</i>											
		west		east			south			north	
		LT/TH	TH	TH	TH	RT	LT	LT/TH	RT	--	--
<b>Cascade Rd &amp; I-285 NB Ramps</b>											
Roundabout	AM	LOS	A	A	B	B	A	B	B	A	--
		Queue (ft)	200'	150'	75'	100'	0'	100'	100'	100'	--
		Delay (s)	8.9	2.7	16.1	11.3	2.7	17.9	15.1	6.1	--
		v/c ratio	0.60	0.50	0.44	0.44	0.10	0.53	0.533	0.47	--
		Approach LOS	A		B			B			--
		Approach Delay (s)	6.3		10.6			12.2			--
		Intersection LOS	A								
	Intersection Delay (s)	9.3									
	PM	LOS	A	A	A	A	A	B	B	A	--
		Queue (ft)	125'	125'	100'	100'	0'	75'	75'	75'	--
		Delay (s)	7.5	2.7	9.9	7.1	2.7	13.4	11.8	5.6	--
		v/c ratio	0.45	0.45	0.53	0.53	0.12	0.37	0.37	0.39	--
		Approach LOS	A		A			A			--
		Approach Delay (s)	5.0		7.3			9.7			--
Intersection LOS		A									
Intersection Delay (s)	7.2										

As shown in **Table 18**, all movements at the intersection of Cascade Road and I-285 Southbound Ramp Terminal will operate at LOS 'B' or better during the 2030 design year.

### Cascade Parkway SW Roundabout Corridor Improvements

As a result of the design of the I-285 northbound ramp terminal roundabout, the existing intersection of Cascade Parkway SW is too close to the ramp terminal roundabout, and therefore is restricted to a right-in/right-out only. The Cascade Parkway SW intersection is proposed to be one-way stop controlled.

For those drivers exiting Cascade Parkway SW destined to go east, they will need to make a right turn, go to the I-285 northbound ramp terminal and make a U-turn through the roundabout to then travel east. Likewise, a driver traveling eastbound wanting to go north on Cascade Parkway SW will need to make a U-turn through the roundabout at Shanter Trail.

The 2030 one-way stop controlled traffic operation results for the proposed intersection of Cascade Road and Cascade Parkway SW is summarized in **Table 19**.

**Table 19: 2030 Improved Traffic Operation at Cascade Parkway SW (One-way Stop Controlled)**

<i>2035 Traffic Operation Analysis (HCS 2010)</i>						
		Eastbound	Westbound		Southbound	
		TH	TH	TH/RT	RT	
<b>Cascade Rd &amp; Cascade Pkwy SW</b>						
Roundabout	AM	LOS	A	A	A	B
		Queue (ft)	0'	0'	0'	25'
		Delay (s)	0.0	0.0	0.0	12.2
		Approach LOS	A	A		B
		Approach Delay (s)	0.0	0		12.2
		Intersection Delay (s)	0			
	PM	LOS	A	A	A	C
		Queue (ft)	0'	0'	0'	75'
		Delay (s)	0.0	0.0	0.0	21.3
		Approach LOS	A	A		C
		Approach Delay (s)	0.0	0		21.3
		Intersection Delay (s)	0			

As shown in **Table 19**, all movements at the intersection of Cascade Road and Cascade Parkway SW will operate at LOS 'C' or better during the 2030 design year.

**Shanter Trail with Roundabout Control**

The design of the Shanter Trail roundabout includes the following layouts on each approach:

- Two lane entry on the eastbound approach (through/left and through/right)
- One lane entry on the northbound approach
- Two lane entry on the westbound approach (through/left and through/right)
- One lane entry on the southbound approach

The 2030 roundabout traffic operation results for the proposed roundabout at the intersection of Cascade Road and Shanter Trail is summarized in **Table 20**.

**Table 20: 2030 Roundabout Traffic Operation at Shanter Trail**

<i>2030 Traffic Operation Analysis (SIDRA Model)</i>								
		WEST		EAST		SOUTH	NORTH	
		L	R	L	R	L	L	
<b>Cascade Rd &amp; Shanter Trail</b>								
Roundabout	AM	LOS	A	A	A	A	B	B
		Queue (ft)	125'	75'	50'	50'	25'	75'
		Delay (s)	5.7	5.4	4.2	3.9	12.6	10.7
		v/c ratio	0.53	0.35	0.19	0.19	0.06	0.47
		Approach LOS	A		A		B	B
		Approach Delay (s)	5.6		4		12.6	10.7
		Intersection LOS	A					
		Intersection Delay (s)	6.2					
	PM	LOS	A	A	A	A	B	B
		Queue (ft)	125'	75'	75'	75'	25'	75'
		Delay (s)	5.8	4.9	4.5	4.3	14.0	11.3
		v/c ratio	0.48	0.33	0.3	0.3	0.06	0.45
		Approach LOS	A		A		B	B
		Approach Delay (s)	5.5		4.4		14.0	11.3
		Intersection LOS	A					
		Intersection Delay (s)	6.0					

As shown in **Table 20**, all movements at the intersection of Cascade Road and Shanter Trail will operate at LOS 'B' or better during the 2030 design year.

