ADD-ONS

ADD-ONS

COUNTY COUNCIL OF BEAUFORT COUNTY

ADMINISTRATION BUILDING
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AGENDA
PUBLIC FACILITIES COMMITTEE
Monday, February 12, 2018
2:00 p.m.
Executive Conference Room, Administration Building
Beaufort County Government Robert Smalls Complex
100 Ribaut Road, Beaufort

Committee Members:
Stu Rodman, Chairman
York Glover, Vice Chairman
Rick Caporale
Michael Covert
Alice Howard
Jerry Stewart
Roberts "Tabor" Vaux

Staff Support:
Colin Kinton, Division Director
Transportation Engineering
Eric Larson, Division Director
Environmental Engineering
Robert McFee, Division Director
Facilities and Construction Engineering

1. CALL TO ORDER – 2:00 P.M.

2. TRANSPORTATION UPDATE ITEMS
   A. Bluffton Parkway / S.C. Highway 46 Traffic Circle Presentation from MSA / Ourston (backup)
   B. 278 Gateway Corridor (backup)
      (i) Bridges
      (ii) Jenkins Island
      (iii) Causeway to Squire Pope Road
      (iv) 278 Traffic Signal Enhancements

3. CONSIDERATION OF CONTRACT AWARDS
   A. One New 2018 Trail King Tk80HT Heavy Equipment Trailer for the Public Works Department ($80,560.60) (backup)
   B. One New 2018 John Deere Side-Arm Mower for the Public Works Department ($107,308.79) (backup)
   C. 2018 Schwarze A7 Tornado Sweeper for the Public Works Department – Stormwater Infrastructure Section ($244,943) (backup)
   D. U.S. 278 Signal Timing Analysis and Implementation Project ($81,000 total; $73,486 contact amount and $7,514 contingency) (backup)
   E. Engineering and Consulting Services for design build construction / Beaufort County Whitehall Boat Ramp Improvements ($193,660 total; $184,438 contract amounts and 5% contingency of $9,222) (backup)

4. UPDATE / ARTHUR HORNE BUILDING REPLACEMENT (backup)

5. SOUTH CAROLINA RECREATIONAL TRAILS PROGRAM GRANT FOR KAYAK RAMP AT WHALE BRANCH FISHING PIER (backup)

6. CONSIDERATION OF REAPPOINTMENTS AND APPOINTMENTS
   A. County Transportation Committee
   B. Keep Beaufort County Beautiful Board
   C. Solid Waste and Recycling Board

7. EXECUTIVE SESSION
   A. Discussion of negotiations incident to proposed contractual arrangements (Solid Waste and Recycling – Daufuskie Island)
   B. Receipt of legal advice regarding contractual negotiations and potential litigation related to traffic management in Callawassie Island area

8. ADJOURNMENT

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Ourston

To: Colin Kinton, PE – Beaufort County, SC

From: Mark Lenters – Ourston, and Joe M. Garcia, PE – Ourston

Subject: Bluffton Parkway at Bluffton Road (SC 46)
Roundabout In-Service Review

Date: February 2, 2018

BACKGROUND

Ourston was tasked by the Beaufort County to provide an in-service review of a roundabout at Bluffton Parkway and Bluffton Road in Bluffton, SC. There is concern that the roundabout is experiencing higher than normal number of crashes, albeit, mainly property damage only (PDO) type crashes. The intersection has experienced significant control changes since Bluffton Parkway was connected to SC 46 in 2004 where Bluffton Parkway was under stop control. In 2009, a temporary roundabout was installed by SCDOT as a temporary fix until the permanent roundabout could be installed. In 2011, SC 46 was widened and the permanent multi-lane roundabout was construction. However, crash incidents have been increasing over time since it was installed. South Carolina Department of Transportation (SCDOT) has tracked the crash incidents since the installation of multilane roundabout. In 2011 there were 6 collisions and in 2016 there was more than 36 collisions. Despite the increase in traffic flow masking some of the increase in collisions, the road authorities wish to reduce the frequency and rate of collisions through application of countermeasures ranging from physical geometry to enforcement, encouragement and education. The intersection is currently exhibiting a total crash frequency of 31 crashes per year, well above a predicted average of approximately 10 to 15 crashes per year. A 50% reduction of crashes per year would need to be achieved for this roundabout to perform within the range of national expected average number of crashes.

The results from this investigation should give informed recommendations to decision makers to combat the probable causes of overrepresented crash patterns with their corresponding countermeasures. Through the implementation of geometric, traffic control, and education countermeasures, it is anticipated that crashes will decrease based on success of similar treatment of other roundabouts. The goal of this effort is to reduce the number of crashes to those typical of other roundabouts with similar traffic flows.

STUDY METHODOLOGY

Similar to traditional in-service reviews (FHWA methods), this study consisted of office and field reviews to document collision patterns and site deficiencies, which in-turn led to the development and evaluation of collision reduction countermeasures.

A traditional in-service review normally consists of twelve tasks, including a multi-disciplinary stakeholder meeting, usually completed on-site. Ourston eliminated some of the traditional in-service review tasks, including a start-up meeting with various key stakeholders, a detailed field conflict analysis, and an economic evaluation for a more streamlined scope of work. The following in-service tasks were completed:

1. Collision Analysis
2. Geometric Conformance Review (cursory)
3. Operational Analysis (cursory)
4. List of Identified Deficiencies (Office Review)
5. Site Visit – verification of deficiencies
6. Development of Countermeasures
7. Documentation/Reporting

First, a collision analysis was performed to identify target crash patterns. Then, the relative crash frequency in each quadrant of the intersection was compared to the potential conflicts present in each quadrant. Operational analysis was also performed to identify capacity deficiencies that may influence crash patterns.

Field observations were undertaken to identify geometric anomalies, physical deficiencies and driver performance (human factors) issues at the roundabout. Subsequently, countermeasures are proposed based on findings from the previous tasks.

BEFORE AND AFTER STRIPING CHANGE CRASH ANALYSIS

The roundabout opened in early 2011 and after a year and half of operations SCDOT decided to restripe the roundabout to help improve the safety of the intersection. Before the striping change the roundabout was experiencing 35.8 crashes per year. Based on the entering plus circulating volumes a crash rate per quadrant was calculated. A summary of the before and after crash statistics are shown in Table 1.

During the before and after conditions, the AADTs of the intersection have increased from 14,500 to over 22,000. In 2016, the Bluffton Parkway flyover was opened to the east of this intersection and has contributed to the increase in this traffic. Considering the after crash rates have “stabilized” around 1.35 per quadrant, much lower than the before conditions, it is likely the striping change had a decreasing effect total crashes. There is also a likelihood that drivers became more familiar with driving the roundabout, decreasing the number of total crashes per year even with the increase in traffic volumes. It is significant that the crash rate decreased on two of the higher frequency quadrants from the before conditions since those approaches have seen the increase in volumes presently. However, crash patterns are still consistent, indicating drivers are still failing to yield to circulating vehicles and choosing and/or staying in their correct lane. With the current crash rate still at 4.0 MEV the roundabout is still an ideal candidate for safety improvements.

Table 1. Before and After Crash Analysis

	AADT	Total crashes per year	Crash Rate	Quadrant Crash Rate				FYRW/IMP LC %
				NE	SE	SW	NW	
Before	14,500	35.8	6.9	2.9	2.8	0.9	1.6	38/62 %
After	22,000	30.8	4.0	1.4	1.5	1.1	1.5	42/58 %

CRASH ANALYSIS

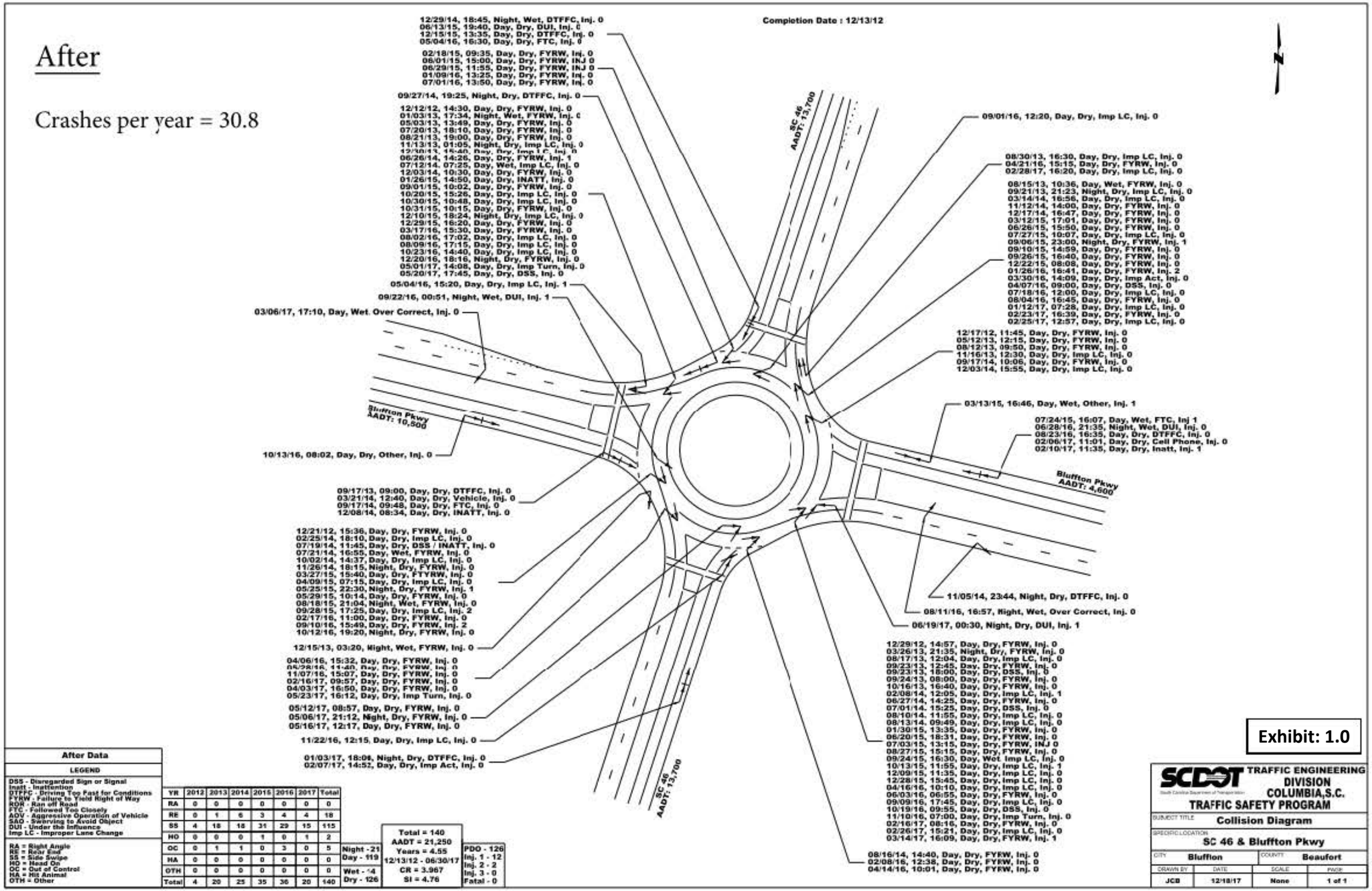
SCDOT retrieved crash data for this intersection from December 13, 2012 through June 30, 2017. Within this period, 140 crashes were analyzed. Of the crashes on record, there were 0 angle collisions, 115 side-swipes, 5 single vehicles, 2 head-on, and 18 rear-end collisions. 15 crashes involved injuries, and no crashes involved a fatality. The crash rate for the intersection is 4.0 MEV. A complete collision diagram can be found in Exhibit 1.0. A quadrant analysis was also completed to determine which quadrant is experiencing the highest number of crashes, see Exhibit 2.0. This analysis helps to focus improvement locations as a means to increase the benefit-cost per improvement.

Table 2. Collision History

	Total	2012	2013	2014	2015	2016	2017
Total crashes	**140**	**4**	**20**	**25**	**35**	**36**	**20**
Injury	**15**	0	0	2	6	4	3
Fatal	**0**	0	0	0	0	0	0
Rear-end	**18**	0	1	6	3	4	4
Angle*	**0**	0	0	0	0	0	0
Sideswipes**	**115**	4	18	18	31	29	15
Head-On	**2**	0	0	0	1	0	1
Single Vehicle	**5**	0	1	1	0	3	0

*Angle collisions include Left-turn opposing, Left-turn, Right-angle, Angle opposing, Angle similar direction, Turn opposing and Right-turn side

**Sideswipes collisions include Sideswipe same direction, Sideswipe opposite directions and Overtake


After
Crashes per year = 30.8
Completion Date : 12/13/12
SC 46
AADT: 13,700
Bluffton Pkwy
AADT: 10,500
Bluffton Pkwy
AADT: 4,600
SC 46
AADT: 13,700
12/29/14, 18:45, Night, Wet, DTFFC, Inj. 0
06/13/15, 19:40, Day, Dry, DUI, Inj. 0
12/15/15, 13:35, Day, Dry, DTFFC, Inj. 0
05/04/16, 16:30, Day, Dry, FTC, Inj. 0
02/18/15, 09:35, Day, Dry, FYRW, Inj. 0
06/01/15, 15:00, Day, Dry, FYRW, INJ 0
06/29/15, 11:55, Day, Dry, FYRW, INJ 0
01/09/16, 13:25, Day, Dry, FYRW, Inj. 0
07/01/16, 13:50, Day, Dry, FYRW, Inj. 0
09/27/14, 19:25, Night, Dry, DTFFC, Inj. 0
12/12/12, 14:30, Day, Dry, FYRW, Inj. 0
01/03/13, 17:34, Night, Wet, FYRW, Inj. 0
05/03/13, 13:49, Day, Dry, FYRW, Inj. 0
07/20/13, 18:10, Day, Dry, FYRW, Inj. 0
08/21/13, 19:00, Day, Dry, FYRW, Inj. 0
11/13/13, 01:05, Night, Dry, Imp LC, Inj. 0
06/26/14, 14:26, Day, Dry, FYRW, Inj. 1
07/12/14, 07:25, Day, Wet, Imp LC, Inj. 0
12/03/14, 10:30, Day, Dry, FYRW, Inj. 0
01/26/15, 14:50, Day, Dry, INATT, Inj. 0
09/01/15, 10:02, Day, Dry, FYRW, Inj. 0
10/20/15, 15:26, Day, Dry, Imp LC, Inj. 0
10/30/15, 10:48, Day, Dry, Imp LC, Inj. 0
10/31/15, 10:15, Day, Dry, FYRW, Inj. 0
12/10/15, 18:24, Night, Dry, Imp LC, Inj. 0
12/29/15, 16:20, Day, Dry, FYRW, Inj. 0
03/17/16, 15:30, Day, Dry, FYRW, Inj. 0
08/02/16, 17:02, Day, Dry, Imp LC, Inj. 0
08/09/16, 17:15, Day, Dry, Imp LC, Inj. 0
10/23/16, 14:40, Day, Dry, Imp LC, Inj. 0
12/20/16, 18:16, Night, Dry, FYRW, Inj. 0
05/01/17, 14:08, Day, Dry, Imp Turn, Inj. 0
05/20/17, 17:45, Day, Dry, DSS, Inj. 0
05/04/16, 15:20, Day, Dry, Imp LC, Inj. 1
09/22/16, 00:51, Night, Wet, DUI, Inj. 1
03/06/17, 17:10, Day, Wet, Over Correct, Inj. 0
10/13/16, 08:02, Day, Dry, Other, Inj. 0
09/17/13, 09:00, Day, Dry, DTFFC, Inj. 0
03/21/14, 12:40, Day, Dry, Vehicle, Inj. 0
09/17/14, 09:48, Day, Dry, FTC, Inj. 0
12/08/14, 08:34, Day, Dry, INATT, Inj. 0
12/21/12, 15:36, Day, Dry, FYRW, Inj. 0
02/25/14, 18:10, Day, Dry, Imp LC, Inj. 0
07/19/14, 11:45, Day, Dry, DSS / INATT, Inj. 0
07/21/14, 16:55, Day, Wet, FYRW, Inj. 0
10/02/14, 14:37, Day, Dry, Imp LC, Inj. 0
11/26/14, 18:15, Night, Dry, FYRW, Inj. 0
03/27/15, 15:40, Day, Dry, FTYRW, Inj. 0
04/09/15, 07:15, Day, Dry, Imp LC, Inj. 0
05/25/15, 22:30, Night, Dry, FYRW, Inj. 1
05/29/15, 10:14, Day, Dry, FYRW, Inj. 0
08/18/15, 21:04, Night, Wet, FYRW, Inj. 0
09/28/15, 17:25, Day, Dry, Imp LC, Inj. 2
02/17/16, 11:00, Day, Dry, FYRW, Inj. 0
09/10/16, 15:49, Day, Dry, FYRW, Inj. 2
10/12/16, 19:20, Night, Dry, FYRW, Inj. 0
12/15/13, 03:20, Night, Wet, FYRW, Inj. 0
04/06/16, 15:32, Day, Dry, FYRW, Inj. 0
11/07/16, 15:07, Day, Dry, FYRW, Inj. 0
02/16/17, 09:57, Day, Dry, FYRW, Inj. 0
04/03/17, 16:50, Day, Dry, FYRW, Inj. 0
05/23/17, 16:12, Day, Dry, Imp Turn, Inj. 0
05/12/17, 08:57, Day, Dry, FYRW, Inj. 0
05/06/17, 21:12, Night, Dry, FYRW, Inj. 0
05/16/17, 12:17, Day, Dry, FYRW, Inj. 0
11/22/16, 12:15, Day, Dry, Imp LC, Inj. 0
01/03/17, 18:04, Night, Dry, DTFFC, Inj. 0
02/07/17, 14:52, Day, Dry, Imp Act, Inj. 0
09/01/16, 12:20, Day, Dry, Imp LC, Inj. 0
08/30/13, 16:30, Day, Dry, Imp LC, Inj. 0
04/21/16, 15:15, Day, Dry, FYRW, Inj. 0
02/28/17, 16:20, Day, Dry, Imp LC, Inj. 0
08/15/13, 10:36, Day, Wet, FYRW, Inj. 0
09/21/13, 21:23, Night, Dry, Imp LC, Inj. 0
03/14/14, 16:56, Day, Dry, Imp LC, Inj. 0
11/12/14, 14:00, Day, Dry, FYRW, Inj. 0
12/17/14, 16:47, Day, Dry, FYRW, Inj. 0
03/12/15, 17:01, Day, Dry, FYRW, Inj. 0
06/26/15, 15:50, Day, Dry, FYRW, Inj. 0
07/27/15, 10:07, Day, Dry, Imp LC, Inj. 0
09/06/15, 23:00, Night, Dry, FYRW, Inj. 1
09/10/15, 14:59, Day, Dry, FYRW, Inj. 0
09/26/15, 16:40, Day, Dry, FYRW, Inj. 0
12/22/15, 08:08, Day, Dry, FYRW, Inj. 0
01/26/16, 16:41, Day, Dry, FYRW, Inj. 2
03/30/16, 14:09, Day, Dry, Imp Act, Inj. 0
04/07/16, 09:00, Day, Dry, DSS, Inj. 0
07/18/16, 12:00, Day, Dry, Imp LC, Inj. 0
08/04/16, 16:45, Day, Dry, FYRW, Inj. 0
01/12/17, 07:28, Day, Dry, Imp LC, Inj. 0
02/23/17, 16:39, Day, Dry, FYRW, Inj. 0
02/25/17, 12:57, Day, Dry, Imp LC, Inj. 0
12/17/12, 11:45, Day, Dry, FYRW, Inj. 0
05/12/13, 12:15, Day, Dry, FYRW, Inj. 0
08/12/13, 09:50, Day, Dry, FYRW, Inj. 0
11/16/13, 12:30, Day, Dry, Imp LC, Inj. 0
09/17/14, 10:06, Day, Dry, FYRW, Inj. 0
12/03/14, 15:55, Day, Dry, Imp LC, Inj. 0
03/13/15, 16:46, Day, Wet, Other, Inj. 1
07/24/15, 16:07, Day, Wet, FTC, Inj 1
06/28/16, 21:35, Night, Wet, DUI, Inj. 0
08/23/16, 16:35, Day, Dry, DTFFC, Inj. 0
02/06/17, 11:01, Day, Dry, Cell Phone, Inj. 0
02/10/17, 11:35, Day, Dry, Inatt, Inj. 1
11/05/14, 23:44, Night, Dry, DTFFC, Inj. 0
08/11/16, 16:57, Night, Wet, Over Correct, Inj. 0
06/19/17, 00:30, Night, Dry, DUI, Inj. 1
12/29/12, 14:57, Day, Dry, FYRW, Inj. 0
03/26/13, 21:35, Night, Dry, FYRW, Inj. 0
08/17/13, 12:04, Day, Dry, Imp LC, Inj. 0
09/23/13, 12:45, Day, Dry, FYRW, Inj. 0
09/23/13, 16:00, Day, Dry, DSS, Inj. 0
09/24/13, 08:00, Day, Dry, FYRW, Inj. 0
10/16/13, 16:40, Day, Dry, FYRW, Inj. 0
02/08/14, 12:05, Day, Dry, Imp LC, Inj. 1
06/27/14, 14:25, Day, Dry, FYRW, Inj. 0
07/01/14, 15:25, Day, Dry, DSS, Inj. 0
08/10/14, 11:55, Day, Dry, Imp LC, Inj. 0
08/13/14, 09:49, Day, Dry, Imp LC, Inj. 0
01/30/15, 13:35, Day, Dry, FYRW, Inj. 0
06/20/15, 16:31, Day, Dry, FYRW, Inj. 0
07/03/15, 13:15, Day, Dry, FYRW, INJ 0
08/27/15, 15:15, Day, Dry, FYRW, Inj. 0
09/24/15, 16:30, Day, Wet, Imp LC, Inj. 0
10/13/15, 11:55, Day, Dry, Imp LC, Inj. 1
12/09/15, 11:35, Day, Dry, Imp LC, Inj. 0
12/28/15, 15:45, Day, Dry, Imp LC, Inj. 0
04/16/16, 10:10, Day, Dry, Imp LC, Inj. 0
06/03/16, 06:55, Day, Dry, FYRW, Inj. 0
09/09/16, 17:45, Day, Dry, Imp LC, Inj. 0
10/19/16, 09:55, Day, Dry, DSS, Inj. 0
11/10/16, 07:00, Day, Dry, Imp Turn, Inj. 0
02/16/17, 08:16, Day, Dry, FYRW, Inj. 0
02/26/17, 15:21, Day, Dry, Imp LC, Inj. 0
03/14/17, 16:09, Day, Dry, FYRW, Inj. 1
08/16/14, 14:40, Day, Dry, FYRW, Inj. 0
02/08/16, 12:38, Day, Dry, FYRW, Inj. 0
04/14/16, 10:01, Day, Dry, FYRW, Inj. 0
After Data
LEGEND
DSS - Disregarded Sign or Signal
Inatt - Inattention
DTFFC - Driving Too Fast for Conditions
FYRW - Failure to Yield Right of Way
ROR - Ran off Road
FTC - Followed Too Closely
AOV - Aggressive Operation of Vehicle
SAO - Swerving to Avoid Object
DUI - Under the Influence
Imp LC - Improper Lane Change
RA = Right Angle
RE = Rear End
SS = Side Swipe
HO = Head On
OC = Out of Control
HA = Hit Animal
OTH = Other
YR | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total
RA | 0 | 0 | 0 | 0 | 0 | 0 | 0
RE | 0 | 1 | 6 | 3 | 4 | 4 | 18
SS | 4 | 18 | 18 | 31 | 29 | 15 | 115
HO | 0 | 0 | 0 | 1 | 0 | 1 | 2
OC | 0 | 1 | 1 | 0 | 3 | 0 | 5
HA | 0 | 0 | 0 | 0 | 0 | 0 | 0
OTH | 0 | 0 | 0 | 0 | 0 | 0 | 0
Total | 4 | 20 | 25 | 35 | 36 | 20 | 140
Night - 21
Day - 119
Wet - 14
Dry - 126
Total = 140
AADT = 21,250
Years = 4.55
12/13/12 - 06/30/17
CR = 3.967
SI = 4.76
PDO - 126
Inj. 1 - 12
Inj. 2 - 2
Inj. 3 - 0
Fatal - 0
Exhibit: 1.0
SCDOT
TRAFFIC ENGINEERING
DIVISION
COLUMBIA,S.C.
TRAFFIC SAFETY PROGRAM
SUBJECT TITLE
Collision Diagram
SPECIFIC LOCATION
SC 46 & Bluffton Pkwy
CITY
Bluffton
COUNTY
Beaufort
DRAWN BY
JCB
DATE
12/18/17
SCALE
None
PAGE
1 of 1

MSA PROFESSIONAL SERVICES | Quantum TRANSPORTATION • MUNICIPAL DEVELOPMENT • ENVIRONMENTAL	BLUFFTON PARKWAY at SC 46 BLUFFTON, SC	**QUADRANT ANALYSIS DIAGRAM**

SCALE 0 25 50

EXHIBIT: 2.0

Table 3 shows the distribution of contributing factors for crashes at the intersection of Bluffton Parkway at SC 46. As indicated in the table, the majority of contributing factors are failure to yield and improper lane change or using the wrong lane. Both of these contributing factors correlate to the major crash type, sideswipe (Table 2).

Table 3. Totals by Contributing Factor

Contributing Factor	#
Failure To Control	7
Failure To Yield	**75**
Followed Too Close	6
Improper Lane Change/Passing/Turn	**42**
Other	10
Total	140

Table 4 shows the distribution of crash severities at the intersection, along with a comparison of average injury and property damage only crashes at roundabouts across the US, and in WI and MN. As indicated in the table, the majority of crashes are property damage type crashes; however, injury crashes are slightly higher than national averages.

Table 4. Totals by Crash Severity

Crash Severity	Site #	% of Total	US %[1]	WI %[2]	MN %[3]	Avg.
Injury/fatality Crash	**15**	**11%**	6.5%	23.6%	8.8%	13.0%
Property Damage Crash	125	89%	93.5%	76.4%	91.2%	87.0%

1 Using the crash Prediction Methodology in Chapter 5.4, NCHRP Report 672
2 Applied Calibration based on Persaud and Lyon Inc. study of 56 roundabouts in Wisconsin, May 2017
3 Evaluating the Performance and Safety Effectiveness of Roundabouts, The Michigan Department of Transportation, 2011

Two studies documented in the US Roundabout Design Guide (NCHRP 672) list percentages of crash types at roundabouts in the US and offer a comparison to international data. The first study categorizes crashes by location within the roundabout while the second study categorizes crashes by type. A comparison of the recorded crash locations/types at the Bluffton Parkway at SC 46 roundabout to US and international averages is provided in Table 5 and Table 6. Compared to US national averages, there is an overrepresentation of entering-circulating crashes (Table 5). Entering-circulating crashes are most likely attributed to failure to yield or inability of drivers to competently judge gaps in circulating traffic.

Table 5. Comparison of Crash Type to US averages (NCHRP 672, Exhibit 5-11)

Crash Type/Location	Percent (US National Averages)	Recorded Totals	Recorded Percentages
Entering-Circulating (FTY)	23%	**75**	**53.6%**
Exiting-Circulating	31%	42	30.0%*
Rear-End on Leg	31%	16	11.4%
Loss of Control on Leg	13%	7	5.0%
Pedestrian and Bicycle	2%	0	0.0%
Other	N/A	0	0%

**Exit-Circulating crashes includes right-turn entering from left lane*

Table 6. Comparison of the Top Five Crash Types to National Averages (NCHRP 672, Exhibit 5-12)

Crash Type	France	Australia	United Kingdom	US Double-Lane	International Averages	Recorded Percentages
Failure to Yield (Angle[4])	36.6%	50.8%	71.1%	17%	43.9%	**53.6%**
Single Vehicle (Fixed Object/Loss of Control)	30.2%	18.2%	8.2%	28%	21.2%	3.6%
Rear End	8.9%	18.3%	7%	19%	13.3%	12.9%
Sideswipe	8.4%	10.1%	-	28%	15.5%	30.0%
Ped/Bike	12.4%	-	3.5%	4%	6.6%	0.0%

4 These types of crashes are coded as sideswipes.

Based on crash prediction models, shown in Table 7, the roundabout is experiencing, more crashes, of all severities, than expected. This demonstrates the need for improvements at the intersection to reduce annual crashes to nationally predicted levels. A reduction 22 crashes per year, a 71% reduction, would achieve safety operations comparable to model predictions.

Table 7. Comparison of Actual Collision Frequency to Predicted Frequency (crashes per year)

Collision Class	Expected Annual Crashes (NCHRP Model)[5]	95th Percentile Expected Crash Frequency (NCHRP Model)	Expected Annual Crashes (WI Calibrated NCHRP Model 2017)[6]	95th Percentile Expected Crash Frequency (WI Calibrated NCHRP Model 2017)	Expected Annual Crashes (MDOT Safety Performance Functions 2011)[7]	95th Percentile Expected Crash Frequency (MDOT Safety Performance Functions 2011)	Recorded Annual Freq. of Crashes (2012 to 2017)
Total Crashes	6.6	17.7	5.1	15.2	1.9	5.4	30.8
Injury Crashes	0.5	1.2	1.2	3.2	0.2	0.5	3.3

Bluffton Parkway at SC 46 is experiencing a crash rate of 4.0 crashes per million entering vehicles (MEV). This is well above the expected crash rate ranging from 0.8 to 0.2 MEV, shown in Table 8.

Table 8. Comparison of Actual Crash Rate to Predicated Crash Rates

Collision Class	Site Crash Rate (2012 to 2017)	NCHRP Expected Crash Rate[5]	WI Expected Crash Rate[6]	MN Expected Crash Rate[7]
Total Crashes	4.0 MEV	0.9 MEV	0.7 MEV	0.2 MEV
Injury Crashes	0.43 MEV	0.06 MEV	0.15 MEV	0.03 MEV

5 Using the crash Prediction Methodology in Chapter 5.4, NCHRP Report 672
6 Applied Calibration based on Persaud and Lyon Inc. study of 56 roundabouts in Wisconsin, May 2017
7 Evaluating the Performance and Safety Effectiveness of Roundabouts, The Michigan Department of Transportation, 2011

Based on the distribution of crashes and the potential exposure to conflicts (based on entering and circulating ADT counts), the southeast (SE) and northwest (NW) quadrants are experiencing higher than expected crashes, see Table 9. This would indicate that the SE and NW quadrants have significance and are the prime candidates for improvement. Refer to Exhibit 2.0 for illustration of the crashes by quadrant.

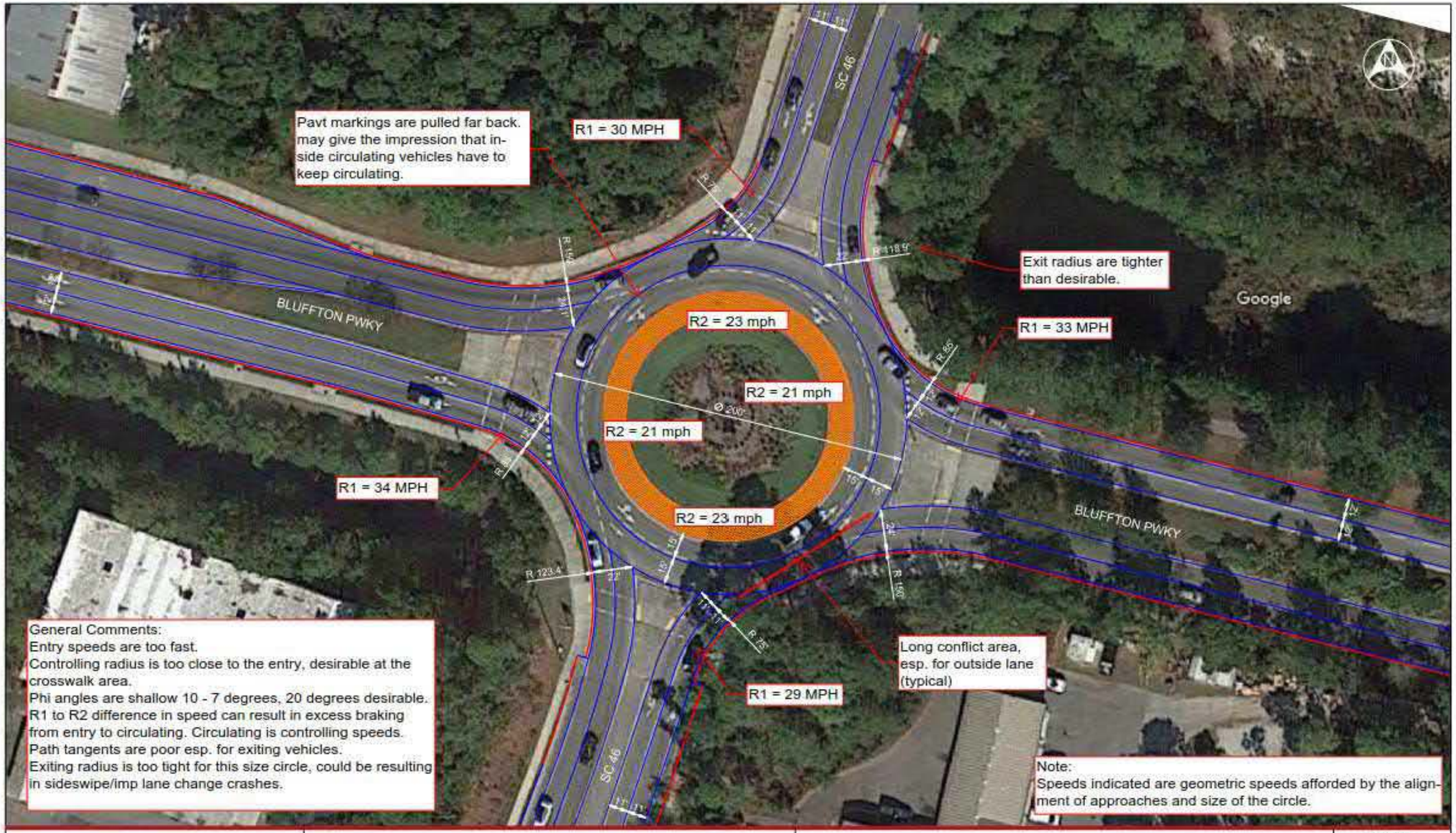
Table 9. Distribution of Crashes and Conflict Exposure on the Circulating Roadway

Quadrant	Avg. Annual Crashes By Quadrant		2017 Potential Conflicts		Crash Rate by Quadrant
	No.	Percentage	No.	Percentage	
NW	8.1	**26%**	3,189	15%	**1.5**
NE	7.7	25%	6,375	30%	1.4
SW	6.2	20%	7,650	36%	1.1
SE	8.8	**29%**	4,038	19%	**1.5**
Total	30.8		21250		-

GEOMETRIC CONFORMANCE REVIEW

The roundabout is a radial design that is defined by approaches coming directly into the roundabout 90 degrees apart from each other. This type of design puts all of the speed control of the roundabout at the central island. This results in high entry (R1) speeds exceeding the recommend 28 MPH for multi-lane roundabouts. The circulating speed (R2) is relatively low compared to the entry speed resulting in excess braking transitioning from entering to circulating. Radial design tends to concentrate speed change on the final few feet prior to entering the roundabout, which is inadequate for drivers and contributes to excessive braking. This has been shown to contribute to failure to yield crashes. The central island controls speeds on a radial design the inscribed circle diameter (ICD) needs to be larger, in this case, the roundabout's ICD is 200 feet. Furthermore, vehicles entering the roundabout have a long conflict area and poor phi angle entering the roundabout, especially for the outside lanes. The entry angle is called the Phi angle. It is a measure of sight to the left and ease of entry to the right. These long conflict areas and fast entry speeds are likely the main reason for failure to yield crashes. Multi-lane roundabout entry and exits need to include a path overlap tangent, typically a minimum of 50 feet in length, to aid vehicles in proper lane choice. This roundabout's path overlap tangent is shorter than the 50 feet minimum, contributing to the roundabout's improper lane crash pattern. Additional geometric deficiencies are shown in Exhibit 3.0.

Preferred multi-lane roundabout designs incorporates an offset-left design which incorporates the entry radii and central island to control fast path speeds within the recommended range. Typical two by two roundabout ICD's range from 150 to 190 feet, smaller than this radial design.



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BLUFFTON PARKWAY at SC 46
BLUFFTON, SC

HORIZONTAL GEOMETRY REVIEW

SCALE 0 25 50

EXHIBIT: 3.0

OPERATIONAL ANALYSIS

The existing roundabout was analyzed in Junctions 9 (ARCADY) roundabout design and capacity analysis software. ARCADY (Assessment of Roundabout Capacity and Delay) is a program based on U.K. empirical research into geometry-capacity relationships. Two features that ARCADY provides are: its ability take into account horizontal geometric design sensitivity and its ability to be calibrated. These two features are critical to accurately modeling the in-service roundabout to determine expected operations for any proposed roundabout geometric modifications. It was determined that a 10% capacity reduction factor was required to calibrate the software to match field observations of queues for the AM and PM peak hours. Turning movement counts conducted by Quality Counts in August 31, 2017 are shown in Figure 1.

The results of the analysis represent capacity measures of level of service (LOS), delay and queuing, consistent with typical unsignalized capacity analysis methodologies (Highway Capacity Manual, 2010). The results of the ARCADY analyses are summarized in Table 10, detailed reports are in Appendix A. In general, the roundabout is exhibiting acceptable operations during the peak periods.

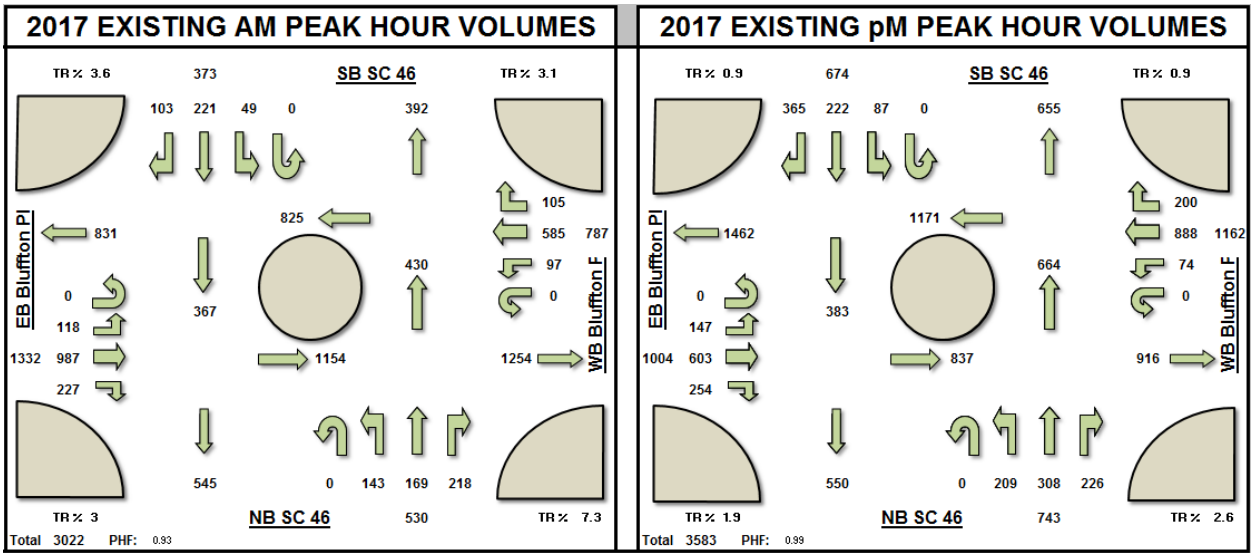


Figure 1. 2017 Peak Hour Turning Movement Volumes

Table 10. Roundabout Operational Analysis

			SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
ARCADY 9.0	AM Peak	LOS	A	B	A	A
		Queue (ft)	25	225	50	25
		v/c	0.31	0.81	0.56	0.50
		Delay (s)	**4.0**	**10.5**	**7.8**	**4.1**
	PM Peak	LOS	A	A	A	B
		Queue (ft)	50	25	25	200
		v/c	0.67	0.61	0.62	0.79
		Delay (s)	**9.7**	**5.0**	**7.0**	**10.6**

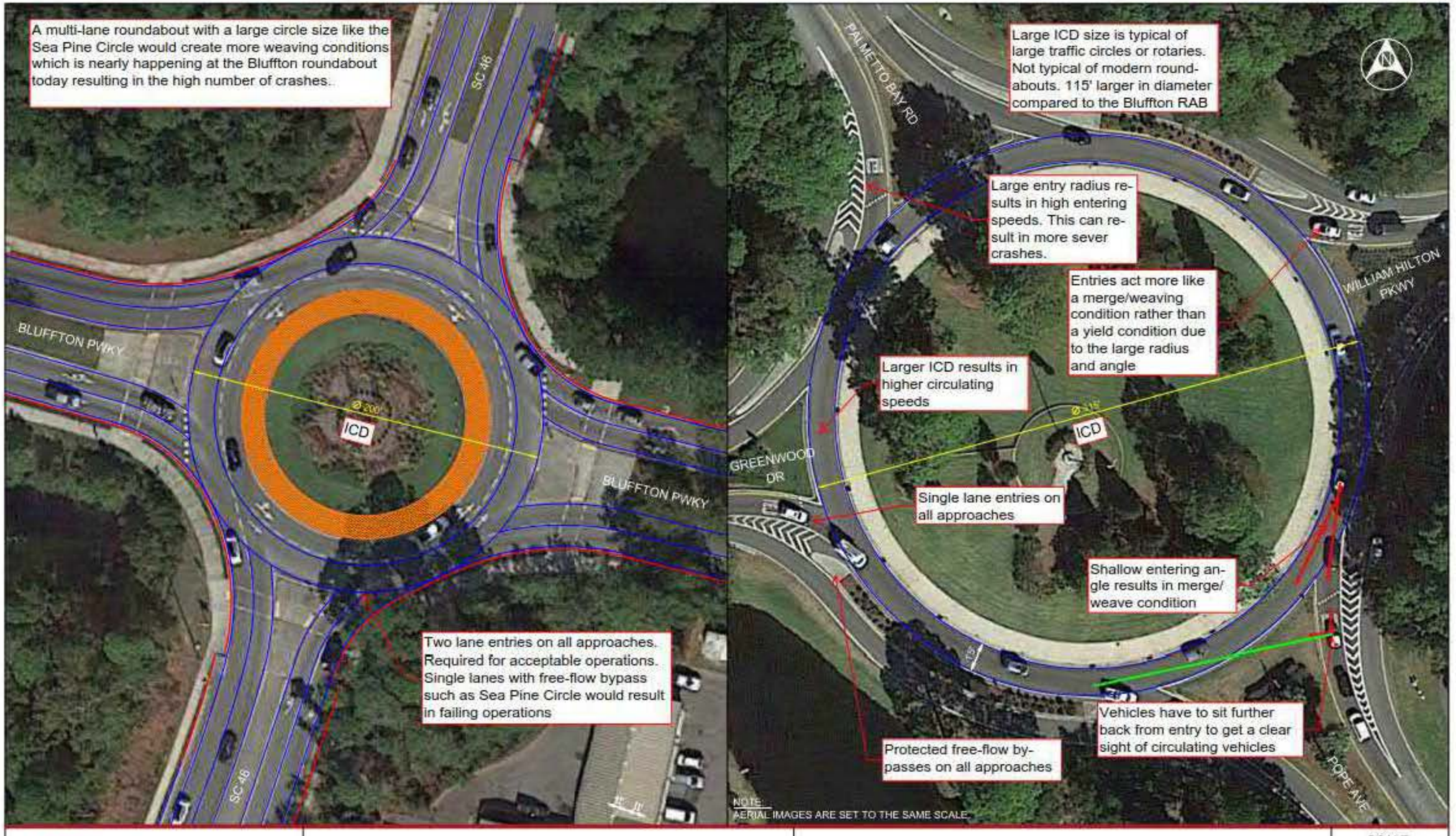
LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle

Site Visit

Ourston conducted a site visit on Tuesday, January 16th, 2018. During the site visit roundabout operations, driver behavior, geometric deficiencies, signing and marking were reviewed to supplement the office review and develop suitable countermeasures. The Sea Pine circle was also visited to compare geometry, driver behavior and operations. The following section summarizes observations made during the site visit to help determine the roundabout's safety deficiencies.

- Drivers had trouble navigating the large conflict area – Drivers had trouble anticipating acceptable gaps to enter
- Poor night time lighting
- No exit guide signs for identification and navigation to downstream destinations
- No overhead lane designation signage for added conspicuity and improved lane choice
- Reduce height of roundabout chevrons on the central island (less that 5ft. is not unreasonable, especially with modern vehicle headlamps
- Shorten exit stripes, so that the lane line does not need to be crossed by a vehicle on the inside (left) lane and exiting.
- The Sea Pine circle is single-lane with free-flow bypasses on all approaches, much larger
    - Queues stretch more than a quarter mile during peak periods
    - The circle would be crash prone if multi-lane
    - It is not possible to reduce the Bluffton roundabout to single lane due to the higher traffic demands there

Further comparison of the Sea Pine circle to the Bluffton roundabout this shown in Exhibit 4.0


A multi-lane roundabout with a large circle size like the Sea Pine Circle would create more weaving conditions which is nearly happening at the Bluffton roundabout today resulting in the high number of crashes.
SC 46
BLUFFTON PWKY
Ø 200'
ICD
BLUFFTON PWKY
Two lane entries on all approaches. Required for acceptable operations. Single lanes with free-flow bypass such as Sea Pine Circle would result in failing operations
SC 46
PALMETTO BAY RD
Large ICD size is typical of large traffic circles or rotaries. Not typical of modern round-abouts. 115' larger in diameter compared to the Bluffton RAB
Large entry radius results in high entering speeds. This can result in more sever crashes.
Entries act more like a merge/weaving condition rather than a yield condition due to the large radius and angle
WILLIAM HILTON PKWY
Larger ICD results in higher circulating speeds
Ø 315'
ICD
GREENWOOD DR
Single lane entries on all approaches
Shallow entering angle results in merge/ weave condition
Vehicles have to sit further back from entry to get a clear sight of circulating vehicles
Protected free-flow by-passes on all approaches
POPE AVE
NOTE:
AERIAL IMAGES ARE SET TO THE SAME SCALE.
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BLUFFTON PARKWAY at SC 46
BLUFFTON, SC
BLUFFTON ROUNDABOUT AND SEA PINE CIRCLE COMPARISON
SCALE
0 25 50
EXHIBIT: 4.0

COUNTERMEASURE ALTERNATIVES

Several countermeasures to improve the safety of the Bluffton Parkway at SC 46 roundabout are presented in this section for consideration by Beaufort County. Countermeasures are organized into low, medium, and high categories. Low countermeasures include improvements that are low-cost or can be implemented immediately. Medium countermeasures are expected to cost more than the low countermeasures, but can likely be implemented at a lower cost than the high counter measures. High countermeasures are expected to incur the most cost, and usually require the most reconstruction of the intersection to implement.

LOW/IMMEDIATE COUNTERMEASURES

An alternative low-cost and immediate solution is to enhance approach signing and markings. Enlarged overhead lane designation signs (see Figure 2 and Figure 3) will mitigate some of the circulating roadway sideswipe collisions by promoting correct lane choice on approaches, as well as, promoting yielding to both lanes. Yield signs could also be enhances with LED indicators to enforce the need to yield on entry, see Figure 5.

Alternatively, Washtenaw County, Michigan has placed a similar sign to Figure 3 in the central island to combat failure to yield crashes at the State Street and Ellsworth Road roundabout, see Figure 4. That sign would require a request to experiment from FHWA (MUTCD).

Figure 2. Overhead Lane Signs

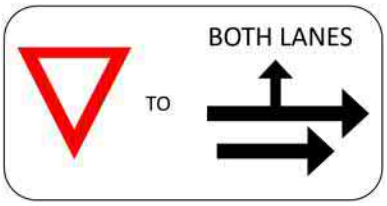

Figure 3. Yield to Both Lanes (Source: Waterloo Region, Ontario)

(Place on overhead lane signs between lane designation signs or under the existing yield signs, or on the central island – Fig 4)

Figure 4. Yield to Both Lanes Sign used in Washtenaw County, MI

Figure 5. LED-enhanced Yield sign (image courtesy of TAPCO)

A further option, to remove the circulating lines and arrows was considered but rejected. The absence of circulating lane lines is thought to mitigate the entering-circulating crash type by creating conditions whereby the entering driver would exercise a slight hesitation before entering, i.e. reducing failure to yield collisions. "By omitting lane lines on the circulating lanes it makes it more difficult for the entering driver to determine which 'lane' the circulating motorist is using, and whether the circulating motorist is preparing to exit. The uncertainty created by the unmarked circulatory lanes should, in a reasonably prudent driver, heighten a sense of caution that results in better yielding performance."[8]

8 Human Factors Assessment Final Report: Homer Watson Boulevard at Block Line Road Kitchener, Ontario, Forbes, G., May 2015

Removing the circulating lane lines is likely to reduce the sideswipe (exiting-circulating) crash type collisions also, since side-by-side travel through the roundabout would appear riskier to drivers. A trade-off of this measure would be the loss of an undetermined percentage of roundabout capacity, since adding circulating lane lines has been shown to improve roundabout capacity in the U.K. Unfortunately, any solution that creates undue congestion is untenable at this location; therefore, removal of the circulatory lane lines is not recommended.

Overhead lane designation signs on each approach is still recommended as an immediate improvement, regardless of what geometric design or marking alterations are contemplated now or later. The fish-hook arrow markings should also be replaced with standard arrow markings. These standard arrows are more legible and more widely recognized by drivers.

An additional low cost countermeasure would be to apply an epoxy surface coloration to outline the conflict area between entering and circulating vehicles (see Exhibit 5.0) This countermeasure hasn't been applied on any roundabouts to date. Highlighting the conflict area to entering drivers would encourage improved yielding and provide a clear indication of how far the driver has to cross to clear circulating traffic. This countermeasure would involve applying an epoxy surface color to the pavement. A "rusty red" color would then mark the conflict area. It would include re-striping circulatory lane lines, and adding in entering lane dots to reinforce lane separation on entry. Two companies, Ennis and TransSafe, provide this color pavement marking treatment that uses a slurry type epoxy that is skid resistance, last for 7 plus years, and allows for custom colors. This product is widely used for coloring bike paths across the country and is approved for use on roadways. Product sheets from both companies are attached in Appendix B. Exhibit 5.0 illustrates these modifications on the existing geometry. Based on the following a request to experiment would need to be submitted to FHWA to test this countermeasure since the coloring of the conflict area is a guide/warning to drivers.

A memorandum from FHWA on the MUTCD Official Ruling on the Application of Colored Pavement, dated August 15, 2013 states: Paragraph 3 of Section 3G.01 in the MUTCD limits the use of colored pavement used as a traffic control device to the colors yellow and white. Interim Approval IA-14 permits the use of green colored pavement for marked bicycle lanes. All other colors for use on highway pavement in the right-of-way are either disallowed or are experimental as described above, unless the colored pavement is a purely aesthetic treatment and makes no discernible attempt to communicate with a roadway user."

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BLUFFTON PARKWAY at SC 46
BLUFFTON, SC

RED COLORED PAVEMENT DIAGRAM

SCALE
0 15 30

EXHIBIT: 5.0

Campaigning for driver education about lane choices and yielding behavior is a low-cost measure that will also serve to relieve the failure to yield and improper lane change issue. Education should also focus on different type of roundabouts particularly concerning the Sea Pine circle. The Sea Pine circle is more like a rotary rather than a modern roundabout, which may be confusing drivers proper driving techniques, i.e. yielding at entry. Rotaries entries act more like a merge condition, similar to on-ramps to major highways; however, modern roundabout entries are yield conditions requiring the driver to yield at the entry and enter the roundabout only when an appropriate gap is available. Appendix C provides examples of hand-outs and flyers that could be used at the time the immediate countermeasures are installed, we recommend the brochures to prepared in Spanish also. We also recommend selective enforcement whereby police officers will give warnings and hand out one of the education brochures.

Medium Countermeasures

2x1 Hybrid Roundabout Design

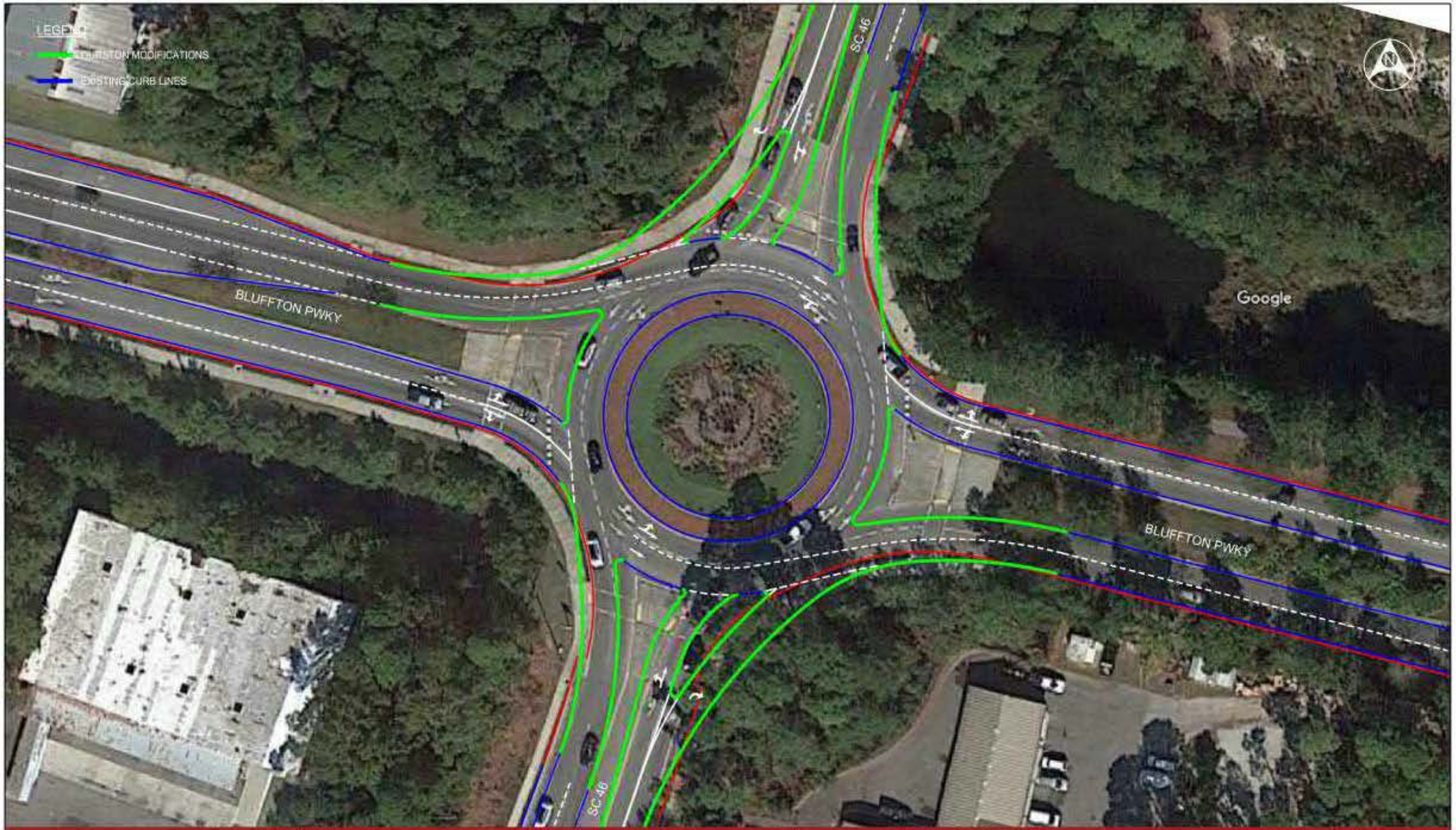
A reduction in lanes was investigated to reduce the number of conflict points. A 2x1 with northbound and southbound yielding bypasses reduces the number of conflict points in the NW and SE quadrants to half, see Exhibit 6.0. Those quadrants exhibit the highest rate of crashes. The design also incorporates improved exit tangents and gradual exit radii. The reduction in conflict area and conflict points, increased speed control on entry, and improved exit path tangents and radii is expected to reduce the complexity of gap-seeking, the failure-to-yield crashes and improper lane change crashes. A comparison of the current and 2x1 roundabout design conflict areas are shown in Exhibit 7.0.

An updated operational analysis was completed to ensure that these modifications would not produce unacceptable operations. The operational analysis was completed in ARCADY 9.0 with a 10% capacity reduction, results are shown in Table 11, detailed reports are in Appendix A. As shown in the table, these modifications will incur oversaturation on some of the approaches during short periods in the PM peak hour. The roundabout then has no residual capacity for any expected future growth. Sensitivity analysis was completed in ARCADY using a 5% capacity reduction instead of a 10% reduction resulting in a residual capacity of 6% and acceptable operations. A 5% capacity reduction would assume drivers are able to navigate the roundabout more efficiently because of the decrease in complexity of the conflict area. It is likely the 2x1 roundabout will operate somewhere in between the 10% and 5% capacity reduction results. At a compounding growth rate of 2% per year the roundabout is expected to operate acceptable for 3 years with a 5% capacity reduction.