### Diverging Diamond Interchange with Traffic Signal Control

As a part of the proposed DDI interchange design, directional crossovers are designed for the eastbound and westbound traffic on Cascade Road to carry traffic through the interchange. This eliminates the need for left-turning vehicles to cross the paths of approaching through vehicles. By shifting cross street traffic to the left side of the street between the signalized crossover intersections, vehicles on the off-ramps making a left turn or right turn to and from the ramps do not conflict with the opposing vehicles on Cascade Road.

The 2030 improved traffic analysis is based on the proposed intersection geometrics of a diverging diamond interchange at the I-285 interchange ramp terminals with Cascade Road. The proposed lane designations for the Cascade Road intersections are included in **Exhibit C** in **Appendix A**. The 2030 proposed diverging diamond interchange with traffic signals operational analysis results of the study intersections are summarized in **Tables 21** through **25**.

### Utoy Springs Road/Research Center Drive Improvements

Recommendations for improvements for the intersection of Cascade Road and Utoy Springs Road/Research Center Drive are summarized as follows:

- Extend the westbound left-turn lane, make the existing right-turn lane a through lane, and construct a new right-turn lane

- Three westbound through lanes will be carried to Fairburn Road
- Realign the southbound approach, extend the dual southbound left-turn lanes, and construct a separated southbound right-turn lane
- Adjust the northbound right-turn movement to operate as protected/overlap under the traffic signal
- Extend the right turn lane and left turn lane on the eastbound approach

The 2030 improved traffic operation results at the intersection of Cascade Road and Utoy Springs Road/Research Center Drive are summarized in **Table 21**.

**Table 21: 2030 Improved Traffic Signal Operation at Utoy Springs Road/Research Center Drive**

<i>2030 Traffic Operation Analysis (Improved Roadway)</i>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; Utoy Springs Rd / Research Center Dr</b>														
Traffic Signal	AM	LOS	B	C	A	C	D	A	D	C	D	C	C	
		Queue (ft)	75'	650'	0'	200'	450'	225'	150'	250'	100'	50'	25'	
		Delay (s)	16.0	28.2	0.0	28.0	35.1	0.0	49.8	34.1	49.6	28.6	29.3	
		Approach LOS	C			C			D			D		
		Approach Delay (s)	27.4			33.8			47.4			42.9		
		Intersection Delay (s)	32.9											
	PM	LOS	C	C	A	C	D	A	D	D	D	C	C	
		Queue (ft)	125'	575'	0'	325'	550'	325'	175'	125'	200'	150'	150'	
		Delay (s)	23.0	28.3	0.0	25.5	41.6	0.0	54.4	35.9	54.9	32.1	30.6	
		Approach LOS	C			D			D			D		
		Approach Delay (s)	27.8			39.1			50.4			45.2		
		Intersection Delay (s)	37.4											

As shown in **Table 21**, all movements at the intersection of Cascade Road and Utoy Springs Road/Research Center Drive will operate at LOS 'D' or better during the 2030 design year.

### **I-285 Southbound Ramp with Diverging Diamond Traffic Signal Control**

The proposed layout for the Cascade Road and I-285 Southbound Off-ramp are as follows:

- Construct dual right-turn lanes and one left-turn lane on the southbound approach
- Construct two eastbound through lanes and a free flow-right-turn lane
- Construct two westbound through lanes; the left lane will provide entrance to southbound I-285

The 2030 improved traffic operation results at the intersection of Cascade Road and the I-285 Southbound Ramp Terminal are summarized in **Table 22**.

**Table 22: 2030 Improved DDI Traffic Signal Operation at I-285 Southbound Ramps**

<i>2030 DDI Traffic Operation Analysis (2 LANE EB / 2 LANE WB)</i>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; I-285 SB Off-ramp</b>														
Traffic Signal	AM	LOS	--	C	A	--	C	--	--	--	--	C	--	B
		Queue (ft)	--	400'	0'	--	175'	--	--	--	--	125'	--	125'
		Delay (s)	--	20.4	0.3	--	27.6	--	--	--	--	24.5	--	13.7
		Approach LOS	B			C			--			--		
		Approach Delay (s)	15.3			27.6			--			--		
		Intersection Delay (s)	19.0											
	PM	LOS	--	A	A	--	D	--	--	--	--	C	--	D
		Queue (ft)	--	400'	0'	--	550'	--	--	--	--	200'	--	650'
		Delay (s)	--	9.6	0.3	--	45.1	--	--	--	--	26.8	--	30.1
		Approach LOS	A			D			--			--		
		Approach Delay (s)	6.6			45.1			--			--		
		Intersection Delay (s)	25.6											

As shown in **Table 22**, all movements at the intersection of Cascade Road and the I-285 Southbound ramps will operate at LOS 'D' or better during the 2030 design year. It should be noted that the westbound queue is shown to extend 550-ft, longer than the distance between the I-285 ramp intersections. The queue will extend onto the I-285 northbound off-ramp during the evening peak hour of travel.

**I-285 Northbound Ramp with Diverging Diamond Traffic Signal Control**

The proposed layout for the Cascade Road and I-285 Northbound Off-ramp are as follows:

- Construct one right-turn lane and dual left-turn lanes on the northbound approach
- Construct two westbound through lanes and a right-turn lane
- Construct two eastbound through lanes; the left lane will provide entrance to northbound I-285

The 2030 improved traffic operation results at the intersection of Cascade Road and the I-285 Northbound Ramp Terminal are summarized in **Table 23**.