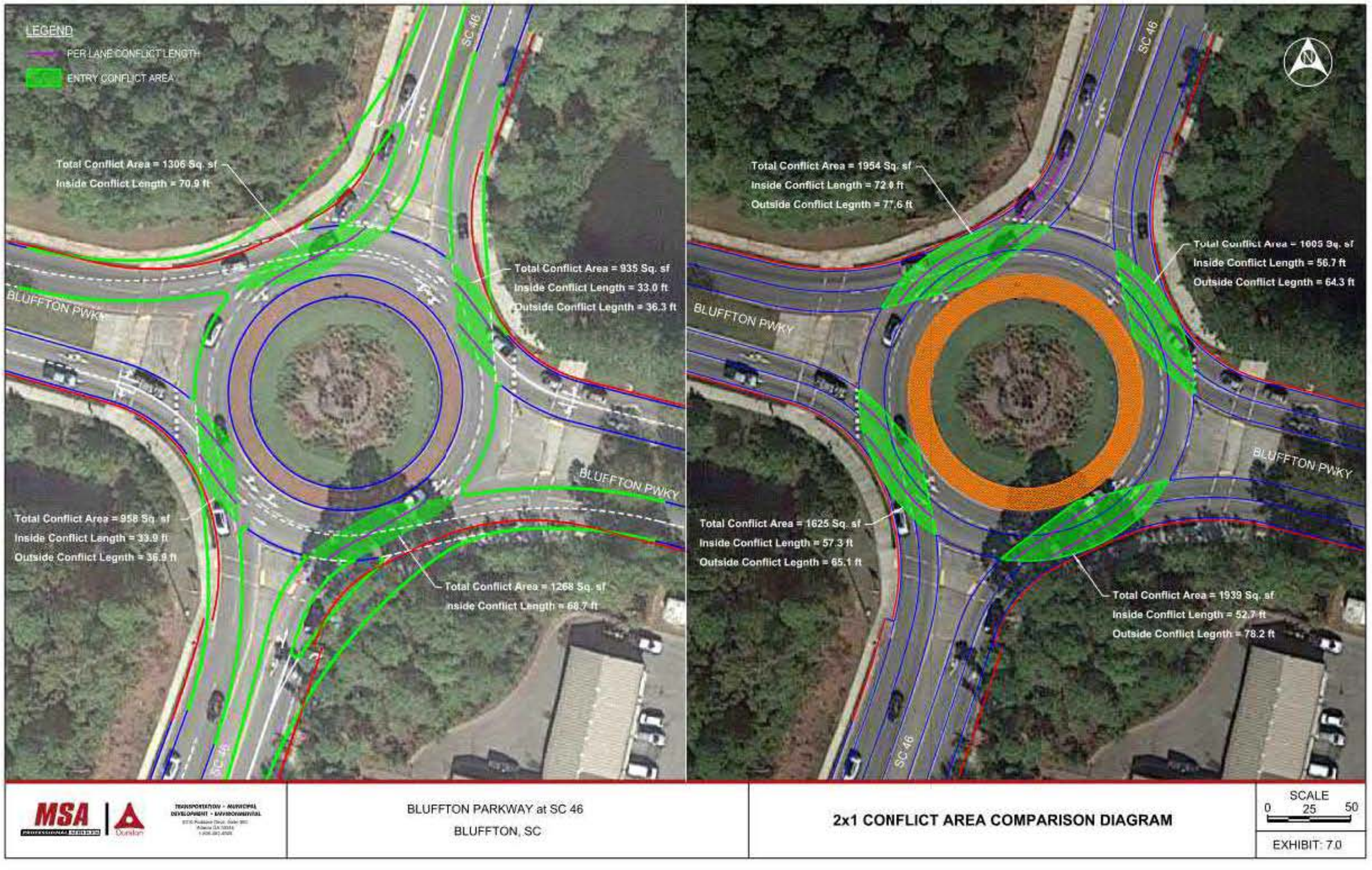
Table 11. 2x1 Roundabout Operational Analysis

			SB SC 46		EB Bluffton Pkwy	NB SC 46		WB Bluffton Pkwy
	Lane Group		LT	R	LTR	LT	R	LTR
ARCADY 9.0	AM Peak	LOS	B	A	B	D	C	A
		Queue (ft)	100	25	725	425	150	50
		v/c	0.45	0.17	0.86	0.78	0.54	0.52
		Delay (s)	**10.1**	**6.7**	**14.3**	**34.9**	**17.7**	**4.6**
	PM Peak	LOS	D	E	A	E	A	C
		Queue (ft)	300	650	75	725	75	650
		v/c	0.72	0.85	0.64	0.86	0.37	0.85
		Delay (s)	**26.5**	**45.5**	**5.8**	**35.6**	**8.7**	**15.4**

LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle



MSA | Dunlop	BLUFFTON PARKWAY at SC 46 BLUFFTON, SC	**2x1 DESIGN DIAGRAM**	SCALE 0 25 50 EXHIBIT: 6.0


LEGEND
PER LANE CONFLICT LENGTH
ENTRY CONFLICT AREA
Total Conflict Area = 1306 Sq. sf
Inside Conflict Length = 70.9 ft
Total Conflict Area = 935 Sq. sf
Inside Conflict Length = 33.0 ft
Outside Conflict Legnth = 36.3 ft
Total Conflict Area = 958 Sq. sf
Inside Conflict Length = 33.9 ft
Outside Conflict Legnth = 36.9 ft
Total Conflict Area = 1268 Sq. sf
Inside Conflict Length = 68.7 ft
Total Conflict Area = 1954 Sq. sf
Inside Conflict Length = 72.8 ft
Outside Conflict Legnth = 77.6 ft
Total Conflict Area = 1605 Sq. sf
Inside Conflict Length = 56.7 ft
Outside Conflict Legnth = 64.3 ft
Total Conflict Area = 1625 Sq. sf
Inside Conflict Length = 57.3 ft
Outside Conflict Legnth = 65.1 ft
Total Conflict Area = 1939 Sq. sf
Inside Conflict Length = 52.7 ft
Outside Conflict Legnth = 78.2 ft
SC 46
BLUFFTON PWKY
N
MSA
TRANSPORTATION - MUNICIPAL
DEVELOPMENT - ENVIRONMENTAL
BLUFFTON PARKWAY at SC 46
BLUFFTON, SC
2x1 CONFLICT AREA COMPARISON DIAGRAM
SCALE
0 25 50
EXHIBIT: 7.0

HIGH COUNTERMEASURES

FULL REBUILD

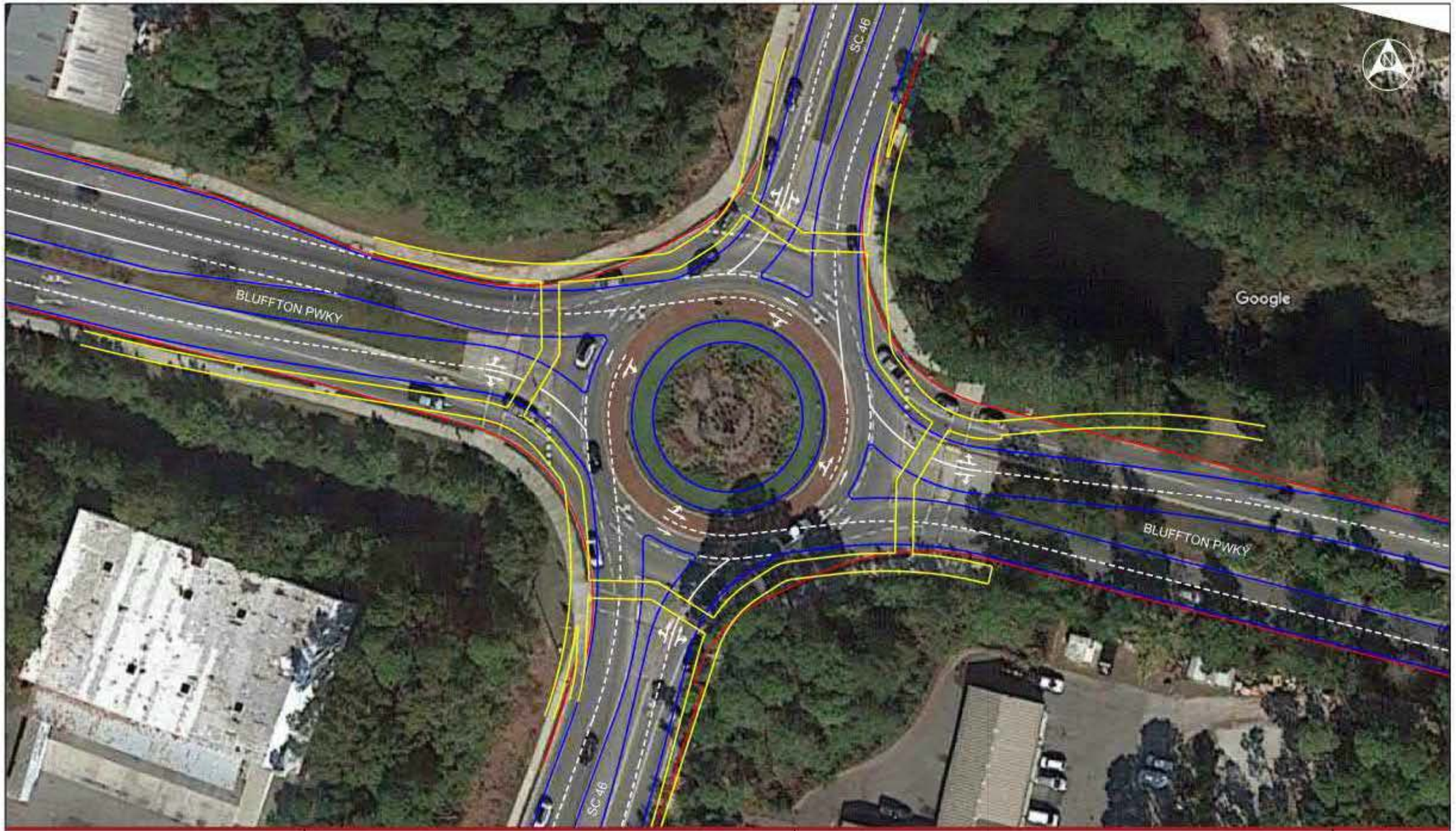
The rebuild alternative is the highest cost option, but provides the ideal geometric design based on current design standards. The redesigned roundabout is able to fit within the existing curb lines and would not require ROW acquisition for its rebuild, see Exhibit 8.0. The roundabout conforms to present day design practices including an offset-left design, 160' ICD, longer path tangents on entry and exit, entry speeds of 28 MPH or less, and reducing vehicle conflict areas. A comparison of the current and full rebuild roundabout design conflict areas are shown in Exhibit 9.0. As seen in this exhibit, conflict areas and conflict path lengths are reduced, especially the outside lane. Vehicles also travel on a tangent through the conflict area rather than curves currently experience in the existing design. By reducing this conflict area, reduced entry speeds, and longer entry and exit path tangents failure to yield and improper lane change crashes are expected to decrease to within national averages. Further driver education is still strongly encouraged with this countermeasure.

An updated operational analysis was completed to ensure that these modifications would not produce unacceptable operations. The operational analysis was completed in ARCADY 9.0 with a 10% capacity reduction results are shown in Table 12, detailed reports are in Appendix A. As shown in the table, the roundabout is expected to operate with acceptable operations. Residual capacity analysis indicates that with an increase of traffic of 16% on all approaches, westbound Bluffton Parkway will begin to experience poor level of service in the PM Peak. At a compounding growth rate of 2% per year the roundabout is expected to operate well for 8 to 10 years, but begin to experience peak hour delays after 8 years.

Table 12. Full Rebuild Roundabout Operational Analysis

			SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
ARCADY 9.0	AM Peak	LOS	A	A	A	A
		Queue (ft)	25	150	50	25
		v/c	0.30	0.78	0.56	0.48
		Delay (s)	**3.8**	**8.7**	**7.8**	**3.8**
	PM Peak	LOS	A	A	A	A
		Queue (ft)	50	25	25	150
		v/c	0.67	0.58	0.60	0.77
		Delay (s)	**9.6**	**4.6**	**6.6**	**9.4**

LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle



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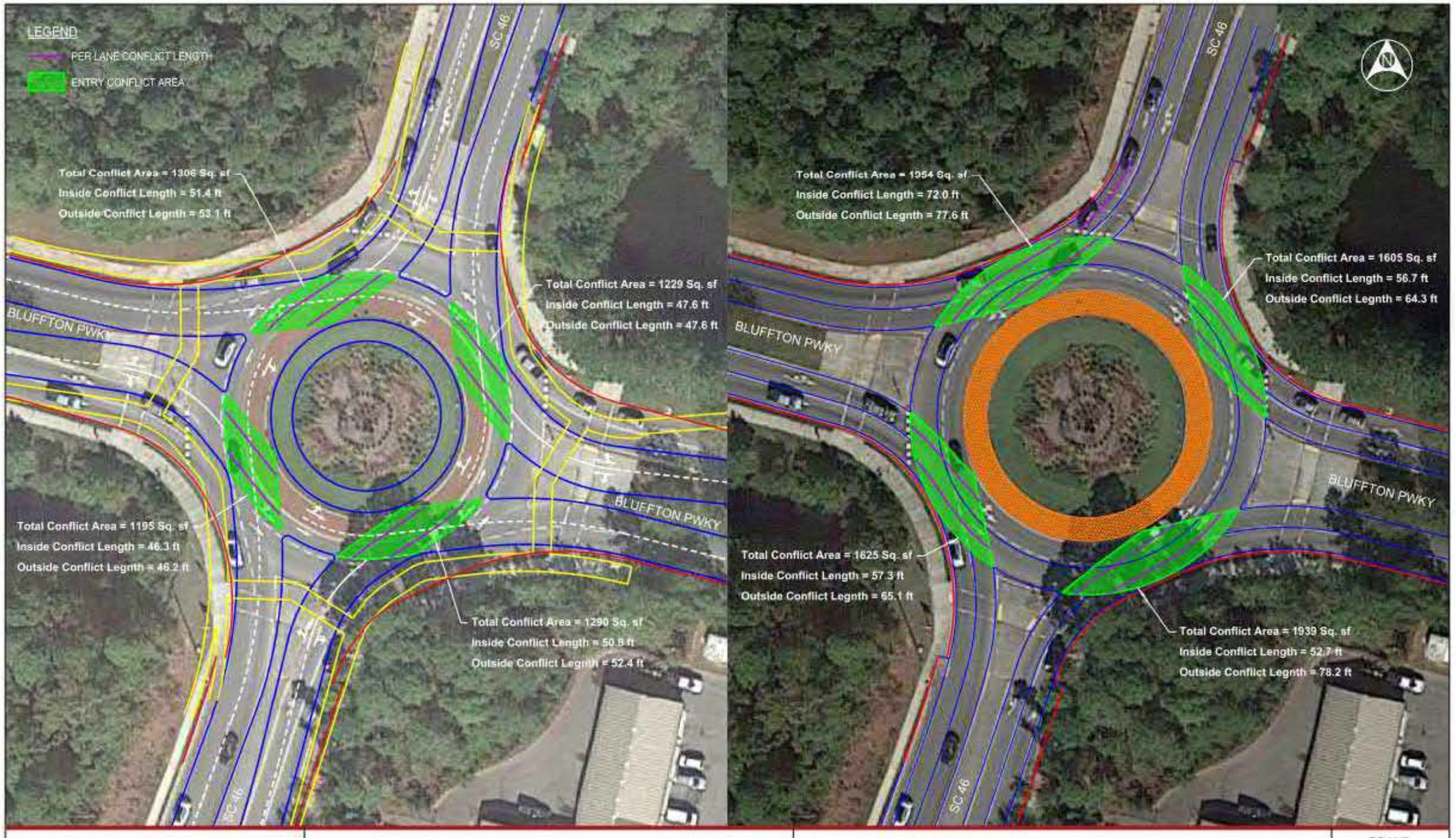
BLUFFTON PARKWAY at SC 46

BLUFFTON, SC

FULL RE-DESIGN DIAGRAM

SCALE 0 25 50

EXHIBIT: 8.0


LEGEND
PER LANE CONFLICT LENGTH
ENTRY CONFLICT AREA
SC 46
BLUFFTON PWKY
Total Conflict Area = 1306 Sq. sf
Inside Conflict Length = 51.4 ft
Outside Conflict Legnth = 53.1 ft
Total Conflict Area = 1229 Sq. sf
Inside Conflict Length = 47.6 ft
Outside Conflict Legnth = 47.6 ft
Total Conflict Area = 1195 Sq. sf
Inside Conflict Length = 46.3 ft
Outside Conflict Legnth = 46.2 ft
Total Conflict Area = 1290 Sq. sf
Inside Conflict Length = 50.8 ft
Outside Conflict Legnth = 52.4 ft
Total Conflict Area = 1954 Sq. sf
Inside Conflict Length = 72.0 ft
Outside Conflict Legnth = 77.6 ft
Total Conflict Area = 1605 Sq. sf
Inside Conflict Length = 56.7 ft
Outside Conflict Legnth = 64.3 ft
Total Conflict Area = 1625 Sq. sf
Inside Conflict Length = 57.3 ft
Outside Conflict Legnth = 65.1 ft
Total Conflict Area = 1939 Sq. sf
Inside Conflict Length = 52.7 ft
Outside Conflict Legnth = 78.2 ft
MSA
Dunlop
TRANSPORTATION - MUNICIPAL
DEVELOPMENT - ENVIRONMENTAL
BLUFFTON PARKWAY at SC 46
BLUFFTON, SC
CONFLICT AREA COMPARISON DIAGRAM
SCALE
0 25 50
EXHIBIT: 9.0

CONCLUSIONS, RECOMMENDATIONS AND APPROXIMATE COSTS

Based on the crash analysis, there is an overrepresentation of sideswipe crashes caused by failure to yield and improper lane changes at the intersection. The higher-than-expected frequency of crashes, of all severities types, indicates a high potential for safety improvement. The NW and SE quadrants of roundabout have the highest percentage of crashes. Findings from this report suggest that deficiencies in the three areas of signing and marking, operations, and geometry are contributors to driver error and the high percentages of crashes.

A 50% reduction of crashes per year would need to be achieved for this roundabout to perform within the range of national expected average number of crashes. This is an ambitious goal for an existing roundabout. Current research into the collision modification benefits of various roundabout safety countermeasures is not well-established in the U.S. Generally, a geometry that conforms to the current guidelines is considered a safer design when accompanied by an aggressive public education/enforcement campaign. Case precedents of crash reduction have been observed for the kinds of improvements that are proposed in this report.

Due to the current geometry of the roundabout and the equal spread of crashes across each approach there is no approved low to medium cost solution that will likely decrease the number of crashes to national averages. It was determined, through discussions with Beaufort County, that SCDOT would likely not pursue testing approval from FHWA for the red colored conflict area pavement marking eliminating this countermeasure. The medium cost, 2x1 roundabout, countermeasure is not considered for implementation because it would suffer from poor operations less than 3 years from construction.

The high cost, full rebuild, countermeasure should be implemented to combat the high number of crashes at this intersection. It is expected that a roundabout that provides ideal geometric design elements based on current design standards will decrease crashes, but as to how much is uncertain. This countermeasure should also include improved signing and markings as described in the low cost countermeasure section. Additionally, selective enforcement by the local Sheriff's office and more widespread driver education will improve awareness and reinforce proper driver behavior at this roundabout. Warnings can be handed out as one of the educational measures. This countermeasure will likely cost $1,500,000 to $2,000,000.

Appendix A – Operational Analyses

Bluffton Parkway at SC 46

ARCADY OPERATIONAL ANALYSIS DOCUMENTATION

STANDARD ROUNDABOUT CAPACITY MODEL

2017
AM Peak Hour

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	103	221	49	0	373
EB Bluffton Pkwy	227	987	118	0	1332
NB SC 46	218	169	143	0	530
WB Bluffton Pkwy	105	585	97	0	787
Total	653	1962	407	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	4	4	4	4	4
EB Bluffton Pkwy	3	3	3	3	3
NB SC 46	7	7	7	7	7
WB Bluffton Pkwy	3	3	3	3	3
Average	4	4	4	4	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	22.00	24.00	22.00	24.00
E - Entry width (ft)	22.00	24.00	22.00	24.00
l' - Effective flare length (ft)	0.0	0.0	0.0	0.0
R - Entry radius (ft)	75.0	85.0	75.0	85.0
D - Inscribed circle diameter (ft)	200.0	200.0	200.0	200.0
PHI - Conflict (entry) angle (deg)	7.5	10.6	7.5	10.9
Exit only	☐	☐	☐	☐
Leg has bypass	☐	☐	☐	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	373	1332	530	787
Max delay (s)	3.99	10.48	7.83	4.08
Max LOS	A	B	A	A
Max 95th percentile Queue (Veh)	1.8	18.0	2.9	1.5
Max V/C Ratio	0.31	0.81	0.56	0.50

2017
PM Peak Hour

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	365	222	87	0	674
EB Bluffton Pkwy	254	603	147	0	1004
NB SC 46	226	308	209	0	743
WB Bluffton Pkwy	200	888	74	0	1162
Total	1045	2021	517	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	1	1	1	1	1
EB Bluffton Pkwy	2	2	2	2	2
NB SC 46	3	3	3	3	3
WB Bluffton Pkwy	1	1	1	1	1
Average	2	2	2	2	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	22.00	24.00	22.00	24.00
E - Entry width (ft)	22.00	24.00	22.00	24.00
l' - Effective flare length (ft)	0.0	0.0	0.0	0.0
R - Entry radius (ft)	75.0	85.0	75.0	85.0
D - Inscribed circle diameter (ft)	200.0	200.0	200.0	200.0
PHI - Conflict (entry) angle (deg)	7.5	10.6	7.5	10.9
Exit only	☐	☐	☐	☐
Leg has bypass	☐	☐	☐	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	674	1004	743	1162
Max delay (s)	9.72	5.02	7.04	10.58
Max LOS	A	A	A	B
Max 95th percentile Queue (Veh)	3.8	2.0	1.8	15.1
Max V/C Ratio	0.67	0.61	0.62	0.79

Residual Capacity

AM Peak Hour

	AM						
	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Network Residual Capacity
	2017						
SB SC 46	1.8	3.99	0.31	A	7.55	A	15 % [EB Bluffton Pkwy]
EB Bluffton Pkwy	18.0	10.48	0.81	B			
NB SC 46	2.9	7.83	0.56	A			
WB Bluffton Pkwy	1.5	4.08	0.50	A			

With an increase of 15% traffic on all approaches, EB Bluffton Pkwy will begin to experience failing results (LOS E, >35 sec of delay).

PM Peak Hour

	PM						
	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Network Residual Capacity
	2017						
SB SC 46	3.8	9.72	0.67	A	8.11	A	14 % [WB Bluffton Pkwy]
EB Bluffton Pkwy	2.0	5.02	0.61	A			
NB SC 46	1.8	7.04	0.62	A			
WB Bluffton Pkwy	15.1	10.58	0.79	B			

With an increase of 14% traffic on all approaches, WB Bluffton Pkwy will begin to experience failing results (LOS E, >35 sec of delay).

2017

AM Peak Hour

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	103	221	49	0	373
EB Bluffton Pkwy	227	987	118	0	1332
NB SC 46	218	169	143	0	530
WB Bluffton Pkwy	105	585	97	0	787
Total	653	1962	407	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	4	4	4	4	4
EB Bluffton Pkwy	3	3	3	3	3
NB SC 46	7	7	7	7	7
WB Bluffton Pkwy	3	3	3	3	3
Average	4	4	4	4	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	12.00	24.00	12.00	24.00
E - Entry width (ft)	14.00	24.00	14.00	24.00
l' - Effective flare length (ft)	130.0	0.0	130.0	0.0
R - Entry radius (ft)	75.0	75.0	75.0	75.0
D - Inscribed circle diameter (ft)	160.0	160.0	160.0	160.0
PHI - Conflict (entry) angle (deg)	20.0	20.0	20.0	20.0
Exit only	☐	☐	☐	☐
Leg has bypass	☑	☐	☑	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	373	1332	530	787
Max delay (s)	10.05	14.29	34.93	4.57
Max LOS	B	B	D	A
Max 95th percentile Queue (Veh)	3.5	28.7	16.8	1.5
Max V/C Ratio	0.45	0.86	0.78	0.52

2017

AM Peak Hour

By-lane Results for Southbound Yielding Right-turn Bypass

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	103	0	0	0	103
EB Bluffton Pkwy	227	987	118	0	1332
NB SC 46	218	169	143	0	530
WB Bluffton Pkwy	105	585	97	0	787
Total	653	1741	358	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	4	4	4	4	4
EB Bluffton Pkwy	3	3	3	3	3
NB SC 46	7	7	7	7	7
WB Bluffton Pkwy	3	3	3	3	3
Average	4	4	4	4	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	12.00	24.00	12.00	24.00
E - Entry width (ft)	14.00	24.00	14.00	24.00
l' - Effective flare length (ft)	130.0	0.0	130.0	0.0
R - Entry radius (ft)	75.0	75.0	75.0	75.0
D - Inscribed circle diameter (ft)	160.0	160.0	160.0	160.0
PHI - Conflict (entry) angle (deg)	20.0	20.0	20.0	20.0
Exit only	☐	☐	☐	☐
Leg has bypass	☐	☐	☑	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	103	1332	530	787
Max delay (s)	6.65	7.65	27.68	4.58
Max LOS	A	A	D	A
Max 95th percentile Queue (Veh)	0.5	7.8	12.7	1.5
Max V/C Ratio	0.17	0.76	0.73	0.52

2017

AM Peak Hour

By-lane Results for Northbound Yielding Right-turn Bypass

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	103	221	49	0	373
EB Bluffton Pkwy	227	987	118	0	1332
NB SC 46	218	0	0	0	218
WB Bluffton Pkwy	105	585	97	0	787
Total	653	1793	264	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	4	4	4	4	4
EB Bluffton Pkwy	3	3	3	3	3
NB SC 46	7	7	7	7	7
WB Bluffton Pkwy	3	3	3	3	3
Average	4	4	4	4	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	12.00	24.00	12.00	24.00
E - Entry width (ft)	14.00	24.00	14.00	24.00
l' - Effective flare length (ft)	130.0	0.0	130.0	0.0
R - Entry radius (ft)	75.0	75.0	75.0	75.0
D - Inscribed circle diameter (ft)	160.0	160.0	160.0	160.0
PHI - Conflict (entry) angle (deg)	20.0	20.0	20.0	20.0
Exit only	☐	☐	☐	☐
Leg has bypass	☑	☐	☐	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	373	1332	218	787
Max delay (s)	8.03	14.29	17.68	3.42
Max LOS	A	B	C	A
Max 95th percentile Queue (Veh)	3.0	28.8	5.3	1.8
Max V/C Ratio	0.40	0.86	0.54	0.45

2017

PM Peak Hour

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	365	222	87	0	674
EB Bluffton Pkwy	254	603	147	0	1004
NB SC 46	226	308	209	0	743
WB Bluffton Pkwy	200	888	74	0	1162
Total	1045	2021	517	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	1	1	1	1	1
EB Bluffton Pkwy	2	2	2	2	2
NB SC 46	3	3	3	3	3
WB Bluffton Pkwy	1	1	1	1	1
Average	2	2	2	2	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	12.00	24.00	12.00	24.00
E - Entry width (ft)	14.00	24.00	14.00	24.00
l' - Effective flare length (ft)	130.0	0.0	130.0	0.0
R - Entry radius (ft)	75.0	75.0	75.0	75.0
D - Inscribed circle diameter (ft)	160.0	160.0	160.0	160.0
PHI - Conflict (entry) angle (deg)	20.0	20.0	20.0	20.0
Exit only	☐	☐	☐	☐
Leg has bypass	☑	☐	☑	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	674	1004	743	1162
Max delay (s)	26.45	5.77	35.58	15.39
Max LOS	D	A	E	C
Max 95th percentile Queue (Veh)	11.6	2.7	28.8	26.2
Max V/C Ratio	0.72	0.64	0.86	0.85

2017

PM Peak Hour

By-lane Results for Southbound Yielding Right-turn Bypass

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	365	0	0	0	365
EB Bluffton Pkwy	254	603	147	0	1004
NB SC 46	226	308	209	0	743
WB Bluffton Pkwy	200	888	74	0	1162
Total	1045	1799	430	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	4	4	4	4	4
EB Bluffton Pkwy	3	3	3	3	3
NB SC 46	7	7	7	7	7
WB Bluffton Pkwy	3	3	3	3	3
Average	4	4	4	4	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	12.00	24.00	12.00	24.00
E - Entry width (ft)	14.00	24.00	14.00	24.00
l' - Effective flare length (ft)	130.0	0.0	130.0	0.0
R - Entry radius (ft)	75.0	75.0	75.0	75.0
D - Inscribed circle diameter (ft)	160.0	160.0	160.0	160.0
PHI - Conflict (entry) angle (deg)	20.0	20.0	20.0	20.0
Exit only	☐	☐	☐	☐
Leg has bypass	☐	☐	☑	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	365	1004	743	1162
Max delay (s)	45.48	4.13	24.03	15.47
Max LOS	E	A	C	C
Max 95th percentile Queue (Veh)	25.6	1.6	18.6	26.7
Max V/C Ratio	0.85	0.56	0.79	0.85

2017

PM Peak Hour

By-lane Results for Northbound Yielding Right-turn Bypass

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	365	222	87	0	674
EB Bluffton Pkwy	254	603	147	0	1004
NB SC 46	226	0	0	0	226
WB Bluffton Pkwy	200	888	74	0	1162
Total	1045	1713	308	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	4	4	4	4	4
EB Bluffton Pkwy	3	3	3	3	3
NB SC 46	7	7	7	7	7
WB Bluffton Pkwy	3	3	3	3	3
Average	4	4	4	4	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	12.00	24.00	12.00	24.00
E - Entry width (ft)	14.00	24.00	14.00	24.00
l' - Effective flare length (ft)	130.0	0.0	130.0	0.0
R - Entry radius (ft)	75.0	75.0	75.0	75.0
D - Inscribed circle diameter (ft)	160.0	160.0	160.0	160.0
PHI - Conflict (entry) angle (deg)	20.0	20.0	20.0	20.0
Exit only	☐	☐	☐	☐
Leg has bypass	☑	☐	☐	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	674	1004	226	1162
Max delay (s)	13.67	5.78	8.67	5.47
Max LOS	B	A	A	A
Max 95th percentile Queue (Veh)	4.7	2.7	2.8	3.5
Max V/C Ratio	0.56	0.64	0.37	0.66

Residual Capacity

AM Peak Hour

	AM						
	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Network Residual Capacity
	2017						
SB SC 46	3.5	10.05	0.45	B	14.99	B	0 % [NB SC 46]
EB Bluffton Pkwy	28.7	14.29	0.86	B			
NB SC 46	16.8	34.93	0.78	D			
WB Bluffton Pkwy	1.5	4.57	0.52	A			

With an increase of 0% traffic on all approaches, NB SC 46 will begin to experience failing results (LOS E, >35 sec of delay).

PM Peak Hour

	PM						
	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Network Residual Capacity
	2017						
SB SC 46	11.6	26.45	0.72	D	18.99	C	0 % [NB SC 46]
EB Bluffton Pkwy	2.7	5.77	0.64	A			
NB SC 46	28.8	35.58	0.86	E			
WB Bluffton Pkwy	26.2	15.39	0.85	C			

With an increase of 0% traffic on all approaches, NB SC 46 will begin to experience failing results (LOS E, >35 sec of delay).

2017
AM Peak Hour

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	103	221	49	0	373
EB Bluffton Pkwy	227	987	118	0	1332
NB SC 46	218	169	143	0	530
WB Bluffton Pkwy	105	585	97	0	787
Total	653	1962	407	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	4	4	4	4	4
EB Bluffton Pkwy	3	3	3	3	3
NB SC 46	7	7	7	7	7
WB Bluffton Pkwy	3	3	3	3	3
Average	4	4	4	4	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	22.00	24.00	22.00	24.00
E - Entry width (ft)	24.00	26.00	24.00	26.00
l' - Effective flare length (ft)	130.0	130.0	130.0	130.0
R - Entry radius (ft)	70.0	70.0	70.0	70.0
D - Inscribed circle diameter (ft)	160.0	160.0	160.0	160.0
PHI - Conflict (entry) angle (deg)	13.2	16.2	14.0	15.8
Exit only	☐	☐	☐	☐
Leg has bypass	☐	☐	☐	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	373	1332	530	787
Max delay (s)	3.84	8.71	7.84	3.79
Max LOS	A	A	A	A
Max 95th percentile Queue (Veh)	1.7	11.8	3.1	1.7
Max V/C Ratio	0.30	0.78	0.56	0.48

2017
PM Peak Hour

Volumes

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Total
SB SC 46	365	222	87	0	674
EB Bluffton Pkwy	254	603	147	0	1004
NB SC 46	226	308	209	0	743
WB Bluffton Pkwy	200	888	74	0	1162
Total	1045	2021	517	0	-

Truck Percentages

From \ To	1st exit	2nd exit	3rd exit	U-Turn	Average
SB SC 46	1	1	1	1	1
EB Bluffton Pkwy	2	2	2	2	2
NB SC 46	3	3	3	3	3
WB Bluffton Pkwy	1	1	1	1	1
Average	2	2	2	2	-

Geometry and Analysis Results

Leg	SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
V - Approach road half-width (ft)	22.00	24.00	22.00	24.00
E - Entry width (ft)	24.00	26.00	24.00	26.00
l' - Effective flare length (ft)	130.0	130.0	130.0	130.0
R - Entry radius (ft)	70.0	70.0	70.0	70.0
D - Inscribed circle diameter (ft)	160.0	160.0	160.0	160.0
PHI - Conflict (entry) angle (deg)	13.2	16.2	14.0	15.8
Exit only	☐	☐	☐	☐
Leg has bypass	☐	☐	☐	☐
Percentage intercept adjustment (%)	90.00	90.00	90.00	90.00
Average Demand (Veh/hr)	674	1004	743	1162
Max delay (s)	9.64	4.57	6.61	9.36
Max LOS	A	A	A	A
Max 95th percentile Queue (Veh)	3.7	1.8	1.6	11.3
Max V/C Ratio	0.67	0.58	0.60	0.77

Residual Capacity

AM Peak Hour

	AM						
	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Network Residual Capacity
	2017						
SB SC 46	1.7	3.84	0.30	A	6.68	A	19 % [EB Bluffton Pkwy]
EB Bluffton Pkwy	11.8	8.71	0.78	A			
NB SC 46	3.1	7.84	0.56	A			
WB Bluffton Pkwy	1.7	3.79	0.48	A			

With an increase of 19% traffic on all approaches, EB Bluffton Pkwy will begin to experience failing results (LOS E, >35 sec of delay).

PM Peak Hour

	PM						
	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Network Residual Capacity
	2017						
SB SC 46	3.7	9.64	0.67	A	7.49	A	16 % [WB Bluffton Pkwy]
EB Bluffton Pkwy	1.8	4.57	0.58	A			
NB SC 46	1.6	6.61	0.60	A			
WB Bluffton Pkwy	11.3	9.36	0.77	A			

With an increase of 16% traffic on all approaches, WB Bluffton Pkwy will begin to experience failing results (LOS E, >35 sec of delay).

Appendix B – Colored Pavement Markings Product Sheets

Color - Safe™

Color Pavement Marking with Anti-Skid Surface

TRAN SAFE
Transportation Safety Products

Color - Safe™

INCREASED SAFETY WITH COLOR PAVEMENT MARKINGS

Cities and municipalities throughout the world are looking for long-term solutions to color pavement markings. Color pavement markings increase safety by alerting motor vehicle operators of special use lanes and increasing visibility in all transportation modals.

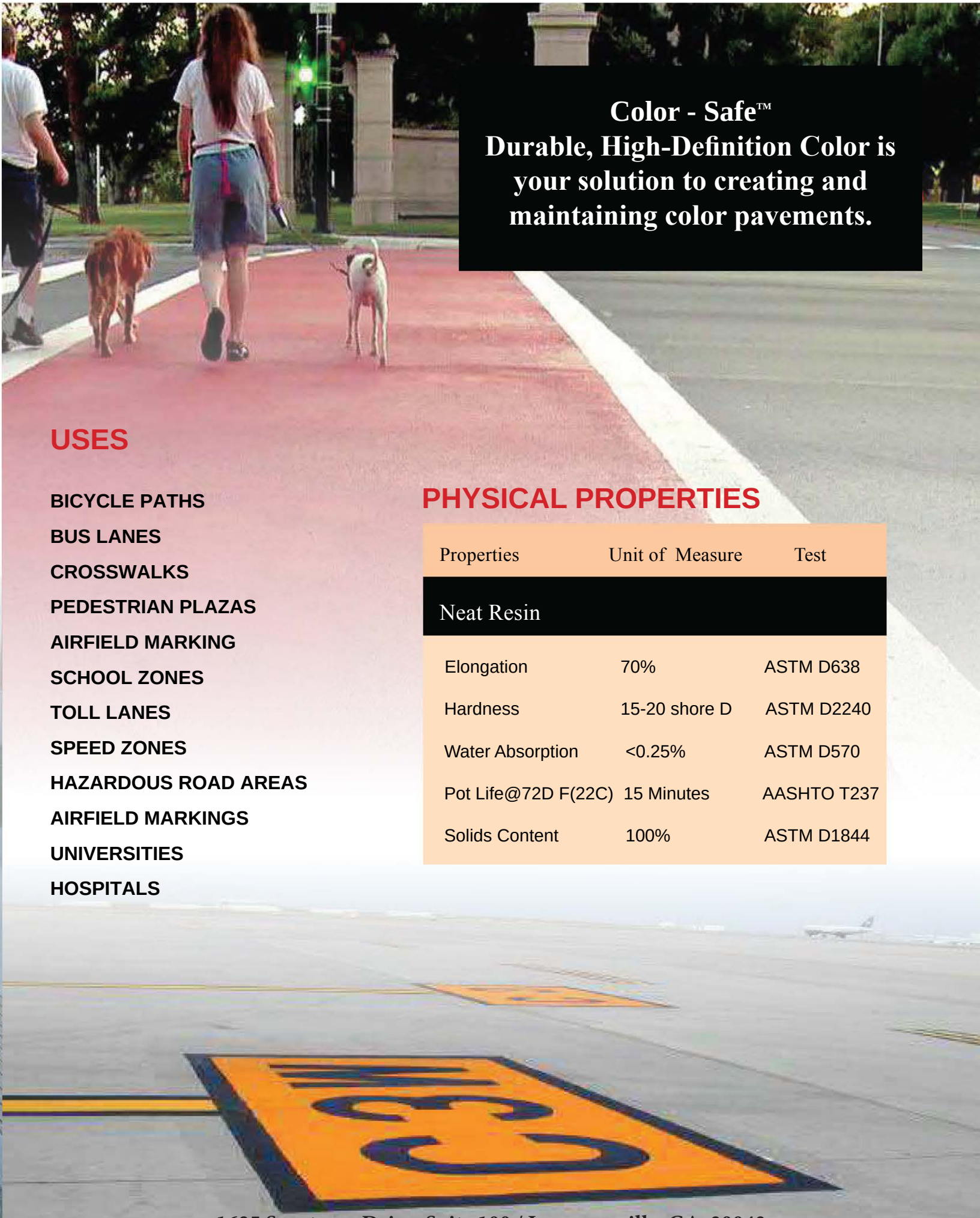
Paint and epoxies do not have the bright color or durability needed and thermoplastic is expensive..... COLOR - SAFE™ IS THE SOLUTION

Color-Safe™ is an acrylic-based material with great adhesion to concrete and asphalt surfaces. It is available in a variety of high-definition colors and aggregate sizes; has excellent color retention; glass beads can be added for increased retro-reflectivity, and its fast cure time allows the surface to be opened to traffic in as little as one hour. Applications are capable of obtaining full cure in a wide range of temperatures and no special equipment is needed.

FEATURES AND ADVANTAGES

- **Variety of Colors and Aggregate Sizes**
- **Durable Skid-Resistant Surface**
- **Alerts Drivers to Special-Use Traffic Lanes**
- **Excellent Color Retention**
- **Easy Application & Fast Cure**
- **Low Life Cycle Cost**
- **Strong Adhesion to Concrete & Asphalt Surfaces**
- **Enhances Traffic Calming**

It is easy to apply and repair and has a low life-cycle cost.



Color - Safe™
Durable, High-Definition Color is your solution to creating and maintaining color pavements.

USES

BICYCLE PATHS
BUS LANES
CROSSWALKS
PEDESTRIAN PLAZAS
AIRFIELD MARKING
SCHOOL ZONES
TOLL LANES
SPEED ZONES
HAZARDOUS ROAD AREAS
AIRFIELD MARKINGS
UNIVERSITIES
HOSPITALS

PHYSICAL PROPERTIES

Properties	Unit of Measure	Test
Neat Resin		
Elongation	70%	ASTM D638
Hardness	15-20 shore D	ASTM D2240
Water Absorption	<0.25%	ASTM D570
Pot Life@72D F(22C)	15 Minutes	AASHTO T237
Solids Content	100%	ASTM D1844

1625 Spectrum Drive, Suite 100 / Lawrenceville, GA 30043
800.969.5103 / 770.962.2222 / Fax: 770.513.8881

Color-Safe™

TRANSAFE Transportation Safety Products

CROSSWALK SAFETY

[PHOTO © Transpo Industries]

Sharing the road with Pedestrians

Transportation authorities around the world have recently been placing a greater emphasis on improving pedestrian safety and are finding MMA acrylic resin based road markings to be an ideal solution, creating visual awareness for all road users. In recent years the number of Americans who use walking as a regular mode of travel has risen to over 107 million. Without counting recreational trips, walking makes up roughly 10.9% of the total 388 billion trips taken by Americans each year. This rising trend makes it important to focus on the safety of the facilities available for pedestrians nationwide. Known for their high durability, increased wet-night visibility, skid resistance and optimal color stability, contrast area markings are increasingly being used to apply bright crosswalks to high traffic areas. These markings not only offer increased safety to pedestrians, but also provide local authorities with a cost-efficient alternative to other road marking systems in the industry. Due to their high durability, road markings based on MMA acrylic resin cost less in maintenance and material costs over the extended lifecycle of the markings. In this newsletter, you will learn how the Colorado Department of Transportation is saving the lives of their pedestrians through a network of highly visible crosswalks using the MMA acrylic resin Color-Safe™ pavement marking and anti-skid surface.

1625 Spectrum Drive, Suite 100 Lawrenceville, GA 30043 / 770-962-2222

Color-Safe™

Bright markings getting the attention of drivers

[PHOTO © Transpo Industries]

Color-Safe™ area markings were recently applied at three intersections along one of the busiest roads in Colorado to increase pedestrian safety. The color stability of the area markings and the retained retro reflectivity of the accent stripes are getting the attention of drivers passing by and are expected to reduce the number of pedestrian vs. vehicle accidents at these locations.

The Colorado Department of Transportation (CDOT) installed, Color-Safe™ bright red crosswalks this past summer at three major intersections in the Denver Metro Area (Colorado Boulevard & East Colfax Avenue, East 14th Avenue, and East Montview Boulevard). These red crosswalks and white accent stripes cover an area of 4,750 ft2 (441.2 m2), with the largest of the three crosswalks spanning six lanes of traffic.

In 2008, similar markings were applied to the intersection of Colorado Boulevard and Louisiana Avenue. Based on the reduction of crashes documented at these crosswalks, CDOT saw an opportunity to evaluate how a more durable area marking would perform at other intersections with high crash statistics. Having had experience using MMA acrylic resin road marking for various other applications and impressed with the thin millage at which the MMA acrylic resin area markings could be applied, CDOT determined this system would be the most beneficial system for the three additional crosswalks along Colorado Boulevard. “The new friction-grip material is more for durability,” said Bryan Allery, CDOT Traffic Engineer, PE II. “We want that to stand out and to last longer.”

CDOT has stated that the newly applied bright red crosswalks are getting the attention of drivers. They have received many calls commenting on the brightness of the markings, to which CDOT replied “We are glad you noticed. It’s supposed to get your attention.” The awareness generated by these crosswalks has led to a decrease in pedestrian vs. vehicle accidents since the first installation in 2008. “It’s certainly not going to solve all the problems,” Bryan Allery stated. “It does draw attention to motorists as they are approaching these crosswalks, and it’s also proven through Colorado Boulevard and Louisiana Avenue that they are helping.”

Saving lives one crosswalk at a time

The number of pedestrian vs. vehicle crashes have been documented by CDOT over the years and a decrease has been seen since the installation of bright red crosswalks at the various intersections in Colorado. Prior to 2008, when the red crosswalks were initially installed at the intersection of Colorado Boulevard and Louisiana Avenue, there was an average of two people struck each year by oncoming vehicles, with one year having five people struck. Since installed, the red crosswalks have alerted drivers and, as a result, there has only been three people hit within the past three years. Although more years of post-installation data is needed, CDOT is optimistic that the use of these area markings for visual awareness will continue to increase safety.

At the intersection of Colorado Boulevard and East Colfax Avenue, where Color-Safe™ was recently applied, there have been five people hit while crossing the road within the last three years. CDOT foresees that the newly applied crosswalks will have the same effect seen at the intersection of Colorado Boulevard and Louisiana Avenue. In addition to the interest generated by pedestrians and motorists traveling through these intersections, the red crosswalks based on wet-night visibility, skid resistance and optimal color sparked local news coverage in the months following their application. Highlighting the brightness and safety aspects of these markings, various local news stations recognized CDOT for their dedication to improving the safety of all road users at intersections in Denver.

1625 Spectrum Drive, Suite 100 Lawrenceville, GA 30043 / 770-962-2222

TRANSAFE Transportation Safety Products

Transpo Industries, Inc. manufactures a variety of innovative products and materials designed for improving road safety and bridge preservation. The company's reputation as an expert in rehabilitation, preservation and safety products has made Transpo a leading supplier since 1968.

www.transafeproducts.com

Color-Safe®

PAVEMENT MARKING

Durable and High Definition Color

Color-Safe® is a Methyl Methacrylate (MMA) based material used for color pavement marking.

Color-Safe® is typically used for demarcation of bike lanes, pedestrian areas, bus lanes and other specially designated areas. A variety of supplied aggregates will create appropriate skid resistance for the application, vehicular traffic and specification requirements.

Color-Safe® can be applied by hand with squeegees and rollers or with automatic spray equipment and cures without requiring external heat sources.

Color-Safe® is capable of full cure in a wide range of temperatures allowing for a longer marking season.

PHYSICAL PROPERTIES*

Properties	Unit of Measure	Test
Neat Resin		
Tensile Strength	500-1000 psi (3.4-6.9 MPa)	ASTM D638 Type I
Elongation	>30%	ASTM D638 Type I
Hardness	55-60 Shore D	ASTM D2240
Water Absorption	<0.25%	ASTM D570
Pot Life @72°F (22°C)	15 Minutes	AASHTO T237
Solids Content	100%	ASTM D1644
Aggregate		
Hardness	7.0	Mohs Scale

*To be used as general guidelines only

Color-Safe® enhances your safety program with high visibility color and increased service life.

SAFER TRANSPORTATION THROUGH INNOVATION

1625 Spectrum Drive, Suite 100 / Lawrenceville, GA 30043 / 800.969.5103

Color-Safe®

PAVEMENT MARKING

Features and Advantages

- Excellent Color Retention and Durability
- High Visibility Color Increases Motorist Awareness
- Available in a Variety of Colors and Aggregate Sizes
- Easy Application
- Fast Cure Time (30 min at 70° F)
- Wide Application Temperature Range (40°-100° F)
- Low Life Cycle Cost
- Ability to Adhere to Both Concrete and Asphalt Surfaces

Application Process

Surfaces receiving Color-Safe® must be thoroughly cleaned and free of all dirt. Contaminates that might interfere with the proper adhesion of the material must be removed by sand blasting or shot blasting.

Color-Safe® is made up of resin, powder hardener and aggregate. These components must be mixed thoroughly for uniform curing and performance.

Color-Safe® is applied by either the mixed resin and aggregate method or the spray/broadcast aggregate method. Refer to the technical data sheet for application details.

No special equipment is required for installation.

Applications

Transpo's Color-Safe® can be used as an anti-skid surface and/or for demarcation.

- Bike Lanes and Bike Boxes
- Pedestrian Refuge and Plaza
- Toll Lanes
- Bus Lanes
- Airfields
- Crosswalks
- Roundabouts
- High Friction Surface Treatments

Standard and Custom Colors

Transpo's Color-Safe® has many standard color options as well as custom colors available upon request.

- Bike Lane Green
- Bus Lane Red
- Buff
- Traffic Yellow
- White
- Black
- Pink
- Handicap Blue
- Orange
- Red

TRAN SAFE
Transportation Safety Products

Need More Information?

1625 Spectrum Drive, Suite 100
Lawrenceville, GA 30043
800.969.5103 / 770.962.2222
Fax: 770.513.8881

www.transafeproducts.com

SYRACUSE, NY

Color-Safe®

Color-Safe®

16 lanes – BEFORE Color-Safe

16 lanes – AFTER Color-Safe

STANDARD COLORS
AND CUSTOM COLORS!

TRAN SAFE
Transportation Safety Products

Color-Safe®
Methyl Methacrylate (MMA)
Resin System

Why Choose Color-Safe® MMA over Thermoplastic?

COMPARISON

Color-Safe® MMA
vs.
Hot applied Thermoplastic

	COLOR-SAFE® MMA	Applied Thermoplastic
Adhesion to Concrete	EXCELLENT	Poor
Life Cycle	6 - 10 YEARS	3 - 5 Years
Refresh or Removal	REFRESH	Full Removal
UV Stable	YES	No
Cure Time	20 - 40 MIN.	Wait for Cooling
Adhesion to Self	YES	No
Working Hazards	NONE	Potential Burns
Specialized Equipment Needed	NO	Yes

Call today to find out how cost effective Color-Safe® MMA can be.

Transpo Industries Inc.
20 Jones Street
New Rochelle, NY 10801

TRANSAFE, INC
1625 Spectrum Drive, Suite 100
Lawrenceville, GA 30043
770.962.2222 / 800.969.5103

www.transpo.com

Office: 914-636-1000
Fax: 914-636-1282
info@transpo.com

Technical Data Sheet

COLOR-SAFE® Color Pavement Marking and Anti-Skid Surfacing

Color-Safe® is a Methyl Methacrylate (MMA) resin system used for pavement area markings and anti-skid surfacing. It is a plural component, liquid applied MMA and catalyst, capable of full cure in a wide range of temperatures without requiring external heat sources. Color-Safe® is typically used for demarcation of crosswalks, bicycle paths, bus lanes and other specially designated areas. It can also be used as a surface to enhance skid resistance on hazardous turns and other areas prone to accidents. It can be applied to either concrete or asphalt using two different methods: mixed resin/aggregate method or spray/broadcast aggregate method. Resin formulations are available in 98:2 and 1:1 ratios to accommodate different types of application equipment. If using glass beads, they must be coated for use with MMA materials.

Application Procedure

Surface Preparation: All surfaces that are to receive Color-Safe® must be thoroughly clean, dry, and free of all dirt, grease, and other contaminates that might interfere with proper adhesion. Clean the pavement surface using high sand blasting or shot blasting. All damaged or deteriorated surfaces must be repaired before applying Color-Safe®. The surface should be visibly dry and the moisture content should be tested according to ASTM D4263 (modified to 2 hours). New asphalt shall have been placed for a minimum of 30 days prior to installation of Color-Safe® and surface oils should not be present. The temperature of the pavement and air should be between 40ºF-100ºF and 5°F above the Dew Point temperature. Relative humidity should be 75% RH maximum. For colder or warmer application temperatures contact a Transpo representative for recommendations on hardener mix ratios.

Mixed Resin and Aggregate Application Method

Mixing and Application

Primer Application [For Concrete Applications ONLY]:
All areas to be coated with Color-Safe® should be masked prior to application. Mix the un-pigmented Color-Safe® primer and hardener (refer to Table 1 for appropriate hardener quantities) for approximately 30 seconds and apply it to the surface that will receive the Color-Safe®. Primer can be applied using 1/4" nap rollers. Application rate should be approximately 80 square feet per gallon however coverage on rough or porous surfaces will be less. After the primer is applied and before it cures, remove all masking.

Mixing: Transpo Color-Safe® resin comes in three components (Color-Safe® pigmented resin, powder hardener, and supplied pre-packaged aggregate). Thorough and complete mixing of these components with a drill mounted paddle mixer is vital for uniform curing and performance. Air/substrate temperature determines the amount of hardener used; refer to Table 1 for the appropriate amount of hardener to be added to the Color-Safe® resin. Using clean, dry plastic buckets, add hardener to Color-Safe® resin and mix until dissolved (approximately 30 seconds) and then add and thoroughly mix the pre-packaged aggregate. After mixing, the Color-Safe® must be applied to the pavement immediately.

Table 1: Hardener per 2 Gallons of Color-Safe® Primer or Resin

Temp ºF(ºC)	Weight %	Grams	Packets (120 g each)
40-59 (0-15)	3	360	3
60-89 (15-32)	2	240	2
90-100 (32-38)	1	120	1

Resin/Aggregate Application: Before mixing and applying the Color-Safe®/Aggregate apply the masking to the area to be coated. Pour the mixed material onto the pavement surface and spread evenly with 3/16" notched squeegees at a rate of approximately 24 square feet per gallon. The surface can be back rolled with 1/4" nap rollers to give a uniform even finish. After the application and before the material cures, remove the masking. At the onset of rain, installation shall cease until the substrate is sufficiently dry to the satisfaction of the engineer. Application of markings** must be completed before contamination of the substrate occurs.

Before applying any line striping or symbols; confirm compatibility of materials with manufacturer
Color-Safe® may be used for application of line striping and symbols

Spray/Broadcast Aggregate Application Method

Mixing and Application

It is important to use the resin formulation that matches the mixing ratio of the equipment that will be used for the application.

Spray applications using a 98:2 formulation with equipment that does not automatically proportion the hardener requires the resin and hardener to be premixed. It is very important that small quantities be mixed as the time available to spray the material is limited and further reduced by high ambient temperatures. The Color-Safe® resin and the powder hardener should be mixed for 30 seconds before adding to the spray equipment. Refer to Table 2 for hardener mixing ratios. If there is an interruption in the spray application the equipment should be cleaned with solvent to prevent material from curing and creating clogging.

Spray applications using a 98:2 formulation with equipment that automatically adds proportioned hardener does not require premixing. The Color-Safe® resin is the same for all 98:2 applications however for this type of equipment the hardener will be a liquid. Random checks should be performed to make sure the hardener ratio is consistent. Application interruptions do not require the equipment to be cleaned prior to the resumption of application.

Spray applications using a 1:1 formulation with equipment that mixes equal parts of resin with hardener prior to the spray head require resin different than 98:2 material. Color-Safe® part A resin will be added to the equipment without any hardener added. Color-Safe® part B is a completely different resin and the powder hardener is to be added to this resin and mixed for 30 seconds prior to adding to the equipment. Refer to Table 3 for the hardener mixing ratios. Applications do not require the equipment to be cleaned prior to the resumption of application.

Primer Application [For Concrete Applications ONLY]:
All areas to be coated with Color-Safe® should be masked prior to application. Refer to Tables 2 and 3 for the appropriate hardener/primer mixing ratios. Application rate should be approximately 80 square feet per gallon however coverage on rough or porous surfaces will be less. After the primer is applied and before it cures, remove all masking. Immediately after primer application, broadcast the supplied aggregate onto the surface at a rate of ½ pound per square foot. After the aggregate is applied and before the material cures, remove all masking

Base Coat/Aggregate Application [For Asphalt Applications ONLY]: All areas to be coated with Color-Safe® should be masked prior to application. Note that the Color-Safe® resin and hardener are identical for both pigmented base coat and pigmented top coat applications. Refer to Hardener Mix Ratio Tables for the appropriate hardener/resin mixing ratios. Base coat application rate should be approximately 60 square feet per gallon however coverage on rough or porous surfaces will be less. Under compacted asphalt will absorb the base coat and coverage could be 40 square feet per gallon or less. Immediately after base coat application, broadcast the supplied aggregate onto the surface at a rate of ½ pound per square foot, assuring all coated areas are covered with aggregate. After the Base Coat/Aggregate is applied and before it cures remove all masking.

Top Coat Application: Before applying the Color-Safe® top coat remove all un-bonded aggregate from the primed surface using brooms or dry compressed air. Reapply the masking in the area to be coated. Make sure that all of the broadcast aggregate is covered with the Color-Safe® resin top coat; application rate should be approximately 40 square feet per gallon. The surface can be back rolled with ¼" nap rollers to give a uniform even finish. After the Color-Safe® is applied and before it cures, remove all masking. At the onset of rain, installation shall cease until the substrate is sufficiently dry to the satisfaction of the engineer. Application of markings** must be completed before contamination of the substrate occurs.

Before applying any line striping or symbols; confirm compatibility of materials with manufacturer
Color-Safe® may be used for application of line striping and symbols

Table 2: Hardener per Gallon of Color-Safe® Primer and Resin (98:2 spray equipment without automatic proportioning)

Temp ºF(ºC)	Weight %	Grams	30 g Packets
40-59 (4-15)	4-3	240-180	8-6
60-89 (15-32)	2-1	120-60	4-2
90-100 (32-38)	1-.5	60-30	2-1

Table 3: Hardener per Gallon of Color-Safe® Primer and Resin (1:1 spray equipment)

Temp ºF(ºC)	Weight %	Grams	120 g Packets
40-59 (4-15)	8-6	480-360	4-3
60-89 (15-32)	6-4	360-240	3-2
90-100 (32-38)	2	120	1

Table 4: Physical Properties* of Color-Safe®

Property	Unit of Measure	Test
Resin		
Elongation	30% min	ASTM D638 Type I
Hardness	55-60 Shore D	ASTM D2240
Water Absorption	0.25% max	ASTM D570
Pot Life	15 minutes @ 72°F (22°C)	AASHTO T237
Flash Point	50°F (10°C)	ASTM D1310
Solids Content	99%	ASTM D1644
Aggregate		
Specific Gravity	2.65	ASTM C128
Hardness	7.0	Mohs Scale

*To be used as general guidelines only

Storage

Materials shall be kept in dry protected areas between 40°F – 80°F out of direct sunlight, protected from open flame. Hardener component shall be stored separately from other materials. Manufacturer's specific label instructions and prudent safety practices for storage and handling shall be followed at all times. Materials shall be suitable for use for six months after the date of receipt when stored in accordance with the manufacturer's instructions.

Caution

The binder shall be 100% reactive, solvent-free, acrylic vehicle. Blends with other resins or liquid vehicles shall not be permitted. Coarse aggregate shall be part of the formulation to provide for skid resistance.

Warranty

The following warranty is made in lieu of all other warranties, either expressed or implied. This product is manufactured of select raw materials by skilled technicians. Neither seller nor manufacturer has any knowledge or control concerning the purchaser's use of the product and no warranty is made as to the result of any use. The only obligation of either seller or manufacturer shall be to replace any quantity of this product that proves to be defective. Neither seller nor manufacturer assumes any liability for injury, loss, or damage resulting from use of this product.

Standard & Custom* Colors

- Traffic Yellow
- Bike Green
- Red
- Pink
- Blue
- White
- Black

*Custom Colors available upon request

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TRANSAFE, INC
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MMAX Area Markings

Specialized Lane delineation

PRODUCT DATA

Product Type: MMA Area Markings with Anti-Skid
Product Code: 999660TC-KIT
Product Color: Terra Cotta
Effective Date: September 2014

Product Description:
MMAX Area Marking products conveniently combine state-of-the-art Methyl Methacrylate resins with hardwearing aggregate and premium pigments to deliver an extremely durable, highly visible and color stable lane delineation treatment that meets the non-slip requirements needed for pedestrians, cyclists and vehicles.

Terra Cotta colored MMAX Area Markings can be used to delineate bus lanes, or other specialty applications, where a durable area marking is required.

Product Advantages:
- Kitted for consistent on-site mixing and convenience
- Very Durable
- Color stable
- Fast back to traffic
- Non-slip surface
- Easy to apply
- Can be inlaid
- 100% solids

Packaging:
Each MMAX area marking kit mixes to approximately 2.79 gallons and covers approximately 45-50 sq. ft. @ 90 mils build thickness.

One Kit includes:
- MMAX Resin(Pre-pigmented) : 2 gallons / 7.57 liters
  - *Supplied in 5 gallon pail for easy mixing*
- MMAX Aggregate: 1 – 25.0 lbs / 11.34 kg bag
- Catalyst*: 8 fl. oz. / 236 ml (.52 lbs / 0.24 g)

Storage:
Keep Cool. Keep in dry protected areas between 40°F – 80°F, out of direct sunlight and protected from open flame. Use within six months of receipt.

Product Characteristics		Test
Binder Resin		
Density	8.1 +/- .35	Lbs/Gal
Tensile	> 400 psi	ASTM D638
Elongation	> 180%	ASTM D638
Flash Point	> 10°C	ASTM D1310
Aggregate		
Hardness	9	Mohs Scale
Preferential Lane Treatment		
Density	18.5 +/- 0.5	Lbs/Gal
Build Thickness	90 +/- 10	Mils
VOC	< 100	Grams/Liter
Pot Life	~15min	AASHTO T237
Solids	> 99% (cured)	ASTM D2369
Skid	> 60	ASTM E303
Hardness	50-60	ASTM D2240
Water Absorption	< 0.25%	ASTM D570
Cure Time	< 30	Minutes

Other:
*Amount of catalyst used is dependent on ambient and road temperatures. Each kit is supplied with the maximum amount of catalyst that would be required. Refer to Application Instructions.

Appendix C – Educational Brochure Examples

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Driving a Roundabout
Turn by Turn

- Observe all standard road rules, including yielding for pedestrians in crosswalks.
- To safely and efficiently drive a roundabout:
  - Slow down.
  - Read advance signing and choose correct lane.
  - Yield to traffic in all lanes on your **left** before entering.
  - Stay in your lane to your exit.