**Table 23: 2030 Improved DDI Traffic Signal Operation at I-285 Northbound Ramps**

<b>2030 DDI Traffic Operation Analysis (2 LANE EB / 2 LANE WB)</b>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; I-285 NB Off-ramp</b>														
Traffic Signal	AM	LOS	--	C	--	--	B	A	C	--	C	--	--	--
		Queue (ft)	--	625'	--	--	175'	75'	300'	--	375'	--	--	--
		Delay (s)	--	28.9	--	--	21.0	51.3	20.5	--	31.7	--	--	--
		Approach LOS	C			C			--			--		
		Approach Delay (s)	28.9			28.9			--			--		
		Intersection Delay (s)	26.9											
	PM	LOS	--	C	--	--	B	A	C	--	B	--	--	--
		Queue (ft)	--	175'	--	--	350'	75'	275'	--	325'	--	--	--
		Delay (s)	--	26.0	--	--	15.6	12.1	33.1	--	17.2	--	--	--
		Approach LOS	B			C			--			--		
		Approach Delay (s)	26.0			15.0			--			--		
		Intersection Delay (s)	22.4											

As shown in **Table 23**, all movements at the intersection of Cascade Road and the I-285 Northbound ramps will operate at LOS 'C' or better during the 2030 design year.

**Cascade Parkway SW Traffic Signal Improvements**

Under the DDI alternative, spacing between Cascade Parkway SW and the I-285 Northbound ramps allow the intersection to remain open and operative under a traffic signal. There are no proposed adjustments to the existing layout of the intersection.

The 2030 improved traffic operation results at the intersection of Cascade Road and the Cascade Parkway SW are summarized in **Table 24**.

**Table 24: 2030 Improved Traffic Signal Operation at Cascade Parkway SW**

<b>2030 Traffic Operation Analysis (Improved Roadway)</b>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; Cascade Pkwy SW</b>														
Traffic Signal	AM	LOS	A	A	A	A		D		D		D		
		Queue (ft)	25'	75'	25'	0'		50'		50'		50'		
		Delay (s)	2.2	2.4	0.3	0.0		50.1		48.4		53.7		
		Approach LOS	A			A			D			D		
		Approach Delay (s)	2.3			0.3			50.1			51.7		
		Intersection Delay (s)	4.7											
	PM	LOS	A	A	A	A		D		D		E		
		Queue (ft)	50'	75'	75'	25'		75'		75'		75'		
		Delay (s)	1.9	0.4	0.5	0.0		55.0		53.3		64.2		
		Approach LOS	A			A			D			E		
		Approach Delay (s)	0.7			0.5			55.0			60.8		
		Intersection Delay (s)	5.6											

As shown in **Table 24**, all movements at the intersection of Cascade Road and Cascade Parkway SW will operate at LOS 'E' or better during the 2030 design year. It should be noted that the LOS 'E' for the southbound right-turn lane is a minor movement and queuing is expected to extend on average 75-feet. As such, it is not recommended that extensive improvements be made to the southbound approach to accommodate the relatively small amount of queuing and delay anticipated.

### Shanter Trail Traffic Signal Improvements

Recommendations for improvements for the intersection of Cascade Road and Shanter Trail are summarized as follows:

- Construct an additional through/right-turn lane on the eastbound approach
  - Right lane becomes a right turn only lane at Melbenan Drive SW

The 2030 improved traffic operation results at the intersection of Cascade Road and Shanter Trail are summarized in **Table 25**.

**Table 25: 2030 Improved Traffic Signal Operation at Shanter Trail**

<i>2030 Traffic Operation Analysis (Improved Roadway)</i>														
		Eastbound			Westbound			Northbound			Southbound			
		L	T	R	L	T	R	L	T	R	L	T	R	
<b>Cascade Rd &amp; Shanter Trail</b>														
Traffic Signal	AM	LOS	A	A	A	A	A	D			D			
		Queue (ft)	25'	175'	25'	100'	25'	50'			150'			
		Delay (s)	0.2	0.7	3.3	3.8	3.2	40.6			47.6			
		Approach LOS	A			A			D			D		
		Approach Delay (s)	0.7			3.8			40.6			47.6		
		Intersection Delay (s)	5.9											
	PM	LOS	C	C	B	A	A	D			D			
		Queue (ft)	50'	325'	25'	200'	25'	25'			250'			
		Delay (s)	21.0	21.7	13.3	5.3	4.2	43.6			51.9			
		Approach LOS	A			A			D			D		
		Approach Delay (s)	21.7			5.3			43.6			51.9		
		Intersection Delay (s)	18.8											

As shown in **Table 25**, all movements at the intersection of Cascade Road and Shanter Trail will operate at LOS 'D' or better during the 2030 design year.

## Intersection Crash Analysis

Traffic crash data was collected from GDOT and Fortuna County for a five-year time period between 2010 and 2014 at the intersections of Cascade Road with the I-285 ramps. At the intersections of Cascade Road with Utoy Springs Drive, Cascade Parkway and Shanter Trail, crash data was provided from June 2013 through June 2015. **Table 26** through **30** show the number of crashes per segment between 2010 and 2014 along with the predominant crash types for the I-285 Southbound ramps and I-285 Northbound ramps respectively. Crash statistics sheets are included in **Appendix C**.