Always obey the signs and markings

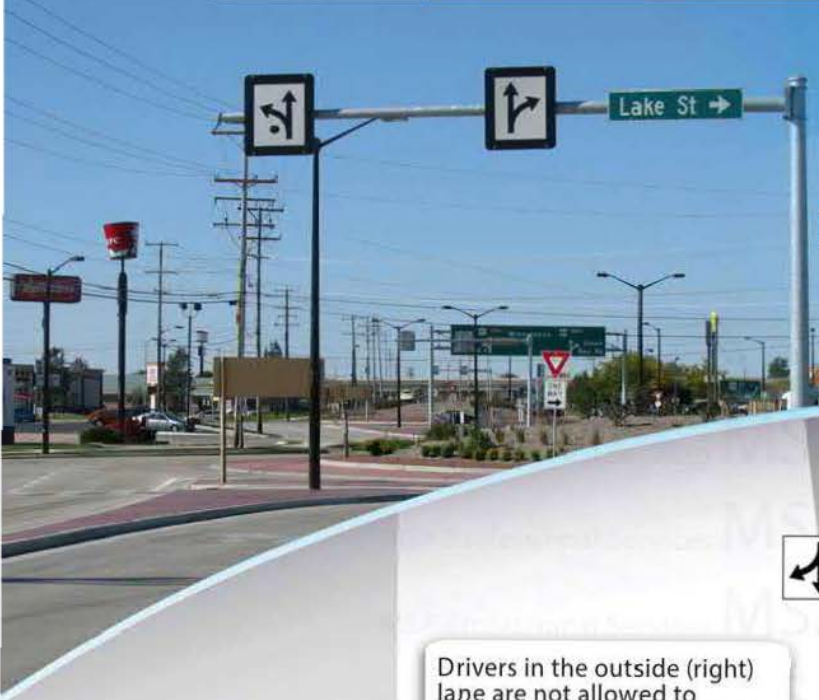
As you get closer to the roundabout entrance, it is very important to observe the signs and arrows to determine which lane to use before entering a roundabout. Signs above the road and white arrows on the road will show the correct lane to use.

Roundabout ahead, slow down.

Guide signs near the entry to a roundabout show lane designations.

Yield to all traffic in the roundabout.

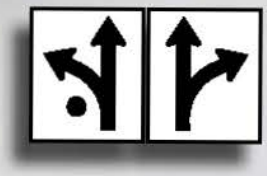
Roundabout traffic travels one-way.



How to Drive Through a Roundabout

CHOOSE YOUR LANE

BEFORE ENTERING A ROUNDABOUT



As with any other intersection, the proper lane must be chosen before entering a roundabout.

In advance of the roundabout, signs and pavement markings will always indicate which lanes may be used for the direction you want to go.

Keep left to turn left through the roundabout and keep right to turn right.

Never change lanes within a roundabout.

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Drivers in the outside (right) lane are not allowed to turn left, they must exit the roundabout. Drivers in the left lane may exit or turn left.

In this type of crash, the driver of the RED car is at fault for failing to obey the lane use signs and choosing the incorrect lane.

Drivers wishing to turn left **must** be in the left (inside) lane before entering the roundabout.

Multiple **signs and** pavement **markings on** every **approach remind** drivers **of the need to** choose **the proper lane.**

Failure **to use the** proper **lane can result** in a ticket **or a crash.**

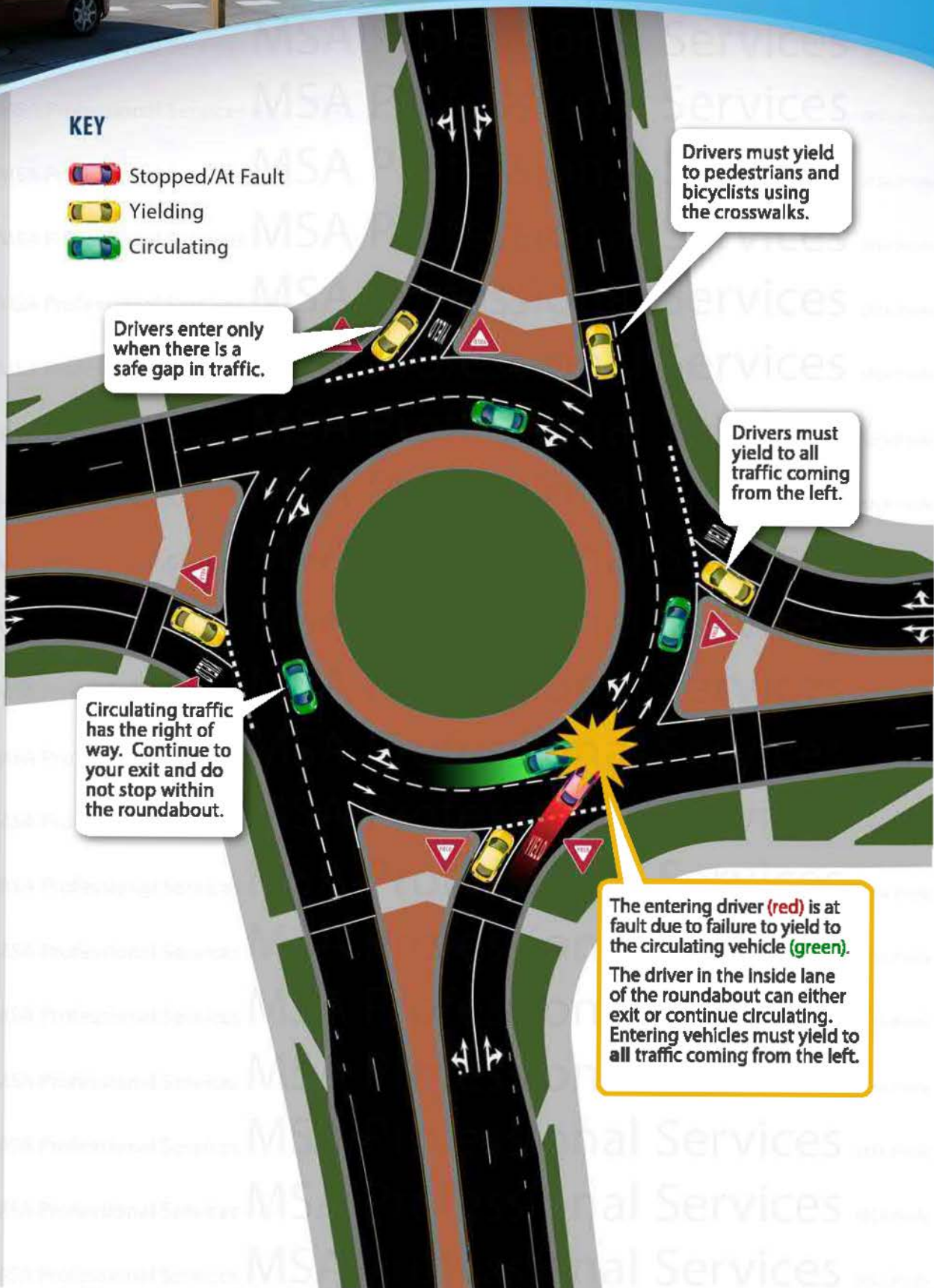
How to Drive Through a Roundabout

ALWAYS YIELD
TO ALL CIRCULATING TRAFFIC

YIELD
The "Golden Rule" of roundabouts.

Drivers entering a roundabout must yield to circulating traffic, pedestrians and bicyclists.

Drivers in the circle have the right of way. A motorist approaching a roundabout should wait for a safe gap in traffic before entering.



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Bluffton Parkway at SC 46 Roundabout In-Service Review

Mark Lenters – Ourston

Study Methodology

1. Collision Analysis
2. Geometric Conformance Review (cursory)
3. Operational Analysis (cursory)
4. List of Identified Deficiencies (Office Review)
5. Site Visit – verification of deficiencies
6. Development of Countermeasures
7. Documentation/Reporting

Before and After Striping Change Crash Analysis

	AADT	Total crashes per year	Crash Rate	Quadrant Crash Rate				FYRW/IMP LC %
				NE	SE	SW	NW	
Before	14,500	35.8	6.9	2.9	2.8	0.9	1.6	38/62 %
After	22,000	30.8	4.0	1.4	1.5	1.1	1.5	42/58 %

- Reduction of ~6 crashes per year
- Quadrant Crash Rate stabilized around 1.3 even with an increase in volume
- However, roundabout is still crash prone and above national averages

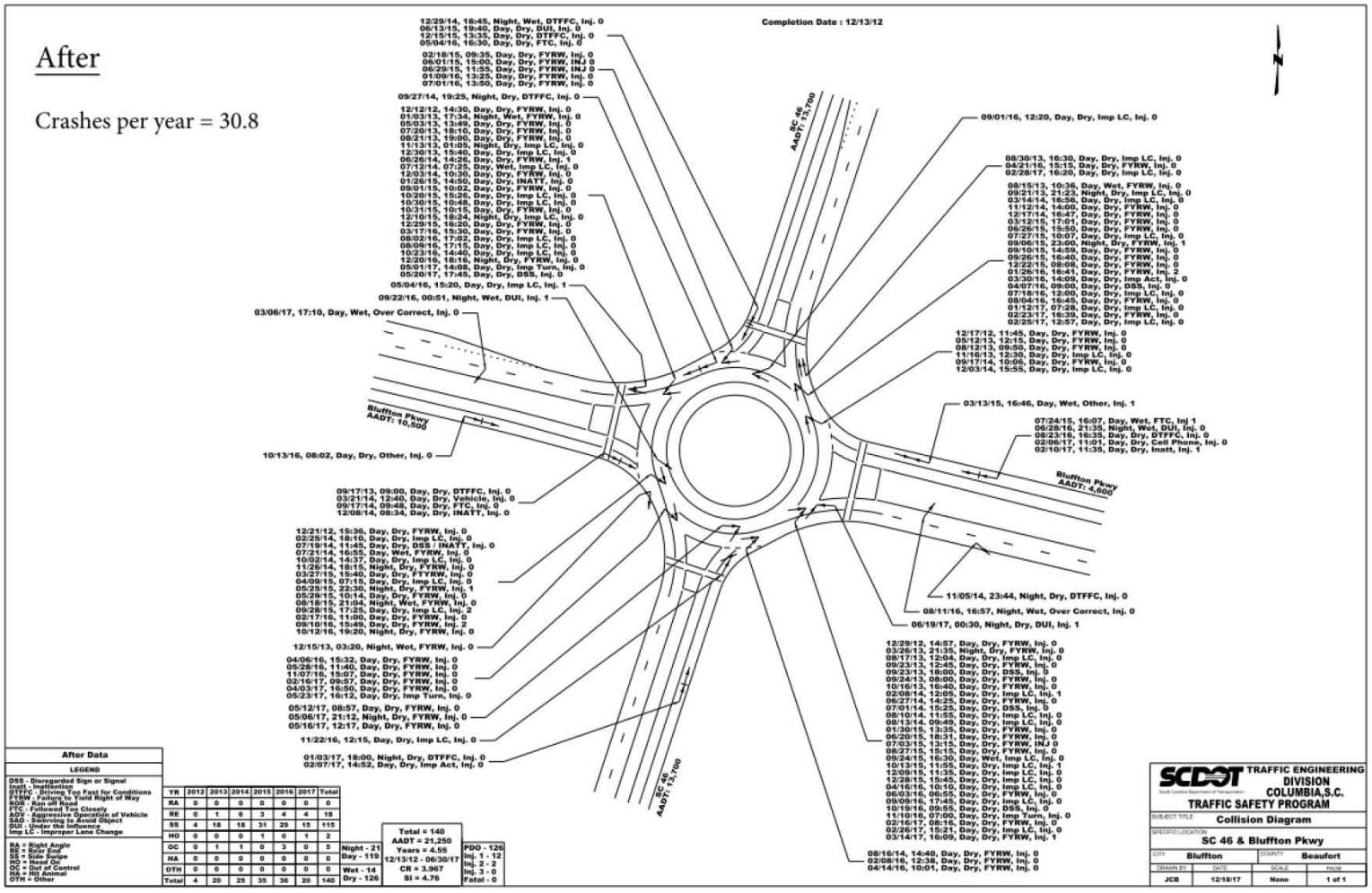
Crash Analysis

	Total	2012	2013	2014	2015	2016	2017
Total crashes	**140**	**4**	**20**	**25**	**35**	**36**	**20**
Injury	**15**	0	0	2	6	4	3
Fatal	**0**	0	0	0	0	0	0
Rear-end	**18**	0	1	6	3	4	4
Angle*	**0**	0	0	0	0	0	0
Sideswipes**	**115**	4	18	18	31	29	15
Head-On	**2**	0	0	0	1	0	1
Single Vehicle	**5**	0	1	1	0	3	0

*Angle collisions include Left-turn opposing, Left-turn, Right-angle, Angle opposing, Angle similar direction, Turn opposing and Right-turn side

**Sideswipes collisions include Sideswipe same direction, Sideswipe opposite directions and Overtake

Crash Analysis cont.



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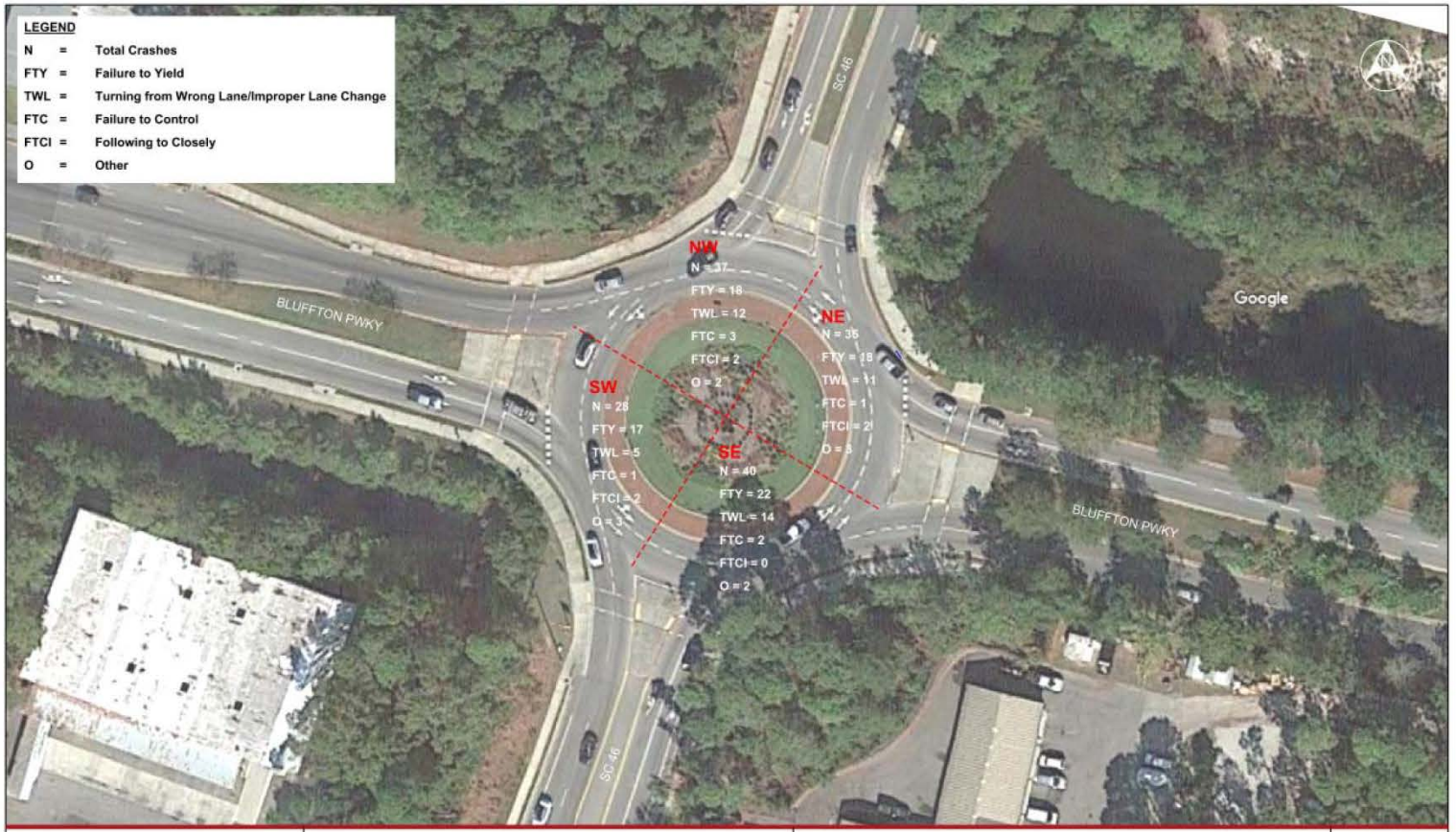
Crash Analysis cont.



Crash Analysis cont.

Contributing Factor	#
Failure To Control	7
Failure To Yield	**75**
Followed Too Close	6
Improper Lane Change/Passing/Turn	**42**
Other	10
Total	140

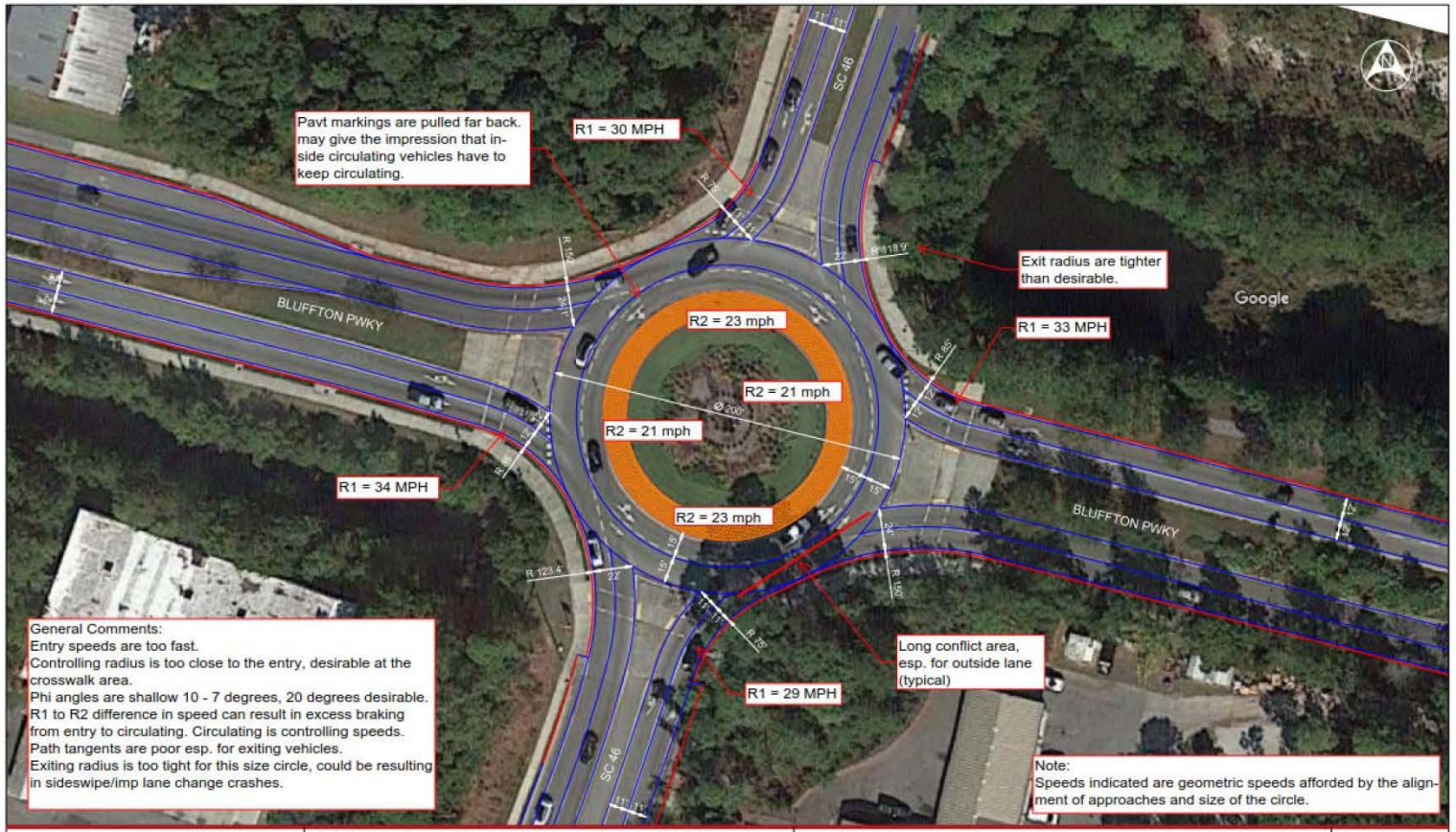
Crash Severity	Site #	% of Total	US %[1]	WI %[2]	MN %[3]	Avg.
Injury/fatality Crash	**15**	**11%**	6.5%	23.6%	8.8%	13.0%
Property Damage Crash	125	89%	93.5%	76.4%	91.2%	87.0%

Crash Analysis cont.

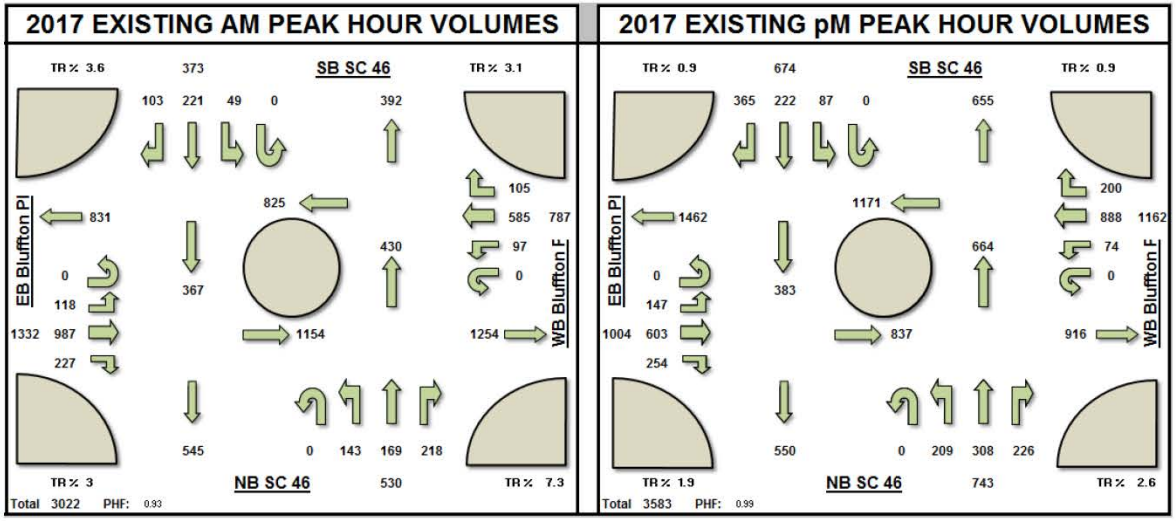
Collision Class	Expected Annual Crashes (NCHRP Model)[5]	95th Percentile Expected Crash Frequency (NCHRP Model)	Expected Annual Crashes (WI Calibrated NCHRP Model 2017)[6]	95th Percentile Expected Crash Frequency (WI Calibrated NCHRP Model 2017)	Expected Annual Crashes (MDOT Safety Performance Functions 2011)[7]	95th Percentile Expected Crash Frequency (MDOT Safety Performance Functions 2011)	Recorded Annual Freq. of Crashes (2012 to 2017)
Total Crashes	6.6	17.7	5.1	15.2	1.9	5.4	30.8
Injury Crashes	0.5	1.2	1.2	3.2	0.2	0.5	3.3

Collision Class	Site Crash Rate (2012 to 2017)	NCHRP Expected Crash Rate[5]	WI Expected Crash Rate[6]	MN Expected Crash Rate[7]
Total Crashes	4.0 MEV	0.9 MEV	0.7 MEV	0.2 MEV
Injury Crashes	0.43 MEV	0.06 MEV	0.15 MEV	0.03 MEV

Geometric Conformance Review



Operational Analysis



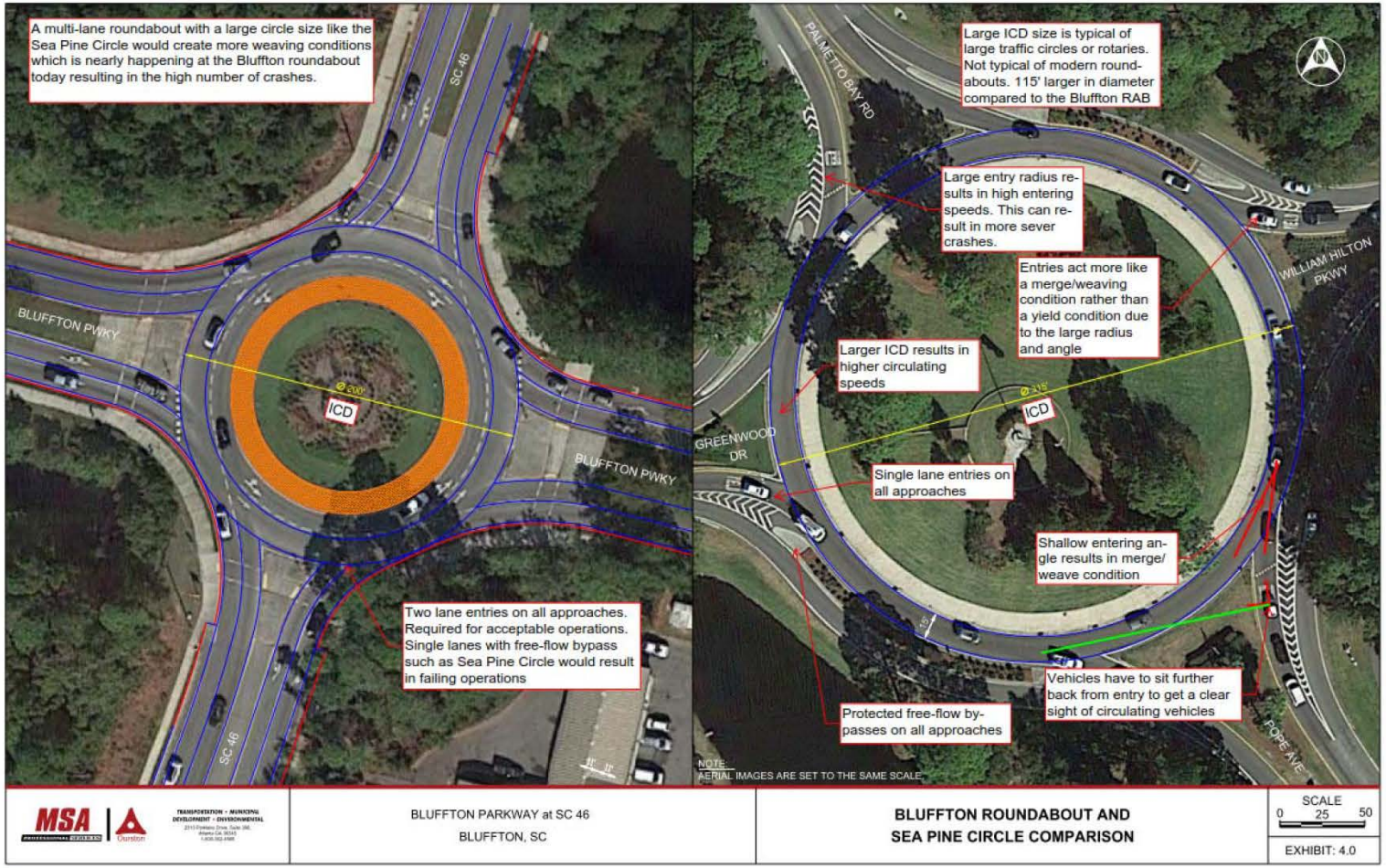
			SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
ARCADY 9.0	AM Peak	LOS	A	B	A	A
		Queue (ft)	25	225	50	25
		v/c	0.31	0.81	0.56	0.50
		Delay (s)	**4.0**	**10.5**	**7.8**	**4.1**
	PM Peak	LOS	A	A	A	B
		Queue (ft)	50	25	25	200
		v/c	0.67	0.61	0.62	0.79
		Delay (s)	**9.7**	**5.0**	**7.0**	**10.6**

LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle

Site Visit

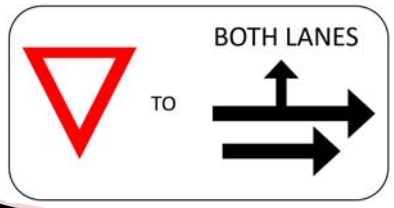
- Drivers had trouble navigating the large conflict area – Drivers had trouble anticipating acceptable gaps to enter
- Poor night time lighting
- No exit guide signs for identification and navigation to downstream destinations
- No overhead lane designation signage for added conspicuity and improved lane choice
- Reduce height of roundabout chevrons on the central island (less that 5ft. is not unreasonable, especially with modern vehicle headlamps
- Shorten exit stripes, so that the lane line does not need to be crossed by a vehicle on the inside (left) lane and exiting.
- The Sea Pine circle is single-lane with free-flow bypasses on all approaches, much larger
  - Queues stretch more than a quarter mile during peak periods
  - The circle would be crash prone if multi-lane
  - It is not possible to reduce the Bluffton roundabout to single lane due to the higher traffic demands there

Sea Pine Circle Comparison



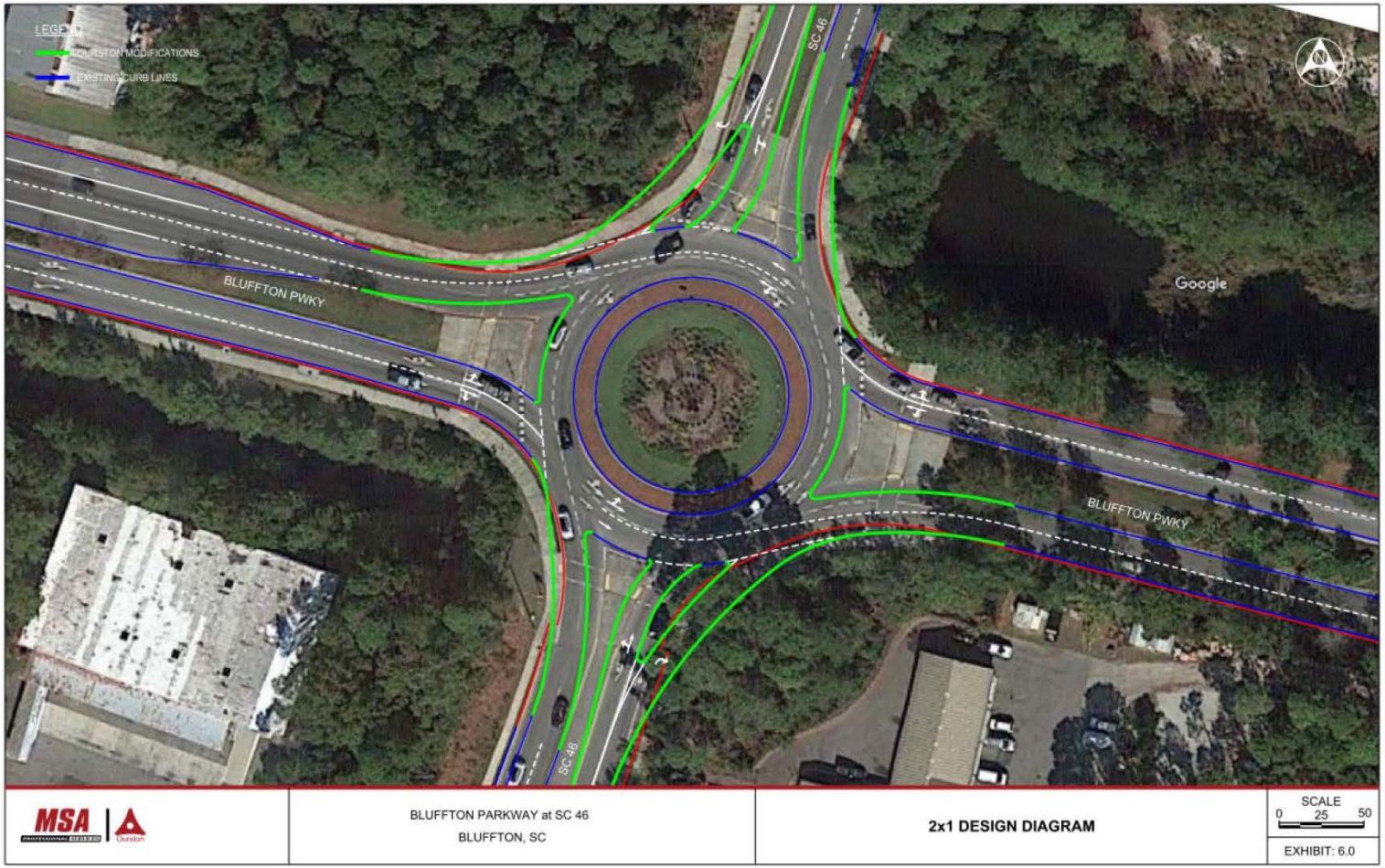
Low/Immediate Countermeasures

- Improved Sign and Marking
- Education
- Red Colored Conflict Area



Medium Countermeasure

2x1 Hybrid Roundabout



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Medium Countermeasure

2x1 Hybrid Roundabout

			SB SC 46		EB Bluffton Pkwy	NB SC 46		WB Bluffton Pkwy
	Lane Group		LT	R	LTR	LT	R	LTR
ARCADY 9.0	AM Peak	LOS	B	A	B	D	C	A
		Queue (ft)	100	25	725	425	150	50
		v/c	0.45	0.17	0.86	0.78	0.54	0.52
		Delay (s)	**10.1**	**6.7**	**14.3**	**34.9**	**17.7**	**4.6**
	PM Peak	LOS	D	E	A	E	A	C
		Queue (ft)	300	650	75	725	75	650
		v/c	0.72	0.85	0.64	0.86	0.37	0.85
		Delay (s)	**26.5**	**45.5**	**5.8**	**35.6**	**8.7**	**15.4**

LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle

- Poor Operations
- No Residual Capacity

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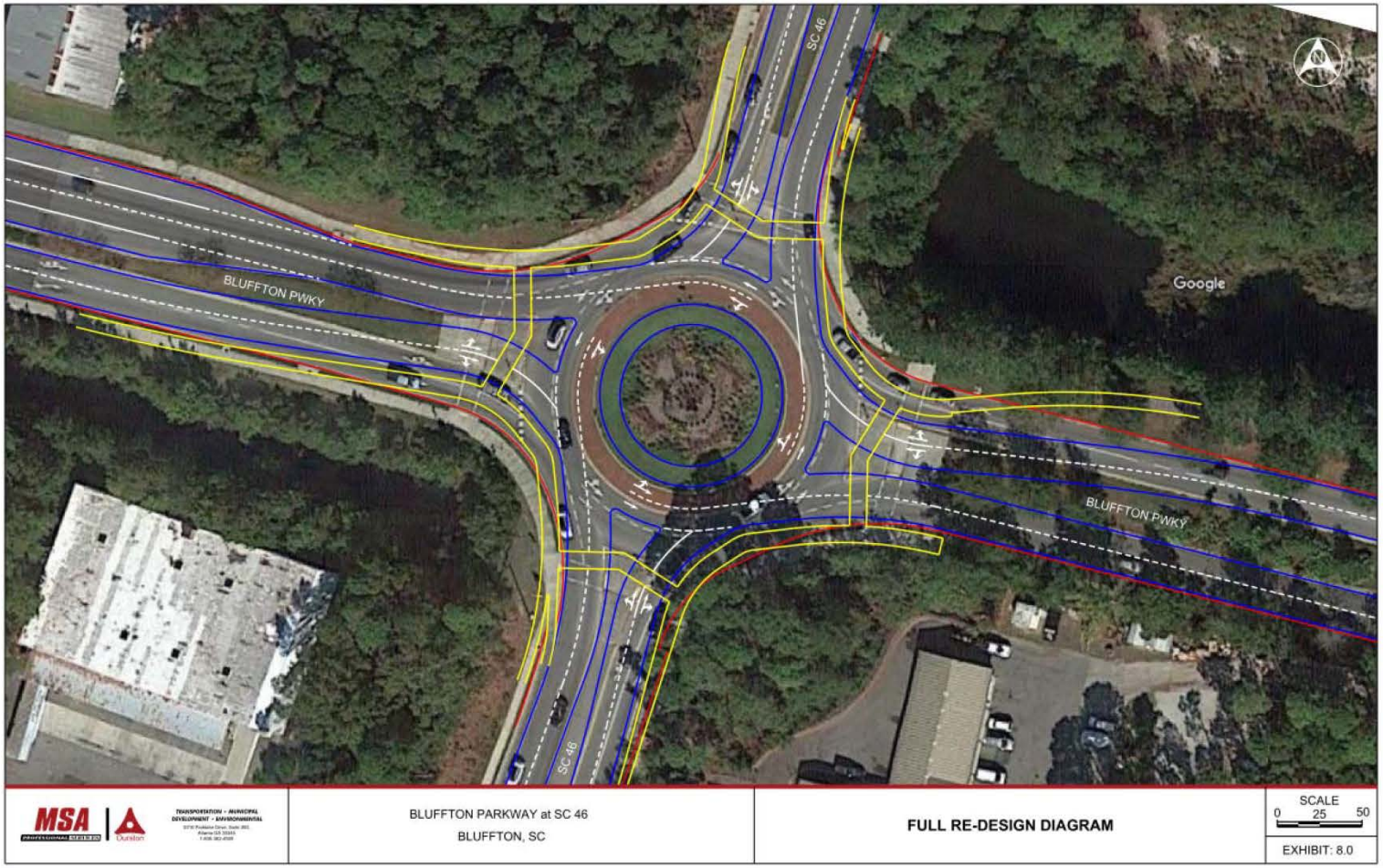
High Countermeasure

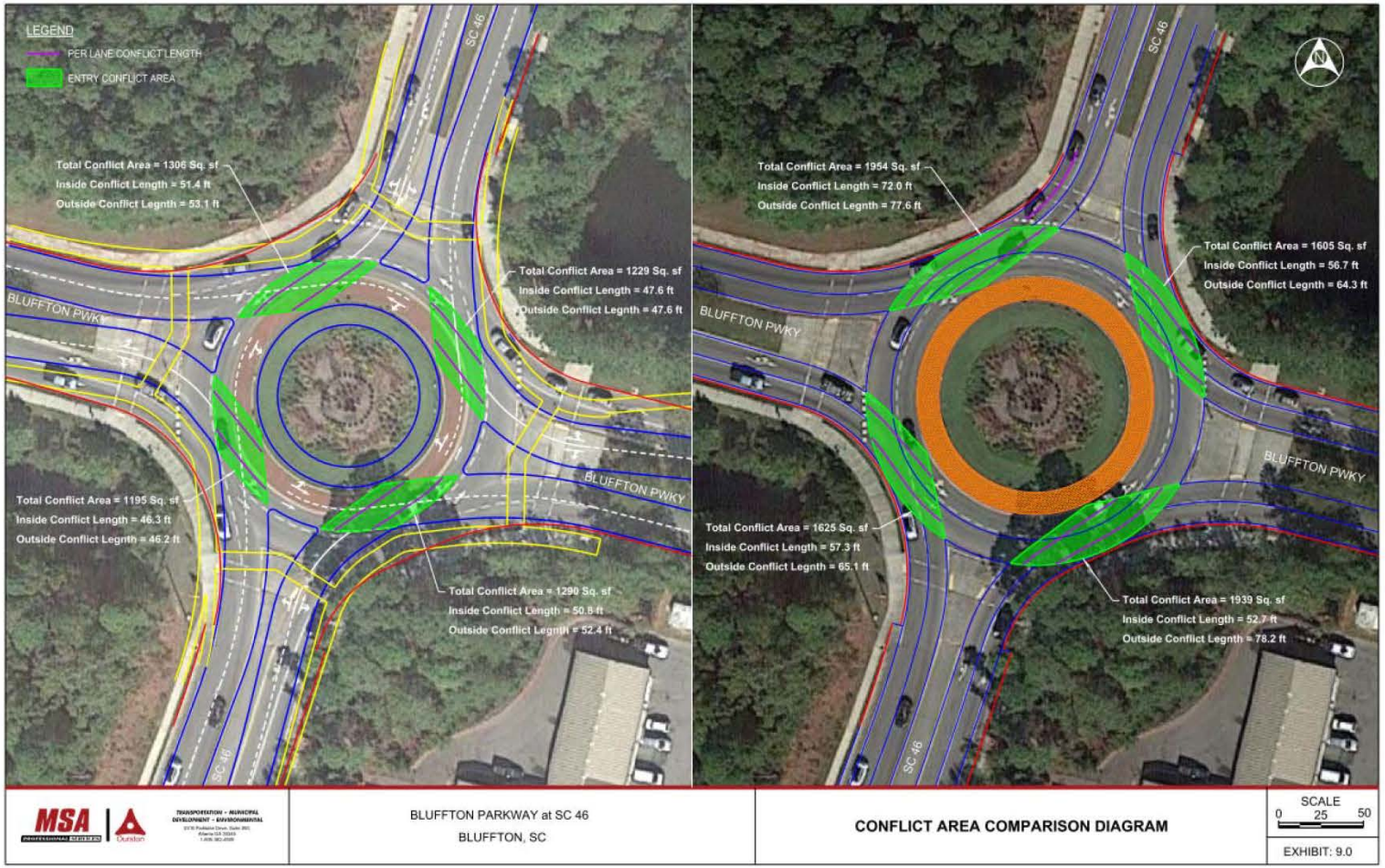
Full Rebuild Roundabout



MSA PROFESSIONAL SERVICES | Ourston

High Countermeasure

Full Rebuild Roundabout



High Countermeasure

Full Rebuild Roundabout

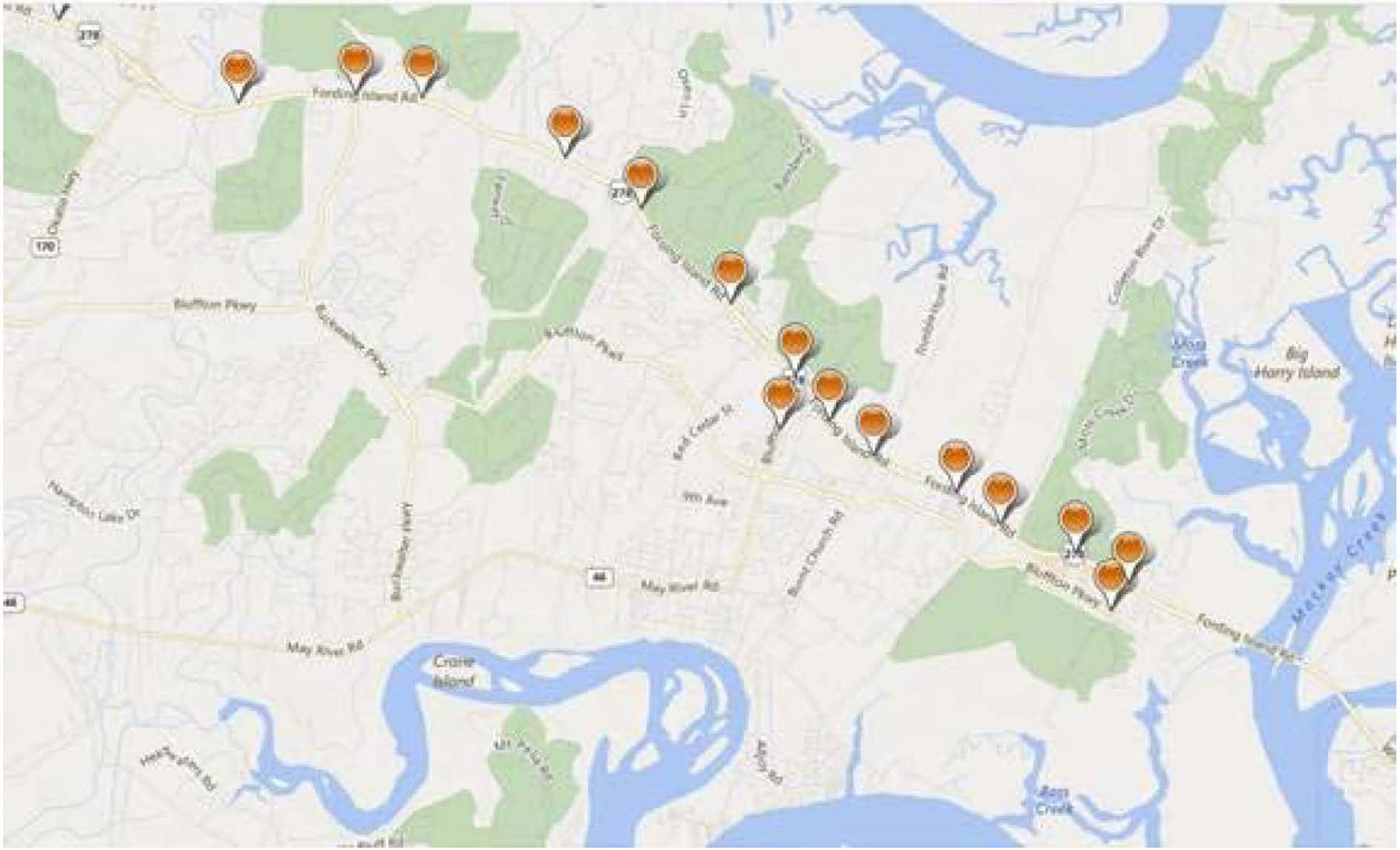
			SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
ARCADY 9.0	AM Peak	LOS	A	A	A	A
		Queue (ft)	25	150	50	25
		v/c	0.30	0.78	0.56	0.48
		Delay (s)	**3.8**	**8.7**	**7.8**	**3.8**
	PM Peak	LOS	A	A	A	A
		Queue (ft)	50	25	25	150
		v/c	0.67	0.58	0.60	0.77
		Delay (s)	**9.6**	**4.6**	**6.6**	**9.4**

LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle

- Acceptable Operations
- 16% Residual Capacity

Conclusions, Recommendations and Approximate Costs

- 50% reduction of crashes per year would need to be achieved for this roundabout to perform within the range of national expected average number of crashes
- High cost, full rebuild, countermeasure should be implemented
- Include improved signing and markings
- Widespread driver education
- Cost $1,500,000 to $2,000,000


Buffton Pkwy
May River Rd
Crane Island
Big Harry Island
Bass Creek

US 278 Gateway Corridor Status Update

BEAUFORT COUNTY

Corridor Components

- Jenkins Island Access Management & Safety
- Mainland to HHI Environmental Assessment (EA)
- Hilton Head Island Signal Re-Timing (7 Signals)
- Hilton Head Island Performance Measures

BEAUFORT COUNTY

Corridor Components (cont.)

- Mainland Signal Re-Timing (15 Signals)
- Mainland Adaptive Signal System
- US 278 Safety Study (SCDOT)

BEAUFORT COUNTY

Jenkins Island Access Management and Safety

- Super Street (signalized U-turns) and Widening
- Budget: $7,400,000
- Next Step: Town of Hilton Head Island approval
- Ready to Bid this Spring

BEAUFORT COUNTY

US 278 Environmental Assessment

- SCDOT Project: Consultant Selected with Limited Notice to Proceed (Moss Creek to Squire Pope)
- Budget: $3,000,000
- Next Steps: Structural Modeling of Existing Bridges
- Corridor Surveying and Soil Boring

BEAUFORT COUNTY

Hilton Head Island Signal Retiming

- SCDOT Project: Consultant, Stantec, Evaluating Timing on first 7 Signals Entering onto HHI
- Budget: $38,378.00
- Next Step: Data Collection and Before Studies
- Implementation early April

BEAUFORT COUNTY

Hilton Head Island Performance Measures

- Joint County/THHI Project to Collect Real-Time Data (Delays, Arrival on Green, Arrival on Red)
- Budget: $30,000.00
- Next Step: Finalize MOU and Purchase Equip.
- Implementation March

BEAUFORT COUNTY

US 278 (Mainland) Signal Re-Timing

- County Project for 13 Signals on US 278 Plus 2 Additional (Agenda Item 3D)
- Budget: $81,000.00
- Next Step: Finalize Contract and NTP.
- Implementation Spring

BEAUFORT COUNTY

US 278 (Mainland) Adaptive Signal System

- Joint SCDOT/County Project for 13 Signals on US 278 Plus 2 Additional (Agenda Item 3D)
- Budget: $275,000.00
- Next Step: Installation of Detection by SCDOT Contractor
- Implementation Fall

BEAUFORT COUNTY

US 278 Safety Study

- SCDOT Safety Analysis of the Corridor: 2015
- Next Step: Programming Detailed Design and Construction
- Implementation: No Date Programmed

BEAUFORT COUNTY

COUNTY COUNCIL OF BEAUFORT COUNTY

PURCHASING DEPARTMENT

106 Industrial Village Road, Bldg. 2, Post Office Drawer 1228
Beaufort, South Carolina 29901-1228

David L Thomas, Purchasing Director
dthomas@bcgov.net 843.255.2353

TO: Councilman Stu Rodman, Chairman, Public Facilities Committee

FROM: David L Thomas. CPPO. Purchasing Director

SUBJ: State Contract Purchase

Request to Purchase a 2018 Trail King Heavy Equipment Trailer from the National Joint Powers Alliance (NJPA) Contract

DATE: 01/24/2018

BACKGROUND:

The Purchasing Department received a request from the Beaufort County Fleet Manager to purchase a 40Ton heavy equipment trailer to replace a 1998 Eager Beaver heavy equipment trailer that is showing signs of metal fatigue which is causing a safety concern.

Total cost of $80,560.63 includes all discounts, SC sales tax, and manuals.

VENDOR INFORMATION:

Flint Equipment Company, Savannah GA

COST:

$80,560.63

FUNDING:

Fiscal Year 2018, General Fund Appropriation in Account #10001320-54200, Specialized Capital Equipment.

Funding approved: Yes By: aholland Date: 01/26/2018

FOR ACTION: Public Facilities Committee meeting on February 26, 2018.

RECOMMENDATION:

The Purchasing Department recommends that the Public Facilities Committee approve the contract award of $80,560.60 to purchase one new 2018 Trail King Tk80HT Heavy Equipment Trailer to support the Public Works Department.

Attachment: Trail King Pricing Info.pdf 363.73 KB

cc: Joshua Gruber, Interim County Administrator Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date:

Alicia Holland, Assistant County Administrator, Finance Approved: Yes Date: 01/26/2018

Eric Larson, Director, Environmental Engineering & Land Mar Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date: ready for admin: ☑

David Wilhelm, Director, Public Works Department Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date: ready for admin: ☑

After Initial Submission, Use the Save and Close Buttons

JOHN DEERE

Quote Id: 16698875

Prepared For:

BEAUFORT COUNTY PUBLIC WORKS

FLINT

CONSTRUCTION & FORESTRY DIVISION

Prepared By: **JOHN PADGETT**

Flint Equipment Company
50 Morgan Industrial Blvd
Savannah, GA 314089563

Tel: 912-964-7370
Fax: 912-964-1822
Email: jpadgett@flintequipco.com

Date: 23 January 2018

Offer Expires: 01 June 2018

JOHN DEERE

Quote Summary

Prepared For:

BEAUFORT COUNTY PUBLIC WORKS
120 Shanklin Rd
Beaufort, SC 29906
Business: 843-255-2800

Prepared By:

JOHN PADGETT
Flint Equipment Company
50 Morgan Industrial Blvd
Savannah, GA 314089563
Phone: 912-964-7370
jpadgett@flintequipco.com

Quote Id:	16698875
Created On:	23 January 2018
Last Modified On:	24 January 2018
Expiration Date:	01 June 2018

Equipment Summary	Selling Price		Qty		Extended
2018 TRAIL KING TK80HT	$ 71,482.75	X	1	=	$ 71,482.75
Equipment Total					**$ 71,482.75**

Quote Summary	
Equipment Total	$ 71,482.75
SubTotal	$ 71,482.75
SC Tax Cap	$ 500.00
FET	$ 8,577.88
Total	$ 80,560.63
Down Payment	(0.00)
Rental Applied	(0.00)
Balance Due	**$ 80,560.63**

Salesperson : X _____ **Accepted By : X** _____

JOHN DEERE

Selling Equipment

Quote Id: 16698875 **Customer:** BEAUFORT COUNTY PUBLIC WORKS

2018 TRAIL KING TK80HT

Hours: 0
Stock Number:

Code	Description	Qty	Unit	Selling Price $ 71,482.75 Extended
1	Trail King TK80HT	1	$ 81,551.00	$ 81,551.00
	Dealer Attachments			
	NJPA #052015-TKI	1	$ 0.00	$ 0.00
	Dealer Attachments Total			**$ 0.00**
	Other Charges			
	Freight	1	$ 1,414.00	$ 1,414.00
	Other Charges Total			**$ 1,414.00**
	Suggested Price			**$ 82,965.00**
	Customer Discounts			
	Customer Discounts Total		**$ -11,482.25**	**$ -11,482.25**
Total Selling Price				$ 71,482.75

COUNTY COUNCIL OF BEAUFORT COUNTY

PURCHASING DEPARTMENT

106 Industrial Village Road, Bldg. 2, Post Office Drawer 1228
Beaufort, South Carolina 29901-1228

David L Thomas, Purchasing Director
dthomas@bcgov.net 843.255.2353

TO: Councilman Stu Rodman, Chairman, Public Facilities Committee

FROM: David L Thomas. CPPO. Purchasing Director

SUBJ: State Contract Purchase

Request to Purchase a New 5100E Tractor with an Alamo Side-Arm Mower for the Public Works Department

DATE: 01/18/2018

BACKGROUND:

The Purchasing Department received a request from the Beaufort County Fleet Manager to purchase one new 2018 John Deere Side-Arm Mower from Blanchard Equipment, Saint George, SC, a State contract vendor. Public Works currently has four (4) side –arm mowers in the fleet, one of which has over 8,000 hours, and has passed its life expectancy according to the American Public Works Association equipment life expectancy charts. First Vehicle also recommends replacement of this equipment.

VENDOR INFORMATION:	**COST:**
Blanchard Equipment, Saint George, SC	$107,308.79
The total cost of $107,308.79 includes all discounts, delivery, SC sales tax; manuals, 5100E John Deere Tractor, and one 18' Alamo Samurai Side-Arm Mower.	

FUNDING:

Fiscal Year 2018, General Fund Appropriation for Account #10001320-54200, Specialized Capital Equipment.

Funding approved: Yes By: aholland Date: 01/26/2018

FOR ACTION: Public Facilities Committee meeting on February 26, 2018.

RECOMMENDATION:

The Purchasing Department recommends that the Public Facilities Committee approve and recommend to County Council the contract award of $107,308.79 to purchase one new 2018 5100E John Deere Tractor and Alamo Side-Arm mower from the aforementioned vendor in support of Public Works operations.

Attachment: Tractor Attachment.pdf 1.24 MB

cc: Joshua Gruber, Interim County Administrator Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date:

Alicia Holland, Assistant County Administrator, Finance Approved: Yes Date: 01/26/2018

Eric Larson, Director, Environmental Engineering & Land Mar Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date: ready for admin: ☑

David Wilhelm, Director, Public Works Department Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date: ready for admin: ☑

After Initial Submission, Use the Save and Close Buttons

Quote Id: 16662502

ALL PURCHASE ORDERS MUST BE MADE OUT TO (VENDOR):
Deere & Company
2000 John Deere Run
Cary, NC 27513
FED ID: 36-2382580; DUNS#: 60-7690989

ALL PURCHASE ORDERS MUST BE SENT TO DELIVERING DEALER:
Blanchard Equipment Co. Inc.
984 Highway 15 North
Saint George, SC 29477
843-563-4522

Prepared For:

Beaufort County Public Works

Proposal For:

Delivering Dealer:
Joe Breland

Blanchard Equipment Co. Inc.
984 Highway 15 North
Saint George, SC 29477

Quote Prepared By:
JOE BRELAND
jbreland@blanchardequipment.com

Date: 16 January 2018

Offer Expires: 15 February 2018

JOHN DEERE

Blanchard EQUIPMENT

ALL PURCHASE ORDERS MUST BE MADE OUT TO (VENDOR):
Deere & Company
2000 John Deere Run
Cary, NC 27513
FED ID: 36-2382580; DUNS#: 60-7690989

ALL PURCHASE ORDERS MUST BE SENT TO DELIVERING DEALER:
Blanchard Equipment Co. Inc.
984 Highway 15 North
Saint George, SC 29477
843-563-4522

Quote Summary

Prepared For:
Beaufort County Public Works
Chad Stanley
120 Shanklin Rd
Beaufort, SC 29906
Business: 843-255-2800

Delivering Dealer:
Blanchard Equipment Co. Inc.
Joe Breland
984 Highway 15 North
Saint George, SC 29477
Phone: 843-563-4522
jbreland@blanchardequipment.com

Quote ID: 16662502
Created On: 16 January 2018
Last Modified On: 16 January 2018
Expiration Date: 15 February 2018

Equipment Summary	Suggested List	Selling Price		Qty		Extended
JOHN DEERE 5100E Utility Tractor	$ 63,098.56	$ 47,323.91	X	1	=	$ 47,323.91
Free Basic Warranty Inspection	Included, Value of $ 0.00	$ 0.00	X	1	=	$ 0.00

Contract: SC Large Tractors and Mowers 4400011017 (PG OA)
Price Effective Date: January 16, 2018

Equipment Total **$ 47,323.91**

* Includes Fees and Non-contract items

Quote Summary	
Equipment Total	$ 47,323.91
Trade In	
SubTotal	**$ 47,323.91**
Sales Tax - (6.00%)	$ 2,839.43
Est. Service Agreement Tax	$ 0.00
Total	$ 50,163.34
Down Payment	(0.00)
Rental Applied	(0.00)
Balance Due	**$ 50,163.34**

Salesperson : X _____ **Accepted By : X** _____

JOHN DEERE

Blanchard EQUIPMENT

Selling Equipment

Quote Id: 16662502 **Customer Name:** BEAUFORT COUNTY PUBLIC WORKS

ALL PURCHASE ORDERS MUST BE MADE OUT TO (VENDOR):
Deere & Company
2000 John Deere Run
Cary, NC 27513
FED ID: 36-2382580; DUNS#: 60-7690989

ALL PURCHASE ORDERS MUST BE SENT TO DELIVERING DEALER:
Blanchard Equipment Co. Inc.
984 Highway 15 North
Saint George, SC 29477
843-563-4522

JOHN DEERE 5100E Utility Tractor

Contract: SC Large Tractors and Mowers 4400011017 (PG OA)