### Utoy Springs Road/Research Center Drive Collisions

The crash statistics related to the intersection of Cascade Road and Utoy Springs Drive/Research Center Drive are shown in **Table 26**.

**Table 26: Cascade Road and Utoy Springs Road/Research Center Drive (June 2013 – June 2015)**

CASCADE RD / UTOY SPRINGS DR		
CRASH TYPE	NO. OF CRASHES	% OF TOTAL
LEFT TURN	6	10%
RIGHT ANGLE	2	3%
REAR-END	44	73%
HEAD-ON	0	0%
SS-SAME	7	12%
SS-OPPOSITE	0	0%
PEDESTRIAN	1	2%
BICYCLE	0	0%
FIXED	0	0%
NOT FIXED	0	0%
DEER	0	0%
OVERTURN	0	0%
OTHR/UNKN	0	0%
TOTAL	60	100%

As shown in **Table 26**, the leading crash type shown occurring is rear-end collisions. These crashes were followed by left-turn and sideswiped same direction collisions.

The following countermeasures are recommended to reduce the amount of crashes at the intersection of Cascade Road and Utoy Springs Road/Research Center Drive:

- Installing a right-turn lane on the southbound approach has the potential to lower rear-end collisions by 15%.

### I-285 Southbound Ramp Terminal Collisions

The crash statistics related to the I-285 Southbound ramps are shown in **Table 27**.

**Table 27: Cascade Road and I-285 Southbound Ramps Crash Statistics (2010 – 2014)**

<b>CASCADE ROAD / I-285 SOUTHBOUND RAMPS</b>		
<b>CRASH TYPE</b>	<b>NO. OF CRASHES</b>	<b>% OF TOTAL</b>
LEFT TURN	17	15%
RIGHT ANGLE	13	12%
REAR-END	58	51%
HEAD-ON	3	3%
SS-SAME	19	17%
SS-OPPOSITE	2	2%
PEDESTRIAN	0	0%
BICYCLE	0	0%
FIXED	1	1%
NOT FIXED	0	0%
DEER	0	0%
OVERTURN	0	0%
OTHR/UNKN	0	0%
<b>TOTAL</b>	<b>113</b>	<b>100%</b>

As shown in **Table 27**, the leading crash type shown occurring is rear-end collisions. A review of the police reports showed a number of these crashes occurred as a result of drivers exiting I-285 Southbound colliding with vehicles at the intersection. These crashes were followed by left-turn and sideswiped same direction collisions. Left-turn crashes typically occurred between motorists traveling eastbound on Cascade Road colliding with vehicles turning left from westbound Cascade Road.

The following countermeasures, pertaining to each alternative, are recommended to reduce the amount of crashes at the intersection of Cascade Road and the I-285 Northbound ramps:

- Conventional Tight Diamond Interchange Alternative
  - The separated left-turn lane in the westbound direction is expected to operate as a protected only movement. As a result, it is expected that left-turn collisions can be reduced by up to 99%.
- Roundabout Alternative
  - Converting a signalized intersection to a multi-lane roundabout decreases all injury related crashes by 71%.
- Diverging Diamond Interchange Alternative
  - The potential for left-turn crossing collisions are completely removed as a result of a DDI design, eliminating 100% of the potential collisions.
  - Converting an intersection to a DDI from a standard interchange has the potential to reduce all types of crashes by 46%.

### **I-285 Northbound Ramp Terminal Collisions**

The crash statistics related to the I-285 Northbound ramps are shown in **Table 28**.

**Table 28: Cascade Road and I-285 Northbound Ramps Crash Statistics (2010 – 2014)**

<b>CASCADE ROAD / I-285 NORTHBOUND RAMPS</b>		
<b>CRASH TYPE</b>	<b>NO. OF CRASHES</b>	<b>% OF TOTAL</b>
LEFT TURN	41	34%
RIGHT ANGLE	10	8%
REAR-END	41	34%
HEAD-ON	1	1%
SS-SAME	20	17%
SS-OPPOSITE	0	0%
PEDESTRIAN	1	1%
BICYCLE	0	0%
FIXED	5	4%
NOT FIXED	1	1%
DEER	0	0%
OVERTURN	0	0%
OTHR/UNKN	0	0%
<b>TOTAL</b>	<b>120</b>	<b>100%</b>

As shown in **Table 28**, the leading crash type shown occurring were left-turn collisions. These collisions occurred between motorists traveling westbound and vehicles traveling eastbound looking to turn left to I-285 Northbound. Other predominant crashes include rear-end collisions and sideswipe-same direction collisions. Vehicles turning from the left-turn lane and shared through/left-turn lane on the eastbound approach of the I-285 Northbound ramps made up most of the sideswipe-same direction collisions. The primary conflicts were between motorists wishing to travel eastbound Cascade Road, and motorists attempting to turn left towards I-285 Northbound.

The following countermeasures, pertaining to each alternative, are recommended to reduce the amount of crashes at the intersection of Cascade Road and the I-285 Northbound ramps:

- Conventional Tight Diamond Interchange Alternative
  - The addition of separated left-turn lanes and elimination of a shared through/left-turn lane eliminates the prevalent problem associated with sideswipe same-direction collisions.
  - The eastbound separated dual left-turn movement is expected to operate under a protected only traffic signal phase. As a result, it is expected that left-turn collisions can be reduced by up to 99%.
- Roundabout Alternative
  - Converting a signalized intersection to a multi-lane roundabout decreases all injury related crashes by 71%.
- Diverging Diamond Interchange Alternative
  - The potential for left-turn crossing collisions are completely removed as a result of a DDI design, eliminating 100% of the potential collisions.
  - Converting an intersection to a DDI from a standard interchange has the potential to reduce all types of crashes by 46%.

## Cascade Parkway SW Collisions

The crash statistics related to the intersection of Cascade Road and Cascade Parkway SW are shown in **Table 29**.

**Table 29: Cascade Road and Cascade Parkway SW (June 2013 – June 2015)**

CASCADE RD / CASCADE PKWY SW		
CRASH TYPE	NO. OF CRASHES	% OF TOTAL
LEFT TURN	1	4%
RIGHT ANGLE	0	0%
REAR-END	19	83%
HEAD-ON	0	0%
SS-SAME	3	13%
SS-OPPOSITE	0	0%
PEDESTRIAN	0	0%
BICYCLE	0	0%
FIXED	0	0%
NOT FIXED	0	0%
DEER	0	0%
OVERTURN	0	0%
OTHR/UNKN	0	0%
TOTAL	23	100%

As shown in **Table 29**, the leading crash type shown occurring is rear-end collisions. These crashes were followed by left-turn and sideswiped same direction collisions.

The following countermeasures are recommended to reduce the amount of crashes at the intersection of Cascade Road and Cascade Parkway SW:

- Installing a raised median and closing off left-turns has the potential to reduce crashes by 39%.

## Shanter Trail Collisions

Based on the crash information provided by GDOT and Fulton County, there were no crashes observed at the intersection of Cascade Road and Shanter Trail.

## Intersection Conflict Points Summary

There are also other safety advantages between a conventional tight diamond interchange, roundabout and diverging diamond interchange which reduces the amount of conflict points between vehicles and pedestrians. **Table 30** below summarizes the number of conflict points for each type of interchange.

**Table 30: Intersection Conflict Point Comparison**

<b>Vehicle to Vehicle Conflict Points</b>			
Type of Movement	Alternative (Interchange Type)		
	Tight Diamond	Roundabout	Diverging Diamond
Diverging	8	4	6
Merging	8	4	6
Crossing	10	0	2
Total	26	8	14
<b>Vehicle to Pedestrian Conflict Points</b>			
Total	16	8	4

Source: FHWA-HRT-11-001

As shown in **Table 30**, the vehicle to vehicle conflict points are the least for the roundabout alternative. The diverging diamond alternative has just 14 vehicle to vehicle conflicts also compared with 26 conflicts in the typical diamond interchange.

## Transit Considerations

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The Metropolitan Atlanta Rapid Transit Authority (MARTA) has provided input on the potential transit impacts of each alternative on Cascade Road. Currently, the existing study area is served by Route 71 (Cascade Road) which is considered a core route with approximately 3,800 boardings per weekday. Approximately 25% of the riders on this route travel to or from the study area.

MARTA has identified four areas to consider with the design of all alternatives:

1. Feasible locations for bus stops – MARTA is concerned with conflicts between buses and vehicles merging in and out of right turn lanes. MARTA would like to retain all current bus stops, yet may move some from a right-turn lane into a through-lane to reduce the need for the bus to merge in and out of traffic.
2. Pedestrian walkways on both side of the street – MARTA’s preference is for sidewalks/multi-use paths on *both sides of the street* to allow patrons access to the bus stops and offer flexibility for where buses can stop.
3. Safe crossings at bus stop locations – Pedestrians need to cross the street to make a round-trip by bus. MARTA would like for each of the bus stops to be connected to a safe, convenient pedestrian crossing, in order to maximize the potential for ridership.
4. Turns designed for buses –Intersection turns should be designed such that a standard 40-foot bus could make them.

The following sections examine the four criteria set by MARTA for each of the design alternatives.

### Conventional Tight Diamond Interchange Transit Considerations

1. Feasible locations for bus stops
  - a. The alternative has shown that the proposed design provides feasible locations for bus stops on the project corridor. Bus stop locations will be adjusted and/or consolidated as a result of the design.
2. Pedestrian walkways on both side of the street
  - a. Sidewalks are being provided on both sides of the roadway as recommended throughout the project limits.
3. Safe crossings at bus stop locations
  - a. Crossings are provided outside of the proposed interchange.
  - b. Crossings are provided at the intersections of Utoy Springs Road/Research Center Drive and Shanter Trail meeting MARTA’s expectations for design.
  - c. There is no proposed crossing provided at Cascade Parkway SW across Cascade Road.
4. Turns designed for buses
  - a. The intersections are designed to accommodate a WB-67 truck at the interchange and WB-62 at the intersections of Utoy Springs Road and Cascade Parkway SW. This meets the necessary area required to accommodate a bus.