Price Effective Date: January 16, 2018

Suggested List *
$ 63,098.56

Selling Price *
$ 47,323.91

* Price per item - includes Fees and Non-contract items

Code	Description	Qty	List Price	Discount%	Discount Amount	Contract Price	Extended Contract Price
697BLV	5100E Utility Tractor	1	$ 52,210.00	25.00	$ 13,052.50	$ 39,157.50	$ 39,157.50
	Standard Options - Per Unit						
0409	English Operators Manual and Decal Kit	1	$ 0.00	25.00	$ 0.00	$ 0.00	$ 0.00
1381	12F/12R PowrReverser Transmission - 540/540E	1	$ 0.00	25.00	$ 0.00	$ 0.00	$ 0.00
2050	Standard Cab	1	$ 9,117.00	25.00	$ 2,279.25	$ 6,837.75	$ 6,837.75
2110	Mechanical Suspension Seat	1	$ 0.00	25.00	$ 0.00	$ 0.00	$ 0.00
3025	Deluxe Cornerpost Exhaust	1	$ 503.00	25.00	$ 125.75	$ 377.25	$ 377.25
3320	Dual Stackable Rear SCV's with Lever Control	1	$ 0.00	25.00	$ 0.00	$ 0.00	$ 0.00
3400	Less Mid Valves	1	$ 0.00	25.00	$ 0.00	$ 0.00	$ 0.00
5911	18.4 - 30 In. 8PR R1 Bias	1	$ 0.00	25.00	$ 0.00	$ 0.00	$ 0.00
6040	MFWD (4 Wheel Drive)	1	$ 0.00	25.00	$ 0.00	$ 0.00	$ 0.00
6701	12.4 - 24 In. 8PR R1 Bias	1	$ 0.00	25.00	$ 0.00	$ 0.00	$ 0.00
	Standard Options Total		**$ 9,620.00**		**$ 2,405.00**	**$ 7,215.00**	**$ 7,215.00**
	Dealer Attachments/Non-Contract/Open Market						
BLV10120	Beacon Light Kit	1	$ 237.60	25.00	$ 59.40	$ 178.20	$ 178.20
LVB25728	Backup Alarm Kit	1	$ 170.50	25.00	$ 42.62	$ 127.88	$ 127.88
L113922	Antenna	1	$ 25.90	25.00	$ 6.48	$ 19.42	$ 19.42
AL80126	Mirror, Telescopic, LH, Manually Adjustable	1	$ 180.40	25.00	$ 45.10	$ 135.30	$ 135.30
AL80127	Mirror, Telescopic, RH, Manually Adjustable	1	$ 180.40	25.00	$ 45.10	$ 135.30	$ 135.30
RE567557	Radio - AM/FM, Bosch (Standard)	1	$ 473.76	25.00	$ 118.44	$ 355.32	$ 355.32
	Dealer Attachments Total		**$ 1,268.56**		**$ 317.14**	**$ 951.42**	**$ 951.42**
	Value Added Services						

Selling Equipment

Quote Id: 16662502 **Customer Name:** BEAUFORT COUNTY PUBLIC WORKS

ALL PURCHASE ORDERS MUST BE MADE OUT TO (VENDOR):
Deere & Company
2000 John Deere Run
Cary, NC 27513
FED ID: 36-2382580; DUNS#: 60-7690989

ALL PURCHASE ORDERS MUST BE SENT TO DELIVERING DEALER:
Blanchard Equipment Co. Inc.
984 Highway 15 North
Saint George, SC 29477
843-563-4522

	Free Basic Warranty Inspection	1	$ 0.00	$ 0.00	$ 0.00
	Value Added Services Total		**$ 0.00**	**$ 0.00**	**$ 0.00**
	Suggested Price				**$ 47,323.92**
Total Selling Price			**$ 63,098.56**	**$ 15,774.64**	**$ 47,323.92**	**$ 47,323.92**

Quote Id: 16161278

Prepared For:

Beaufort County Public Works

Prepared By: **Joe Breland**

Blanchard Equipment Co. Inc.
984 Highway 15 North
Saint George, SC 29477

Tel: 843-563-4522
Fax: 843-563-9557
Email: jbreland@blanchardequipment.com

Date: 02 October 2017

Offer Expires: 09 October 2017

JOHN DEERE

Blanchard EQUIPMENT

Quote Summary

Prepared For:

Beaufort County Public Works
Chad Stanley
120 Shanklin Rd
Beaufort, SC 29906
Business: 843-255-2800

Prepared By:

Joe Breland
Blanchard Equipment Co. Inc.
984 Highway 15 North
Saint George, SC 29477
Phone: 843-563-4522
jbreland@blanchardequipment.com

THIS PRICING IS OFF OF STATE CONTRACT.PURCHASE ORDER SHOULD BE MADE TO ALAMO COMPANY.
QUOTE STILL GOOD AS OF 1/16/2018 JOE BRELAND

Quote Id:	16161278
Created On:	02 October 2017
Last Modified On:	16 January 2018
Expiration Date:	09 October 2017

Equipment Summary	Suggested List	Selling Price		Qty		Extended
ALAMO SAMURAI-18	$ 65,761.00	$ 53,547.09	X	1	=	$ 53,547.09
Equipment Total						**$ 53,547.09**

Quote Summary	
Equipment Total	$ 53,547.09
SubTotal	$ 53,547.09
Sales Tax - (6.00%)	$ 3,598.36
Est. Service Agreement Tax	$ 0.00
Total	$ 57,145.45
Down Payment	(0.00)
Rental Applied	(0.00)
Balance Due	**$ 57,145.45**

Salesperson : X _____ **Accepted By : X** _____

JOHN DEERE

Selling Equipment

Blanchard EQUIPMENT

Quote Id: 16161278 **Customer:** BEAUFORT COUNTY PUBLIC WORKS

ALAMO SAMURAI-18

Hours: 0

Stock Number:

Suggested List
$ 65,761.00

Selling Price
$ 53,547.09

Code	Description	Qty	Unit	Extended
04851805	18FT SAMURAI WITH JOYSTICK/50IN.ROTARY HEAD /W SWIVEL	1	$ 65,761.00	$ 65,761.00
	Suggested Price			**$ 65,761.00**
	Customer Discounts			
	Customer Discounts Total		**$ -12,213.91**	**$ -12,213.91**
Total Selling Price				$ 53,547.09

COUNTY COUNCIL OF BEAUFORT COUNTY

PURCHASING DEPARTMENT

106 Industrial Village Road, Bldg. 2, Post Office Drawer 1228
Beaufort, South Carolina 29901-1228

David L Thomas, Purchasing Director
dthomas@bcgov.net 843.255.2353

TO: Councilman Stu Rodman, Chairman, Public Facilities Committee

FROM: David L Thomas. CPPO. Purchasing Director

SUBJ: State Contract Purchase

Request to Purchase 2018 Schwarze Tornado Sweeper from the National Jaoint Powers Alliance Cooperative Contract (NJPA)

DATE: 01/26/2018

BACKGROUND:

The Purchasing Department received a request from the Beaufort County Fleet Manager to purchase one new 2018 Schwarze A7 Tornado Sweeper for the Public Works Storm Water fleet. This addition to the fleet would allow for better sediment and contaminant management of Storm Water Projects as there is currently no street sweeping machine owned by Beaufort County. This purchase would also replace the street sweeping contract (parking lots, bridges, streets, etc.) funded through the general fund for the Facility Management Department.

Total cost of $244,943 includes all discounts, delivery, SC sales tax; manuals, and 2018 Schwarze A7 Tornado Sweeper.

VENDOR INFORMATION:	**COST:**
Carolina Environmental Systems Inc., Kernersville, NC	$244,943

FUNDING: Fiscal Year 2018 Stormwater Utility Enterprise Appropriation in Account #50250011-54200, Specialized Capital Equipment.

Funding approved: Yes By: aholland Date: 01/26/2018

FOR ACTION: Public Facilities Committee meeting on February 26, 2018.

RECOMMENDATION:

The Purchasing Department recommends that the Public Facilities Committee approve and recommend to County Council the contract award of $244,943 to purchase one new 2018 Schwarze A7 Tornado Sweeper from the aforementioned vendor in support of Public Work's Storm Water operations.

Attachment: Sweeper Price Quote.pdf 384.59 KB

cc: Joshua Gruber, Interim County Administrator Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date:

Alicia Holland, Assistant County Administrator, Finance Approved: Yes Date: 01/26/2018

Eric Larson, Director, Environmental Engineering & Land Mar Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date: ready for admin: ☑

David Wilhelm, Director, Public Works Department Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date: ready for admin: ☑

After Initial Submission, Use the Save and Close Buttons

Carolina Environmental Systems, Inc.

306 Pineview Dr., Kernersville, NC 27284

(336) 869-9900

October 12, 2017

To: Beaufort County, SC

Attention: Chad Stanley

RE: New Regenerative Air Sweeper Quotation

1 ea. 2017 Schwarze A7 Tornado Sweeper NJPA Price **$ 244,443.00**
Two hundred forty four thousand four hundred forty three dollars

South Carolina Vehicle Sales Tax:	**$ 500.00**
Total Net:	**$244,943.00**

Cab and Chassis: ***International 4300, 33000GVW, Dual Steer, 2017 Model, 200 HP Cummins engine, single speed rear,*** **Allison 2500 Automatic, Air horn**

Sweeper Includes:

115 HP Tier III Turbo Auxiliary Engine Tier ivF
Dual Gutter Brooms, 44" Diameter
Dual Gutter Broom In-cab Tilt
Dual Gutter Broom GEO
Dual Gutter Broom Speed control
Dual Gutter Broom In-cab Down Pressure Control
In Cab Standby Switch Gutter Brooms
Standard 90" Sweeping Head
Sweeper Head Deluge Flush
Hopper Constructed of High Strength Stainless Steel 8.4 cu. yd.
Limited "Lifetime Warranty" on Stainless Steel Hopper
Hopper Sound Suppression
Hopper up Alarm & Indicator
Hopper Load Weight Indicator
Hopper Door Open Alarm
Hopper Drain 6" Stainless Steel
Hopper Auto Drop Down Screens Stainless Steel
Hopper Shaker/Vibrator
250 Gallon Dust Suppression Water System
Front Spray Bar
Hopper Spray Bar, 4 Additional Nozzles
8" Power Boom, Hand Hose, (remote throttle included)

Hand Hose Water Nozzle
High Pressure Wash down System With 50' Hose Reel
Bleed Off Air Indicator
2 Clear LED Strobe lights and 2 Yellow LED Strobe Lights in front grill of Chassis and Mounted on Rear Bumper
LED Rear Mounted Strobe with Guard
Dual LED Strobes with Guards, Rear Mounted
LED Rear Mounted Traffic Guide Arrow Board
Cab Mounted LED Bar Light With Guard
Camera System W/7" Color Monitor
Strobe, Rear W/Guard LED
Tail Lights, LED
Standard Paint, Decal Kit

Includes Safety and Operator Training at your location
Includes Delivery to Beaufort County, SC Public Works location

We appreciate the opportunity to submit this information and I look forward to your response.

Eddie Cooke

Eddie Cooke

cell 919-442-7150
email ceseddie@aol.com

Distributors for:
Heil, Schwarze, K-Pac, Schaefer, Pac-Mac, Pak-Rat, Busch, SwapLoader, Pioneer, O'Brian, Load Lugger, Stellar, Galbreath

COUNTY COUNCIL OF BEAUFORT COUNTY

PURCHASING DEPARTMENT

106 Industrial Village Road, Bldg. 2, Post Office Drawer 1228
Beaufort, South Carolina 29901-1228

David L Thomas, Purchasing Director
dthomas@bcgov.net 843.255.2353

TO: Councilman Stu Rodman, Chairman, Public Facilities Committee

FROM: David L Thomas. CPPO. Purchasing Director

SUBJ: New Contract as a Result of Solicitation
RFP 010918E, Award of RFP Signal Timing Improvements Along US 278

DATE: 01/26/2018

BACKGROUND:

Beaufort County Traffic and Transportation Engineering Division requested funding from Beaufort County Transportation Committee (BCTC) at its July 19, 2017 meeting for the retiming of traffic signals along the US 278 corridor. The BCTC recommended funding of that project in the amount of $89,000.00, along with a local match from Beaufort County for $11,000.00, at their meeting on September 20, 2017. The project will involve updating the existing traffic responsive signal control and coordination plans for fifteen (15) signalized intersections along US 278 and adjacent area. The work will include data collection, timing plan development and implementation, and system documentation. A detailed before and after study will also be performed for the project.

Beaufort County Traffic and Transportation Engineering requested proposals and prices to complete retiming analysis in RFP 010918E. Three proposals were received. The selection committee consisted of the following Beaufort County staff: Colin Kinton, PE, Director, Traffic & Transportation Engineering; Eric Larson, PE, Director, Environmental Engineering & Land Management; Laura Matney, Assistant Engineer, Traffic & Transportation Engineering. Upon completion of evaluations, the selection committee ranked the proposals as shown below.

VENDOR INFORMATION:	COST:
1. Stantec, North Charleston, SC	$73,486*
2. AECOM, Greenville, SC	$64,295
3. Kimley-Horn and Associates, Inc., Peachtree Corners, GA	$99,140

FUNDING:

*Stantec proposal is $9,191.00 greater than second ranked AECOM, however, Stantec provided an aggressive schedule resulting in implementation this Spring. Staff is requesting an approximate 10% contingency of $7,514, bringing the total project budget to $81,000.

BCTC funding provided by State "C" Funds in Account# 2342001C-54912, $70,000
Traffic Engineering SCDOT Maintenance Funds in Account # 02420011-51994, $11,000

Funding approved: Yes By: aholland Date: 01/26/2018

FOR ACTION: Public Facilities Committee meeting on February 26, 2018.

RECOMMENDATION:

The Public Facilities Committee approve the contract award to Stantec in the amount of $73,486 for the US 278 Signal Timing Analysis and Implementation Project. Additionally, approve a project contingency of $7,514, bringing the total project budget to $81,000 with funding as outlined above.

Attachment: RFP 010918E Ranking Summary.pdf 126.53 KB

cc: Joshua Gruber, Interim County Administrator Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date:

Alicia Holland, Assistant County Administrator, Finance Approved: Yes Date: 01/26/2018

Robert McFee, PE, Division Director, Construction, Engineeri Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date: ready for admin: ☑

Colin Kinton, Director, Transportation Engineering Division Approved: Yes Date: 01/26/2018

Check to override approval: ☐ Overridden by: Override Date: ready for admin: ☑

After Initial Submission, Use the Save and Close Buttons

Traffic Signal Timing Improvements Along US 278 and Adjacent Area

RFP 010918E

Summary Score Sheet

Evaluators	Name of Company	Name of Company	Name of Company
	Stantec	AECOM	Kimley-Horn
E. Larsen	91	85	74
C. Kinton	94	93	91
L. Matney	89	84	85
TOTALS:	274	262	250
1. Stantec	274		
2. AECOM	262		
3. Kimley-Horn	250		

COUNTY COUNCIL OF BEAUFORT COUNTY

PURCHASING DEPARTMENT

106 Industrial Village Road, Bldg. 2, Post Office Drawer 1228
Beaufort, South Carolina 29901-1228

David L Thomas, Purchasing Director
dthomas@bcgov.net 843.255.2353

TO: Councilman Stu Rodman, Chairman, Public Facilities Committee

FROM: David L Thomas. CPPO. Purchasing Director

SUBJ: New Contract as a Result of Solicitation
RFP 121417E, Engineering and Consulting Services for Design Build Construction - Whitehall Boat Ramp Improvements

DATE: 02/06/2018

BACKGROUND:

The Factory Creek Boat Ramp (Whitehall) located on Lady's Island is one of the most popular water access points in the County. This ramp was last improved in 1990 and these improvements have reached the end of their useful life. Additionally, the ramp consistently fails to meet the demands for water access. This facility is identified for improvement in the Priority Investment Element of the Comprehensive Plan and the South Carolina Department of Natural Resources (SCDNR) Coastal County Road Ramp Study. This project will make improvements to the boat ramp and parking areas to allow the general public better and safer access to the Beaufort River and neighboring water bodies.

The Purchasing Department advertised the RFP 121418E and received proposals submitted on December 12, 2017, Design Build Construction for Whitehall Boat Ramp Improvements. The proposers were instructed to provide a Guaranteed Not to Exceed price (GMP) in two phases. Phase one will be the costs for engineering, construction documents and inspections. Phase two will be the cost of construction adjusted based on the final design.

L-J Inc. of Columbia, SC and O'Quinn Marine Construction of Beaufort submitted proposals and a review team consisting of the Beaufort County Division Director of Engineering, Public Works Director and Director of Public Projects for the City of Beaufort rated the proposals based on the criteria established in the RFP. O'Quinn Marine Construction received the highest ranking.

An analysis of the proposal submitted, revealed no apparent cause for rejecting the O'Quinn Marine proposal; therefore, it is recommended that phase one be awarded to O'Quinn Marine Construction, for design/engineering services, in the amount of $184,438. Staff is requesting a 5% project contingency of $9,222. Total project budget $193,660.

Phase two will be the cost of construction adjusted based on the final design.

VENDOR INFORMATION:	COST:
O'Quinn Marine Construction, Beaufort, SC - Design, Phase One	$ 184,438
Construction, Preliminary Estimate	$1,613,467
Total	$1,797,905

FUNDING:

In November 2017 County Council approved an appropriation from Local Hospitality Tax, Ordinance 2017/33, for this river access improvement in the amount of $630,000.

Funding approved: Yes By: aholland Date: 02/07/2018

FOR ACTION: Public Facilities Committee, February 12, 2018.

RECOMMENDATION:

The Public Facilities Committee approves and recommends to County Council the award of Whitehall Boat Ramp improvement design service to O'Quinn Marine Construction in the amount of $184,438 funded from Hospitality Tax Funds. Additionally, recommends approval of a budget to include a 5% project contingency for a total project budget of $193,660.

Attachment: RFP 121417E Summary Score Sheet; Hospitality Tax Summary 12312017.pdf 435.36 KB

cc: Joshua Gruber, Interim County Administrator

Approved: Yes Date: 02/08/2018

Check to override approval: ☐ Overridden by: Override Date:

Alicia Holland, Assistant County Administrator, Finance

Approved: Yes Date: 02/07/2018

Robert McFee, PE, Division Director, Construction, Engineeri

Approved: Yes Date: 02/08/2018

Check to override approval: ☐ Overridden by: Override Date: ready for admin: ☑

After Initial Submission, Use the Save and Close Buttons

Design Build Whitehall Boat Ramp

RFP 121417E

Summary Score Sheet

Evaluators	Name of Company	Name of Company
	L-J, Inc.	Andrews/O'Quinn
R. McFee	76	91
N. Pugliese	83	91
D. Wilhelm	72	68
TOTALS:	231	250
1. Andrews/O'Quinn	250	
2. L-J, Inc.	231	

Beaufort County
Local Hospitality Tax
Fiscal Year 2018 as of December 31, 2017
Unaudited and Preliminary

Revenues	
Local Hospitality Tax Revenues	$ 1,164,351
Total Revenues	1,164,351
Expenditures	
Personnel	19,915
Purchased Services	9,230
Supplies	425
Total Expenditures	29,570
Excess (deficiency) of revenues over expenditures	1,134,781
Other Financing Sources (Uses)	
Transfers to General Fund[1]	(750,000)
Transfers from State Accommodations Tax (2%) Fund[2]	50,000
Total Other Financing Sources (Uses)	(700,000)
Net Change in Fund Balance	434,781
Fund Balance, beginning	**5,315,802**
Fund Balance, ending	**$ 5,750,583**
Encumbrances	
Technical College of the Lowcountry Culinary Institute	(3,243,000)
Factory Creek Boat Ramp (Whitehall)	(630,000)
Pinckney Island Access Design Services	(250,000)
	(4,123,000)
Projected Fund Balance after Encumbrances	**$ 1,627,583**

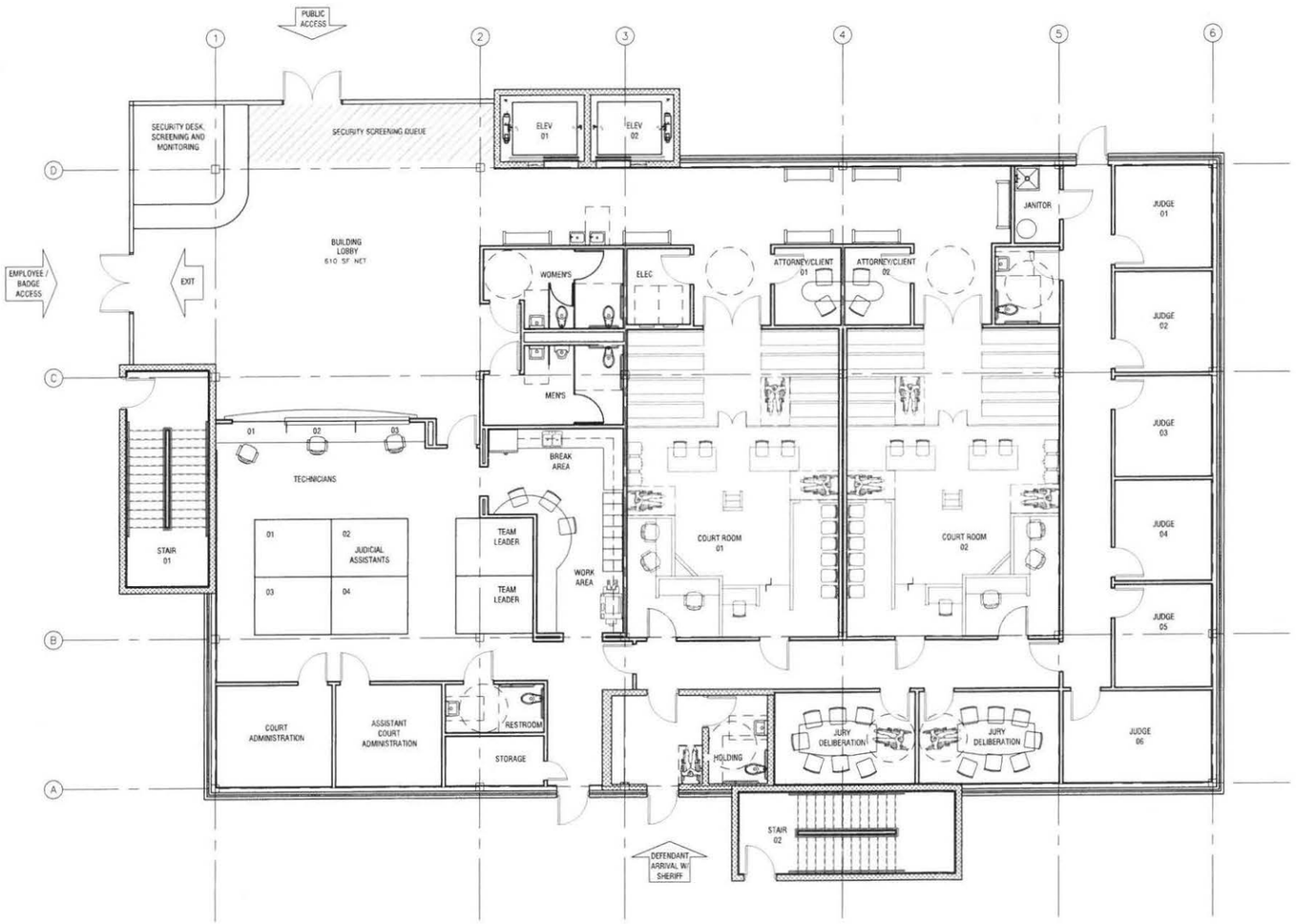
Note 1: The general fund provides for law enforcement and other public safety services, in which police protection of tourist facilities is one of the purposes of the local hospitality tax.

Note 2: County Council approved a transfer of $200,000 from the local hospitality tax fund to the state accommodation tax (2%) fund on October 27, 2014. This transfer is being repaid in four equal annual installments of $50,000 in fiscal years 2015, 2016, 2017, and 2018.

BEAUFORT COUNTY GOVERNMENT COMPLEX
BEAUFORT, SOUTH CAROLINA

DESIGN BUILD

BEAUFORT, SOUTH CAROLINA 29907
PHONE: 843.321.8277



A2 FIRST FLOOR - MAGISTRATE'S OFFICE (7,998 GROSS SF)
3/16" = 1'-0"

GENERAL NOTES:

A. TEXT
B. TEXT
C. TEXT

SHEET KEY NOTES: (X)

1. TEXT
2. TEXT
3. TEXT

LEGEND:

8" CMU

PROPOSED BUILDING WILL BE FULLY FIRE SPRINKLERED

BEAUFORT
73 Sea Island Parkway, S. 30
Beaufort, SC 29907

CHARLOTTE
7315 Swansea Lane
Cornelius, NC 28031

(843) 321-8277
info@beaufortdesignbuild.com
www.beaufortdesignbuild.com

BEAUFORT DESIGN BUILD

BEAUFORT COUNTY SOUTH CAROLINA 1769

BEAUFORT COUNTY GOVERNMENT COMPLEX

NEW OFFICE BUILDING

104 RIBAUT ROAD
BEAUFORT, SC 29902

NOT FOR CONSTRUCTION

REVISIONS / SUBMISSIONS

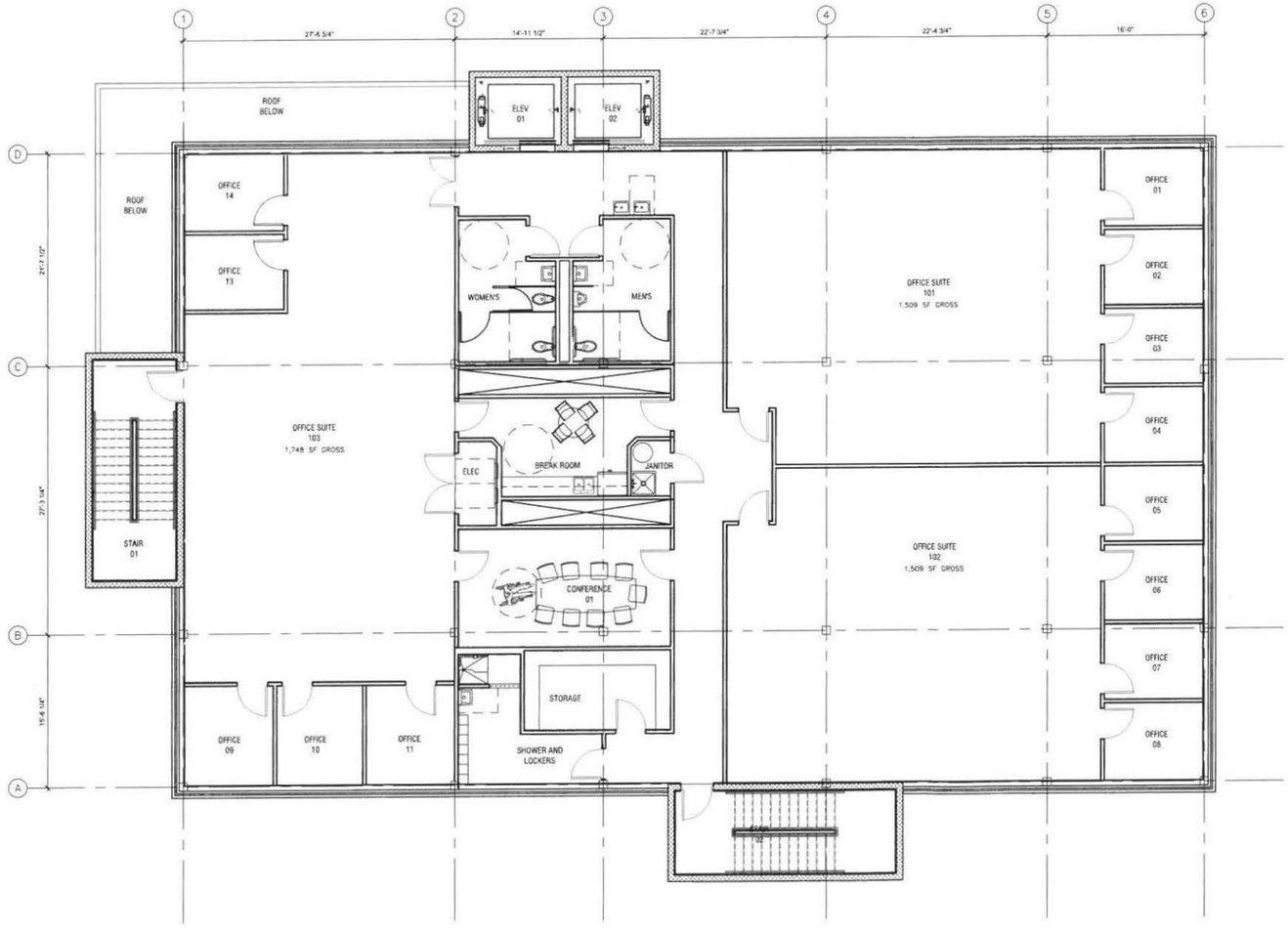
NO.	DESCRIPTION	DATE

SHEET INFORMATION

DATE	NOVEMBER 22, 2017
JOB NUMBER	17013.00
DRAWN	DCS
CHECKED	DCS
APPROVED	DCS

CONCEPTUAL FIRST FLOOR PLAN

A-101



A2 SECOND FLOOR - GENERAL OFFICE (7,608 GROSS SF)
3/16" = 1'-0"

PROPOSED BUILDING WILL BE FULLY FIRE SPRINKLERED

GENERAL NOTES:

A. TEXT
B. TEXT
C. TEXT

SHEET KEY NOTES: (X)

1. TEXT
2. TEXT
3. TEXT

LEGEND:

8" CMU

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BEAUFORT COUNTY GOVERNMENT COMPLEX