### Conventional Roundabout Interchange Transit Considerations

1. Feasible locations for bus stops

- a. The alternative has shown that one bus stop and two bus shelters must be relocated as a result of the proposed design. Other bus stop locations will be consolidated as a result of the design.
- 2. Pedestrian walkways on both side of the street
  - a. A multi-use path on one side of the roundabout interchange does not provide for the recommendations requested by MARTA. However, access to the roundabouts is provided west and east of the interchange.
- 3. Safe crossings at bus stop locations
  - a. Crossings are provided on the outside approaches and the south side of both roundabouts at the proposed interchange.
  - b. Full access crossings are provided at the intersections of Utoy Springs Road/Research Center Drive and Shanter Trail on all intersection approaches.
  - c. There is no proposed crossing provided at Cascade Parkway.
- 4. Turns designed for buses
  - a. All intersections are designed to accommodate a WB-67 truck. This meets the necessary area required to accommodate a bus.

### **Diverging Diamond Interchange Transit Considerations**

- 1. Feasible locations for bus stops
  - a. The alternative has shown that the proposed design provides feasible locations for bus stops on the project corridor. Bus stop locations will be adjusted and/or consolidated as a result of the design.
- 2. Pedestrian walkways on both side of the street
  - a. A sidewalk on one side of the roadway at the proposed DDI interchange does not provide for the recommendations requested by MARTA.
  - b. There is no consistent sidewalk provided on the north side of the roadway.
- 3. Safe crossings at bus stop locations
  - a. There are no crossings on Cascade Road provided at the proposed diverging diamond interchange.
  - b. Full access crossings are provided at the intersections of Utoy Springs Road/Research Center Drive and Shanter Trail on all intersection approaches.
  - c. There is no proposed crossing provided at Cascade Parkway.
- 4. Turns designed for buses
  - a. The intersections are designed to accommodate a WB-67 truck at the interchange and WB-62 at the intersections of Utoy Springs Road and Cascade Parkway SW. This meets the necessary area required to accommodate a bus.

Based on the considerations provided by MARTA, the alternative that has been supported by MARTA is the conventional tight diamond interchange as the impacts to pedestrians and bus stops is the least with this alternative.

## Pedestrian and Bicycle Accommodations

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Cascade Road has been identified by Fulton County as a roadway facility where bicycle accommodations should be considered when the facility is reconstructed. Such accommodations are being planned with the proposed project where appropriate for all three alternatives.

For the tight diamond interchange alternative, sidewalks will be provided along both sides of the roadway. Crossings at each of the ramps of the interchange are proposed. There will be four channelized right turn movements to and from the ramps. The right-turn lanes to and from I-285 Southbound are anticipated to be free-flow. To provide adequate warning for pedestrians crossing the crosswalks at these locations, signage or signalization should be considered. Bicyclists are anticipated to travel in the roadway with motorized traffic with the bike lanes provided along the corridor.

For the roundabout interchange alternative, sidewalks and on-street bike lanes will be provided along both sides of the roadway outside of the I-285 interchange area. To allow the roundabout design to fit within the confines of the existing bridge structure, it is necessary to only provide a sidewalk on the south side of the roadway between the ramp terminals. Bicyclists will have the decision to either act as vehicles do through the roundabout, commanding the driving lane, or they can exit the bike lane onto the sidewalk and travel through the intersection similar to a pedestrian. The bicyclist using the sidewalk would also use the crosswalks to travel through the intersection. The roundabout alternatives include right-turn bypass lanes at the I-285 Southbound ramp terminal to increase capacity by reducing the number of vehicles that need to enter into the roundabout. A draw back to the additional by-pass lanes is the additional lane of traffic that pedestrian and bicyclists must traverse. Additionally, vehicles using the bypass lane will be traveling at higher speeds than those going through the roundabout making crossing decisions more difficult for pedestrians and bicyclists. This may require additional traffic control devices to warn the motorist as to the presence of pedestrians and the need to yield to them while in the crosswalk.

To allow the diverging diamond design to fit within the confines of the existing bridge structure, it is necessary to remove bicycle accommodations on the corridor and the pedestrian sidewalks will be located to outside of the roadway on the south side of the roadway. This allows pedestrian safety to be enhanced around the I-285 ramp terminals as less crossing time would be required and fewer vehicle-pedestrian conflict points are present.

## Environmental Impacts

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In a review of the potential impacts at the I-285 ramp interchange, it became apparent that any modifications to the ramps would have an adverse effect on the environment for all alternatives. For all alternatives, a phase I and II environmental site assessment will be required due to the underground storage tanks in the study area at the gas stations.

### Tight Diamond Interchange Environmental Impacts

Construction of a tight diamond interchange at I-285 and Cascade Road is based on moving the entrance and exit ramps closer to the I-285 bridge structure. As a result, it is necessary to construct a barrier wall along the I-285 freeway section to ensure the embankments do not fail and adversely affect the ramps and Cascade Road. In order for traffic operations to improve from existing, this signalized alternative requires the addition of a second eastbound left turn lane onto northbound I-285.

It has become known that any modifications to the I-285 freeway triggers the National Environmental Policy Act (NEPA), a federal policy that requires agencies to assess the environmental effects of proposed actions prior to making decisions. This process takes time and could delay construction two to five years.

The bridge over South Utoy Creek would need to be widened in this alternative. Impacts to wetlands and the floodplain would have to be determined.

Likewise, the box culvert in the northeast quadrant of the interchange would need to be lengthened to accommodate the new on-ramp to I-285. This would require analyzing impacts to wetlands and the floodplain.

Wetlands will also be impacted by relocating the Library entrance to the north, and widening Research Center Drive to the west.

Considering the current state of traffic operations and the need to make improvements given a small window of opportunity, the additional time required to follow the NEPA process makes the conventional tight diamond not the most feasible alternative.

### Roundabout Interchange Environmental Impacts

Construction of roundabouts at the I-285 ramp terminals creates impacts to the South Utoy Creek and the culverts that run beneath Cascade Road. A multi-cell box culvert is recommended in lieu of a new structure due to the footprint of the roundabout and the location of the southbound ramps. This will require extensive earthwork and temporary rerouting of the existing creek to accommodate the construction of the culvert. Floodplain impacts would need to be analyzed and wetland impacts determined.

The existing culvert beneath the I-285 Northbound ramps would also need to be extended with the construction of a roundabout at the intersection. Analyzing impacts to the floodplain and wetlands would be required.

## **Diverging Diamond Interchange Environmental Impacts**

Environmental impacts associated with the construction of the diverging diamond interchange at I-285 include bridge widening efforts and culvert extensions similar to the roundabout alternative. At the I-285 Southbound ramps, the construction of the southbound dual right-turns and the free-flow right turn from eastbound Cascade Road to I-285 Southbound require the widening of the bridge over South Utoy Creek on Cascade Road. The existing culvert beneath the I-285 Northbound ramps would also need to be extended with the construction of a diverging diamond alternative at the intersection. Analysis of floodplain and wetland impacts would be necessary.

## Real Estate Impacts and Costs

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The potential right-of-way relocations and acquisitions have been addressed with the right-of-way cost estimates prepared for each of the three alternatives. Estimates for each alternative are included in **Table 31**.

**Table 31: Right-of-Way Cost Estimate**

<b>Right-of-Way Cost Estimates</b>			
<b>Alternative</b>	<b>Acres of fee</b>	<b>Easement acquisitions</b>	<b>Estimated Cost (million)</b>
Tight Diamond	2.35	0.66	\$1.03
Roundabout	4.87	0.45	\$2.02
Diverging Diamond	2.1	0.63	\$0.94

Tight Diamond, approximately 2.35 acres of fee and 0.66 acres of easement acquisitions, at an estimated cost of \$1.03 million.

Roundabout, approximately 4.87 acres of fee and 0.45 acres of easement acquisitions, at an estimated cost of \$2.02 million. This alternative also requires the relocation of 3 businesses and potentially 1 residential home. Relocation costs are not included in the estimated costs.

Diverging Diamond, approximately 2.10 acres of fee and 0.63 acres of easement acquisitions, at an estimated cost of \$0.94 million.

## Estimate of Construction Costs

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A general construction cost estimate was completed for each control alternative. Quantities were measured for the major construction cost bid items such as: earthwork, aggregate, concrete curb and gutter, asphaltic pavement, and so forth. The cost estimate includes construction modifications to the I-285 ramp interchanges for each of the alternatives, Utoy Springs Road, Cascade Parkway SW, and Shanter Trail. The breakdowns of the cost estimates are located in **Appendix D**.

The following results are the total estimate values:

- Conventional Tight Diamond Alternative **\$25,900,000**
- Roundabout Interchange Alternative **\$18,200,000**
- Diverging Diamond Interchange Alternative **\$17,700,000**

All alternatives assume an inflation cost of approximately 3% over a two year time period, a 20% construction contingency, utility relocations,. It should be noted that the only alternative that requires a complete reconstruction of the I-285 bridge structure is the tight diamond alternative. The design of the tight diamond requires construction of retaining walls along all sides of the bridge and lengthening to provide the necessary width for travel lanes required for efficient traffic flow on Cascade Road.

## Public Involvement and Participation

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Leading up to the preparation of this report, several meetings had taken place with the stakeholders and general public. Common issues raised by both parties were summarized in the categories of access management, congestion, additional landscaping, street lighting, expanding the scope of work, utilities, roadway geometrics and improved safety.

The following includes considerations that have been explored in the design of each of the three alternatives:

- Continued coordination between the traffic signals on Cascade Road
- Increased vehicular storage on I-285 off-ramps
- Addition of two eastbound lanes between Cascade Parkway and Shanter Trail
- Two left-turn lanes and two through lanes on the eastbound approach of Cascade Road at the I-285 ramps
- Addition of bike lanes and sidewalk for each alternative where appropriate
- Improved pedestrian access for all alternatives provided

A summary of the comments provided at the public information meetings have been included in **Appendix E**.

## Alternative Evaluation Matrix

An evaluation matrix has been prepared to summarize the advantages and disadvantages of each of the proposed interchange alternatives. Each measure of evaluation includes an explanation of the potential implication of each alternative. These explanations have been weighted on a scale of 0 through 4 with 0 being the lowest criteria for each.

**Table 32: Alternatives Evaluation Matrix**

Conceptual Design Alternative Matrices						
Measure of Evaluation	Interchange Alternative					
	Tight Diamond		Roundabout		Diverging Diamond	
	Explanation	Score	Explanation	Score	Explanation	Score
Traffic Operations (Level-of-Service)	D	1	A/B	4	C/D	2
Estimated Total Cost	\$25,900,000	1	\$18,200,000	2	\$17,700,000	3
Right-of-Way Impacts (No. of parcels)	28	2	25	3	28	2
Real Estate Relocations Required	None	4	3/4	2	None	4
Right-of-Way Costs	\$1,200,000	2	\$2,100,000	1	\$1,100,000	2
I-285 Bridge Impacts	New bridges; NEPA Process	0	No change to existing	4	No change to existing	4
South Utoy Creek Crossing Impacts	Minor bridge widening	3	Significant multi-cell box culvert	1	Minor bridge widening	3
Pedestrians and Bicyclists	Bike lanes and sidewalk provided	4	Sidewalk provided; bike lanes removed	1	Sidewalk provided; some bike lane accommodations	2
Construction Duration	3 years	1	2.5 years	2	2 years	3
<b>Total</b>		<b>18</b>		<b>20</b>		<b>25</b>

As shown in **Table 32**, the diverging diamond alternative scores the highest amongst all alternatives based on the cost of construction, anticipated real estate relocations, no impacts to the bridge, and lack of overall design constraints that would prohibit construction in the near future.

## Recommendations and Conclusions

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The conceptual design report was prepared for Cascade Road from Utoy Springs Road to Shanter Trail to identify alternatives to alleviate the high degree of vehicular congestion at the ramp terminals and adjacent intersections. The report serves to examine the existing traffic conditions and those anticipated in the design year 2030 at the following five existing traffic signal controlled intersections along Cascade Road:

- Utoy Springs Road/Research Center Drive
- Southbound I-285 ramp terminal
- Northbound I-285 ramp terminal
- Cascade Parkway
- Shanter Trail

Through analysis of the Cascade Road study intersections, improvements were identified for the existing intersections and the interchange as a whole. For the purpose of this report and as accepted by GDOT, LOS 'D' was used to define acceptable peak hour operating conditions. All intersections were analyzed based on the procedures set forth in the 2010 HCM, where appropriate.

Based on the results of the traffic analysis, costs associated with the reconstruction of the interchange, and the real estate implications of the design at the Cascade Road study area intersections, it is recommended that the diverging diamond interchange and its associated intersection improvements stand as the chosen alternative.

The following improvements are recommended for the design of each of the intersections relating to the 2030 design year:

### Utoy Springs Road/Research Center Drive Improvements

- Extend the westbound left-turn lane, make the existing right-turn lane a through lane, and construct a new right-turn lane
  - Three westbound through lanes will be carried to Fairburn Road
- Realign the southbound approach, extend the dual southbound left-turn lanes, and construct a separated southbound right-turn lane
- Adjust the northbound right-turn movement to operate as protected/overlap under the traffic signal
- Extend the right turn lane and left turn lane on the eastbound approach
- Construct sidewalk in all quadrants of the intersection. It should be noted that sidewalk will not extend on the north side of the road to I-285 in the eastbound direction.
- Provide crosswalks on all approaches of the intersection
- Provide bicycle lanes on the westbound and eastbound approaches of the intersection

### I-285 Southbound Ramp Diverging Diamond Traffic Signal Improvements

- Construct dual right-turn lanes and one left-turn lane on the southbound approach
- Construct two eastbound through lanes and a free flow-right-turn lane

- Construct two westbound through lanes; the left lane will provide entrance to southbound I-285
- Construct sidewalk on the south side of the intersection
- Provide crosswalks on the south leg of the intersection to accommodate the proposed sidewalk
- No bicycle lanes are provided in the intersection. It is anticipated that bicyclists will share the through lanes with westbound and eastbound traffic or utilize the sidewalk to safely cross their bicycles.

#### I-285 Northbound Ramp Diverging Diamond Traffic Signal Improvements

- Construct one right-turn lane and dual left-turn lanes on the northbound approach
- Construct two westbound through lanes and a right-turn lane
- Construct two eastbound through lanes; the left lane will provide entrance to northbound I-285
- Construct sidewalk on the south side of the intersection
- Provide crosswalks on the south leg of the intersection to accommodate the proposed sidewalk
- No bicycle lanes are provided in the intersection. It is anticipated that bicyclists will share the through lanes with westbound and eastbound traffic or utilize the sidewalk to safely cross their bicycles.

#### Cascade Parkway SW Traffic Signal Improvements

- Minor intersection realignment/safety adjustments (crosswalks, median).
- Construct sidewalk on all approaches of the intersection
- Provide crosswalks on the all approaches of the intersection to accommodate the proposed sidewalk
- Provide a bicycle lane on the westbound approach of the intersection and the eastbound exit to the intersection
  - Bicyclists must either travel with traffic in the through lanes west of the intersection or reenter the roadway from the sidewalk

#### Shanter Trail Traffic Signal Improvements

- Construct an additional shared through/right-turn lane on the eastbound approach
  - Right lane becomes a right turn only lane at Melbenan Drive SW
- Construct sidewalk in all quadrants of the intersection
- Provide crosswalks on all approaches of the intersection
- Provide bicycle lanes on the westbound and eastbound approaches of the intersection