NEW OFFICE BUILDING

104 RIBAUT ROAD
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REVISIONS / SUBMISSIONS

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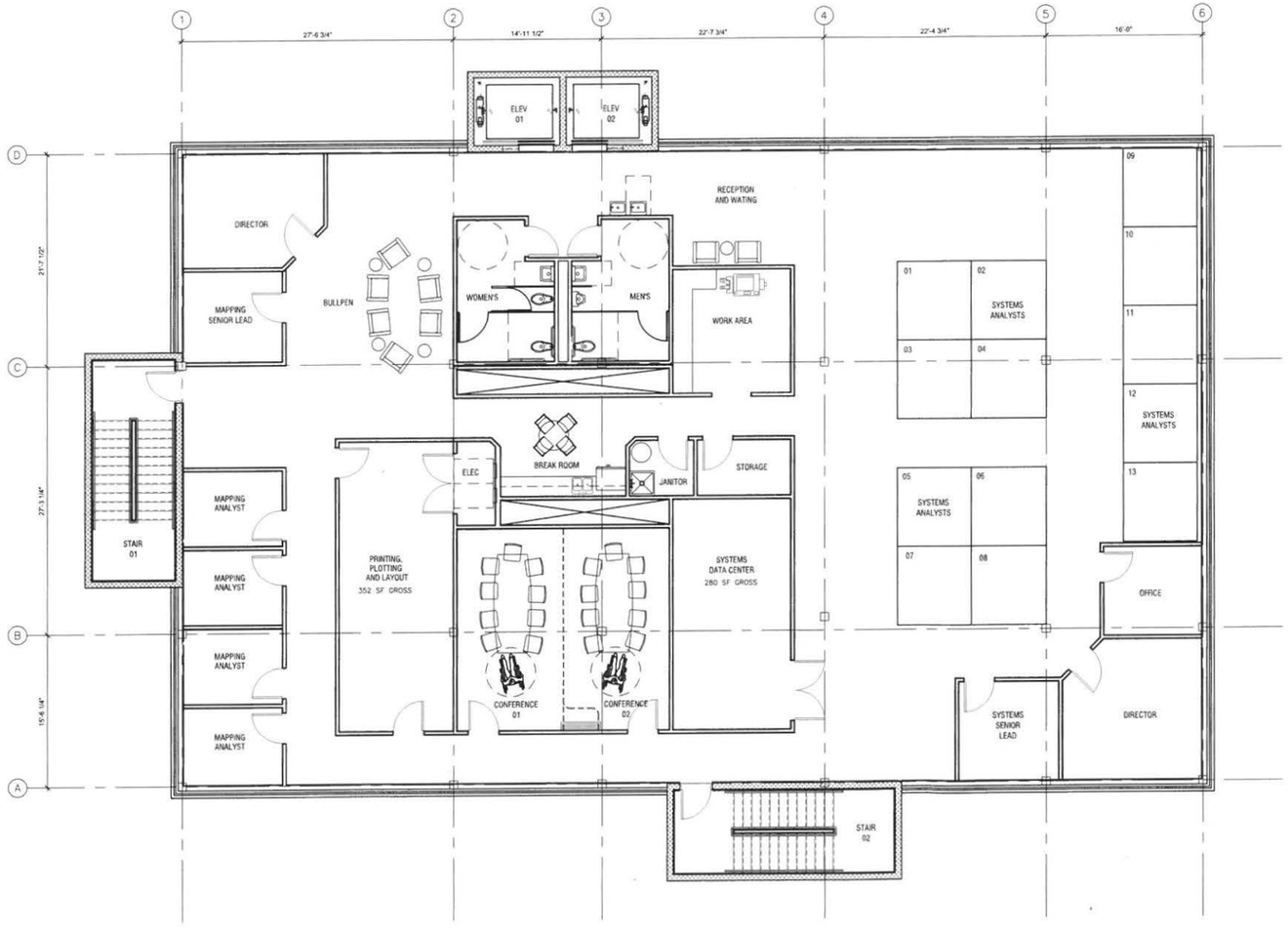
SHEET INFORMATION

DATE	NOVEMBER 22, 2017
JOB NUMBER	17013.00
DRAWN	DCS
CHECKED	DCS
APPROVED	DCS

CONCEPTUAL SECOND FLOOR PLAN

A-102



A2 THIRD FLOOR - IT AND GIS OFFICES (7,608 GROSS SF)
3/16" = 1'-0"

GENERAL NOTES:

A. TEXT
B. TEXT
C. TEXT

SHEET KEY NOTES: (X)

1. TEXT
2. TEXT
3. TEXT

LEGEND:

8" CMU

PROPOSED BUILDING WILL BE FULLY FIRE SPRINKLERED

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BEAUFORT DESIGN BUILD

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BEAUFORT COUNTY GOVERNMENT COMPLEX

NEW OFFICE BUILDING

104 RIBAUT ROAD
BEAUFORT, SC 29902

NOT FOR CONSTRUCTION

REVISIONS / SUBMISSIONS

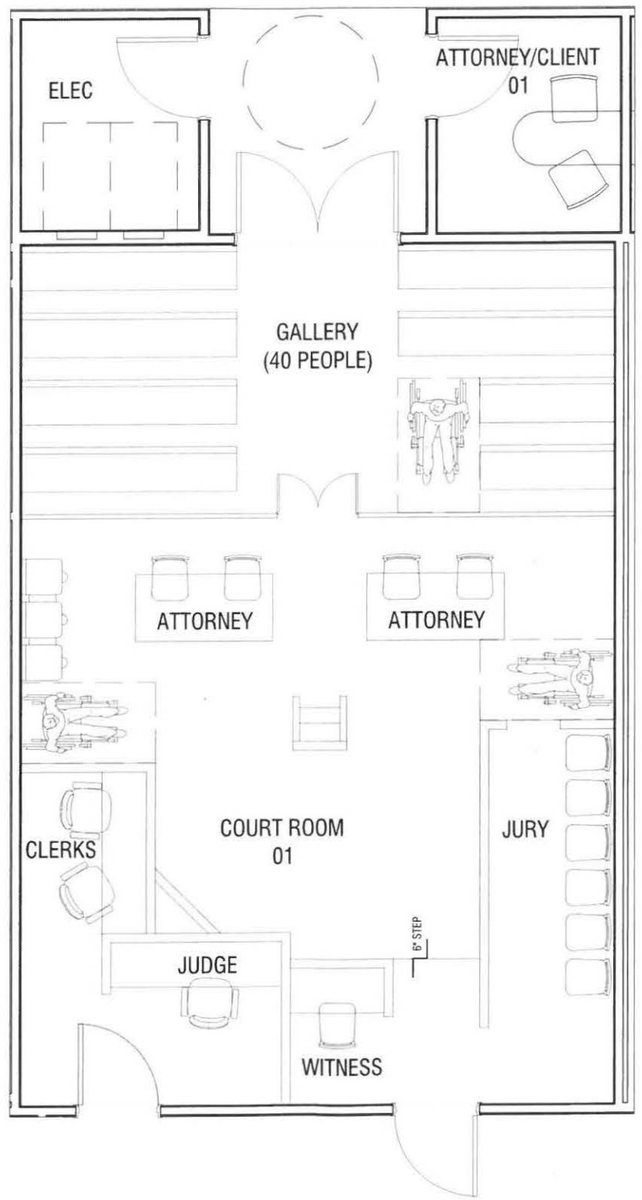
NO.	DESCRIPTION	DATE

SHEET INFORMATION

DATE	NOVEMBER 22, 2017
JOB NUMBER	17013.00
DRAWN	DCS
CHECKED	DCS
APPROVED	DCS

CONCEPTUAL THIRD FLOOR PLAN

A-103



A2 ENLARGED COURTROOM PLAN
1/2" = 1'-0"

GENERAL NOTES:

A. TEXT
B. TEXT
C. TEXT

SHEET KEY NOTES: (X)

1. TEXT
2. TEXT
3. TEXT

THE US COURTS DESIGN GUIDE, PREPARED BY THE JUDICIAL CONFERENCE OF THE UNITED STATES AND PUBLISHED BY THE GOVERNMENT SERVICES ADMINISTRATION (GSA) REQUIRES THAT GALLERY, DEFENDANT, JURY AND ATTORNEY SPACES BE ACCESSIBLE. JUDGE AND CLERK SPACES ARE NOT REQUIRED TO BE ACCESSIBLE

LEGEND:

PROPOSED BUILDING WILL BE FULLY FIRE SPRINKLERED

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BEAUFORT DESIGN BUILD

BEAUFORT COUNTY SOUTH CAROLINA 1769

BEAUFORT COUNTY GOVERNMENT COMPLEX

NEW OFFICE BUILDING

104 RIBAUT ROAD
BEAUFORT, SC 29902

NOT FOR CONSTRUCTION

REVISIONS / SUBMISSIONS

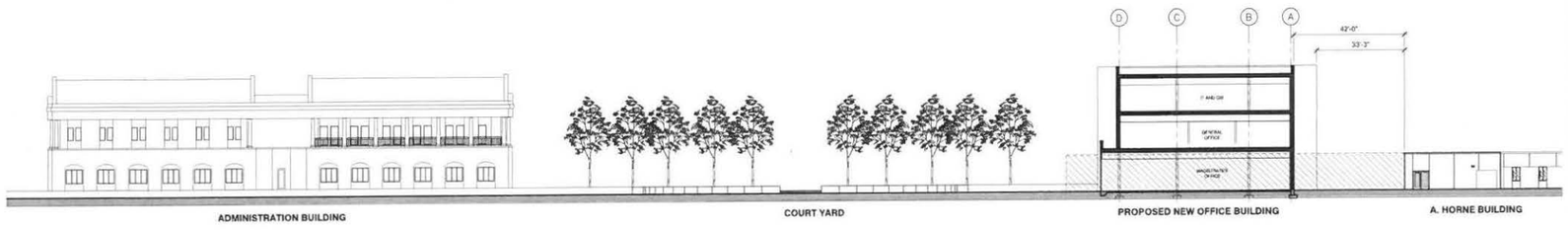
NO.	DESCRIPTION	DATE

SHEET INFORMATION

DATE	NOVEMBER 22, 2017
JOB NUMBER	1701.3.00
DRAWN	DCS
CHECKED	DCS
APPROVED	DCS

ENLARGED PLANS

A-104



B2 BUILDING SECTION - WEST
1" = 20'

A2 BUILDING SECTION - SOUTH
1/16" = 1'-0"

GENERAL NOTES:

A. PROPOSED CONSTRUCTION TYPE IS IIB (NON-COMBUSTIBLE)
B. BUILDING WILL BE EQUIPPED THROUGHOUT WITH AN AUTOMATIC SPRINKLER SYSTEM
C. PRIMARY OCCUPANCY GROUP IS BUSINESS (B)

SHEET KEY NOTES: (X)

1. EXISTING ELECTRICAL POLE WITH OVERHEAD LINES
2. EXISTING ADMINISTRATION BUILDING(BEYOND)

LEGEND:

AREA OF THE BUILDING TO BE REMOVED IN ITS ENTIRETY

BEAUFORT
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BEAUFORT DESIGN BUILD

BEAUFORT COUNTY SOUTH CAROLINA 1769

BEAUFORT COUNTY GOVERNMENT COMPLEX

NEW OFFICE BUILDING

104 RIBAUT ROAD
BEAUFORT, SC 29902

NOT FOR CONSTRUCTION

REVISIONS / SUBMISSIONS

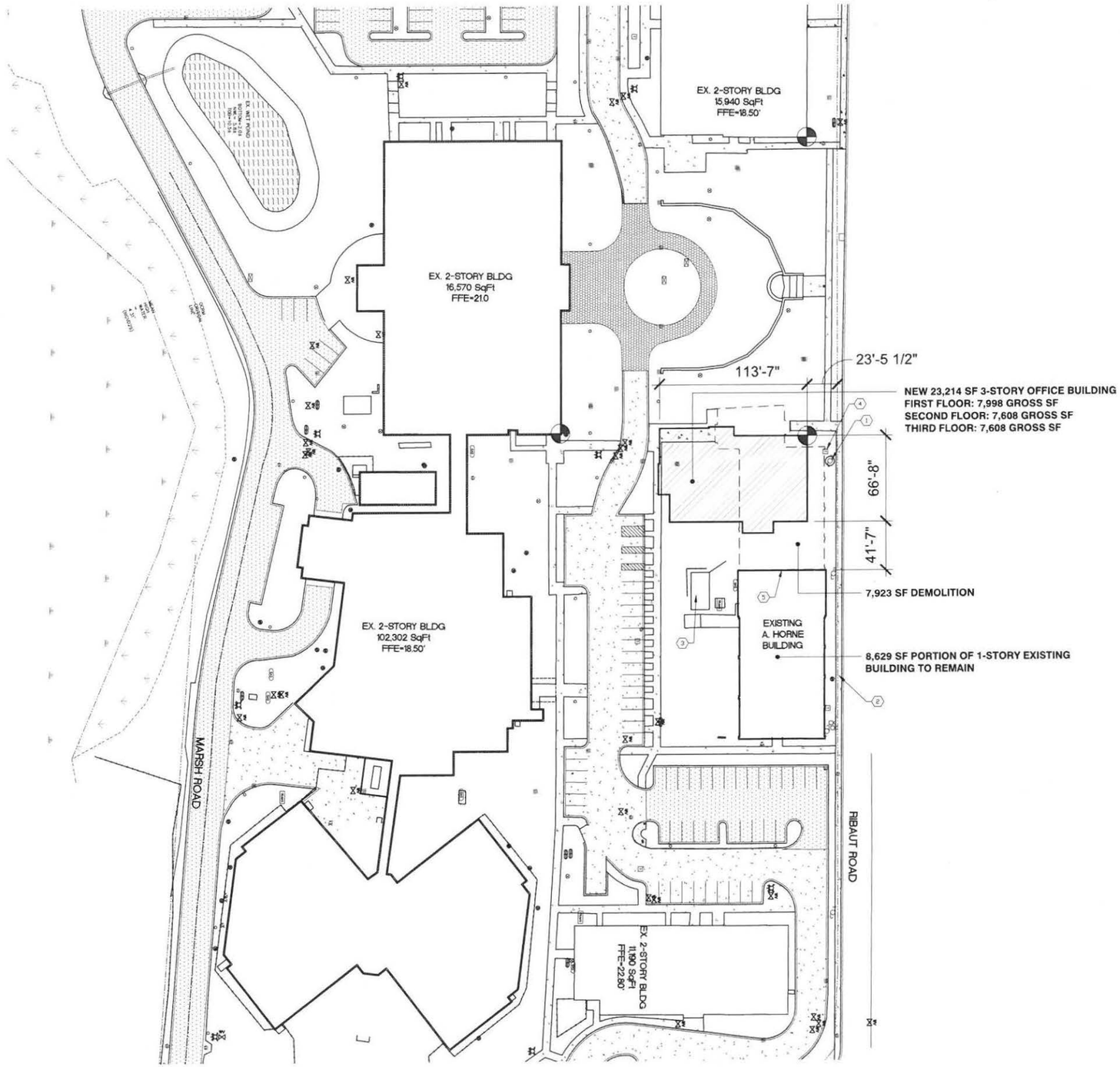
NO.	DESCRIPTION	DATE

SHEET INFORMATION

DATE	NOVEMBER 22, 2017
JOB NUMBER	17013.00
DRAWN	GRM
CHECKED	DCS
APPROVED	DCS

BUILDING / SITE SECTIONS

A-301



A2 CONCEPTUAL SITE PLAN
1/32" = 1'-0"

GENERAL NOTES:

A. PROPOSED CONSTRUCTION TYPE IS IIB (NON-COMBUSTIBLE)
B. BUILDING WILL BE EQUIPPED THROUGHOUT WITH AN AUTOMATIC SPRINKLER SYSTEM
C. PRIMARY OCCUPANCY GROUP IS BUSINESS (B)

SHEET KEY NOTES: (X)

1. EXISTING ELECTRICAL POLE WITH OVERHEAD LINES
2. EXISTING SIDEWALK, CURB AND GUTTER
3. EXISTING GENERATOR
4. EXISTING TRANSFORMER
5. DEMOLITION OF EXISTING BUILDING AT EXISTING BUILDING EXPANSION JOINT AND CMU LATERAL BRACING WALL

7,998 GROSS SF NEW FOOTPRINT / 7,923 GROSS SF DEMOLITION OF EXISTING BUILDING = 1% INCREASE IN EXISTING IMPERVIOUS SURFACE AREA

LEGEND:

ALIGN CORNERS

NEW 3-STORY, 23,214 GROSS SF COUNTY OFFICE BUILDING

BEAUFORT
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Beaufort, SC 29907

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BEAUFORT DESIGN BUILD

BEAUFORT COUNTY SOUTH CAROLINA 1769

BEAUFORT COUNTY GOVERNMENT COMPLEX

NEW OFFICE BUILDING

104 RIBAUT ROAD
BEAUFORT, SC 29902

NOT FOR CONSTRUCTION

REVISIONS / SUBMISSIONS

NO.	DESCRIPTION	DATE

SHEET INFORMATION

DATE	NOVEMBER 22, 2017
JOB NUMBER	1701.3.00
DRAWN	DCS
CHECKED	DCS
APPROVED	DCS

CONCEPTUAL SITE PLAN

AS-101

Beaufort Conservation District
BEAUFORT, SOUTH CAROLINA

Mailing: Po Box 70, Port Royal, SC 29935
124 Lady's Island Dr. Beaufort, SC 29907
Telephone: 843-255-7306
Email: bswcd@islc.net
www.beaufortconservationdistrict.org/

February 7, 2018

Robert McFee, Director
Beaufort County Engineering & Infrastructure
PO Drawer 1228
Beaufort, SC 29901

Re: SC Recreational Trails Program Grant for Kayak Ramp at Whale Branch Fishing Pier

Dear Mr. McFee,

Beaufort Soil and Water Conservation District has a long history of working with schools, communities, organizations, Boy Scout Troops, and local kayakers to promote and develop land and water trails in Beaufort County.

We would like to partner with Beaufort County to install a kayak ramp parallel to the Whale Branch Fishing Pier to allow kayakers and canoers to enjoy the recreational trail provided by an Accommodation Tax Grant that we obtained in 2014. See the Whale Branch Trail link at http://beaufortblueways.info/WhaleBranch.html for map and information.

There are several benefits of this unique area that make this a great location for installing a safe access ramp for paddlers. The Whale Branch Fishing Pier is a maintained facility belonging to Beaufort County with parking and signage. The pier is located at the trail head for The Spanish Moss Trail. The Executive Director of SMT, Dean Moss, is partnering with us on the kayak ramp and will encourage completion of that section of the trail, showing important connectivity to both opportunities! The McLeod Farm property located beside and around the fishing pier is on the National Register of Historic Places and adds cultural appeal to the area. Outside Foundation will also provide a letter of support. They sponsor the Kids in Kayaks program for middle school students and are excited to have a safe kayak access point north of the Broad River. This will allow easier access to students at Whale Branch Middle School and other schools north of the Broad. Lastly, the simple beauty of the Whale Branch River and Pier add much appeal to this project.

We have included partners in the initial meetings on planning the kayak ramp. George Madlinger, SCDHEC/OCRM Permitting, will assist us in obtaining the necessary permits

which will meet all OCRM and US Corps of Engineers requirements and guidelines. Andrea Atherton, Beaufort County CIP Manager, has obtained an estimate for the project, including installation and materials, at a cost of $150,000. The total of grant funds available is 20% match up to a maximum of $100,000. That would mean Beaufort County would have to invest $50,000 in county funds on this project assuming the estimate is accurate. We do not have a budget that will allow us to fully sponsor this $100,000 grant. Neal Hamilton, State Trails Coordinator, informed us that Beaufort Conservation District can apply for the grant, submit invoices to SCPRT and repay Beaufort County for the work. Obviously, we would expect to sign a contract or MOU that guaranteed repayment to Beaufort County in a timely manner once any grant payment checks were received.

Beaufort SWCD staff attended the required SCPRT grant writing workshop in Columbia and learned that all materials must be paid for up front, in our case by Beaufort County. The BSWCD would submit the Beaufort County invoices for the expenditures to SCPRT. Upon receipt of their reimbursement, BSWCD would deposit funds or endorse checks over to Beaufort County, as directed.

There is a point system on grading entities applying for grants. It has been 10 years since we had a RTP grant for completing the first phase of Beaufort Blueways and we would receive 10 points.

I hope I have provided a clear overview of the Kayak Ramp Recreational Trails Program Grant. Please let me know if you have any questions or need any further information that we need to provide at the Public Facility Committee meeting February 12th. The grant application is due, no exceptions, March 14, 2018, so time is of the essence. We appreciate your interest in this worthwhile project and hope you all will be able to support this grant opportunity.

Sincerely,

E. Shelby Berry
District Manager

cc: Andrea Atherton, Engineering, Beaufort County
Claude McLeod, Commissioner, Vice Chairperson, BSWCD
Denise Parsick, Commissioner, Sec/Treasurer, BSWCD
Carol Murphy, Associate Commissioner
Phyllis Atkins, Community Health, Safety & Trails Coordinator, BSWCD

ADD-ONS

The document(s) herein were provided to Council for information and/or discussion after release of the official agenda and backup items.

Topic:	Bluffton Parkway at SC46 Roundabout Review
Date Submitted:	February 12, 2018
Submitted By:	Colin Kinton
Venue:	Public Facilities Committee

Bluffton Parkway at SC 46 Roundabout In-Service Review

Mark Lenters

Topic: Bluffton Parkway at SC46 Roundabout Review
Date Submitted: February 12, 2018
Submitted By: Colin Kinton
Venue: Public Facilities Committee

In-Service Review
Study Method

1. Collision Analysis
2. Geometric Conformance Review
3. Operational Analysis
4. List of Identified Deficiencies
5. Site Visit – validation of deficiencies from observations of drivers and geometry
6. Development of Countermeasures (low, med. & high)
7. Documentation/Reporting/Presenting
8. Implementation and monitoring (“3 E’s”)

BEAUFORT COUNTY

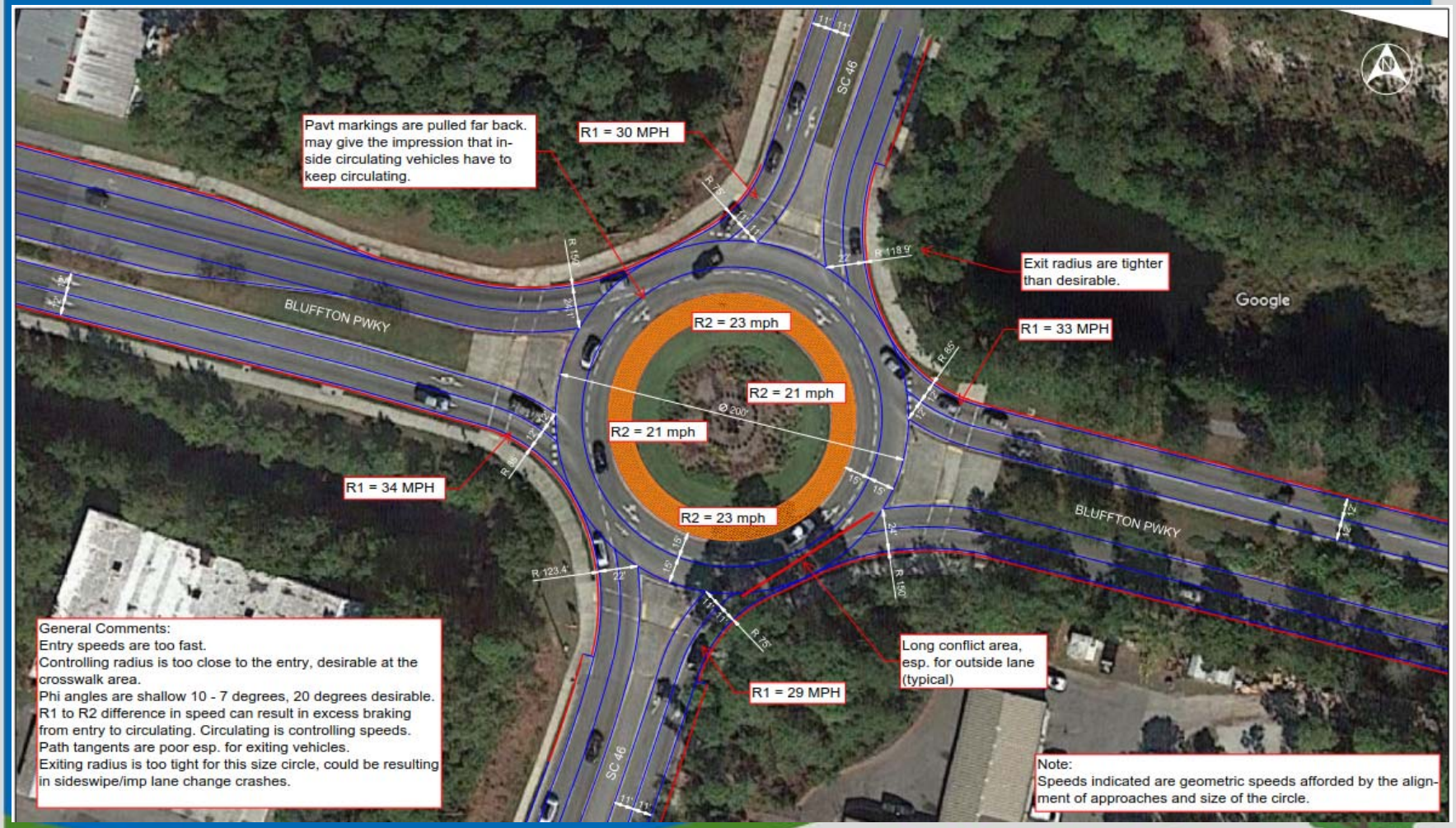
Before and After Striping Change Crash Analysis

	AADT	Total crashes per year	Crash Rate	Quadrant Crash Rate				FYRW/IMP LC %
				NE	SE	SW	NW	
Before	14,500	35.8	6.9	2.9	2.8	0.9	1.6	38/62 %
After	22,000	30.8	4.0	1.4	1.5	1.1	1.5	42/58 %

- Reduction of ~6 crashes per year
- Quadrant Crash Rate stabilized around 1.3 even with an increase in volume
- However, roundabout is still crash prone and above national averages

BEAUFORT COUNTY

Geometric Conformance Review



BEAUFORT COUNTY

Bluffton Parkway Site Visit

- Drivers have trouble navigating the large conflict area – Drivers had trouble anticipating acceptable gaps to enter
- Night time lighting could be improved
- No exit guide signs for navigation to downstream destinations
- No overhead lane assignment signs for lane choice
- Height of roundabout central island chevrons

BEAUFORT COUNTY

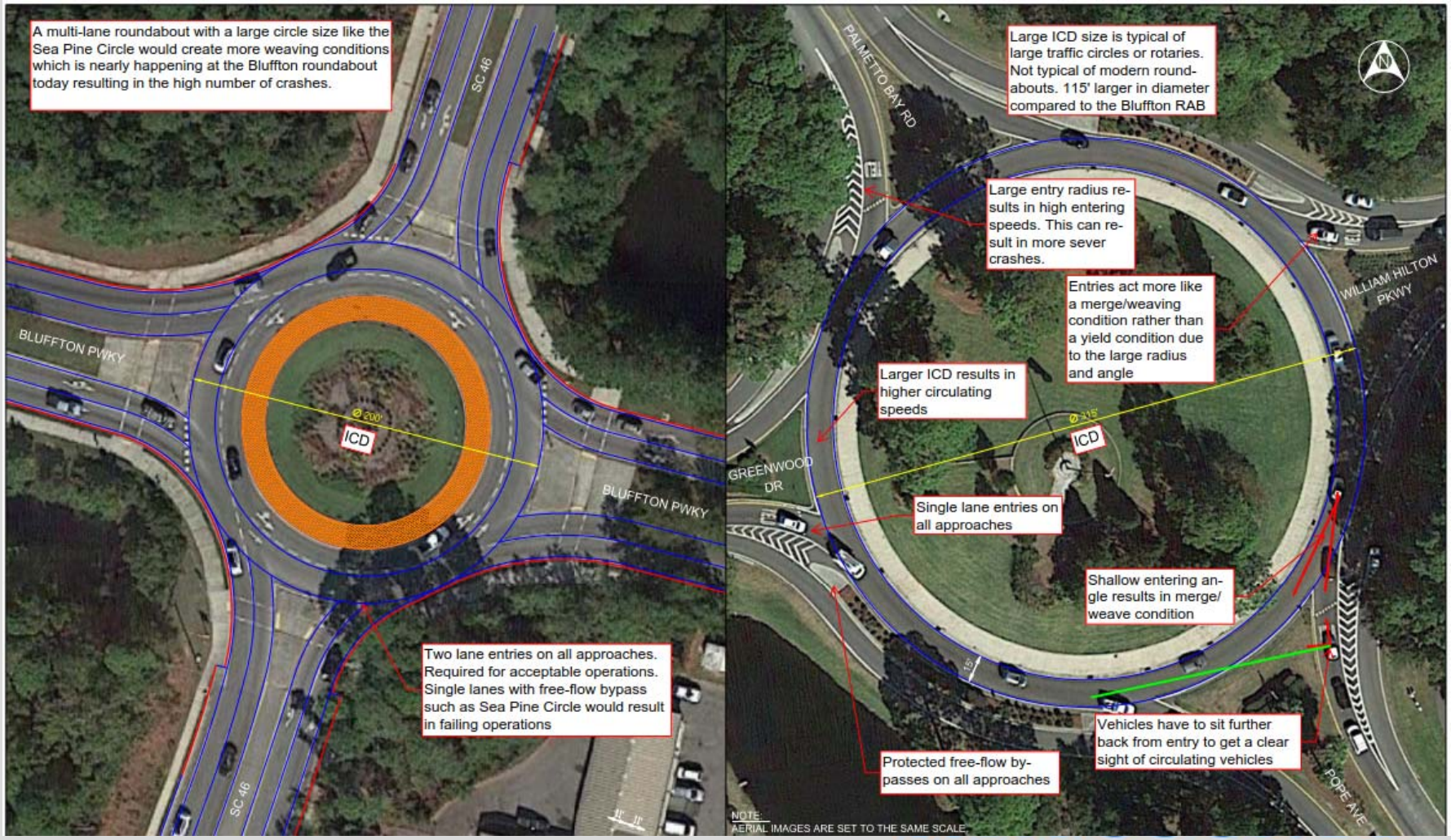
Sea Pines Circle Site Visit

(Tuesday Jan. 16, 2018)

- Previously a non-conforming rotary or traffic circle – aesthetic but not functional as a multilane layout
- Single-lane with free-flow bypasses on all approaches, much larger circle – weaving sections (not a modern roundabout)
- Long queues peak and off-peak
- The circle would be crash prone if set up as a multi-lane (weaving and merging behavior)
- It is not possible to reduce the Bluffton Parkway roundabout to single lane due to its high traffic demands

BEAUFORT COUNTY

Sea Pine Circle Comparison



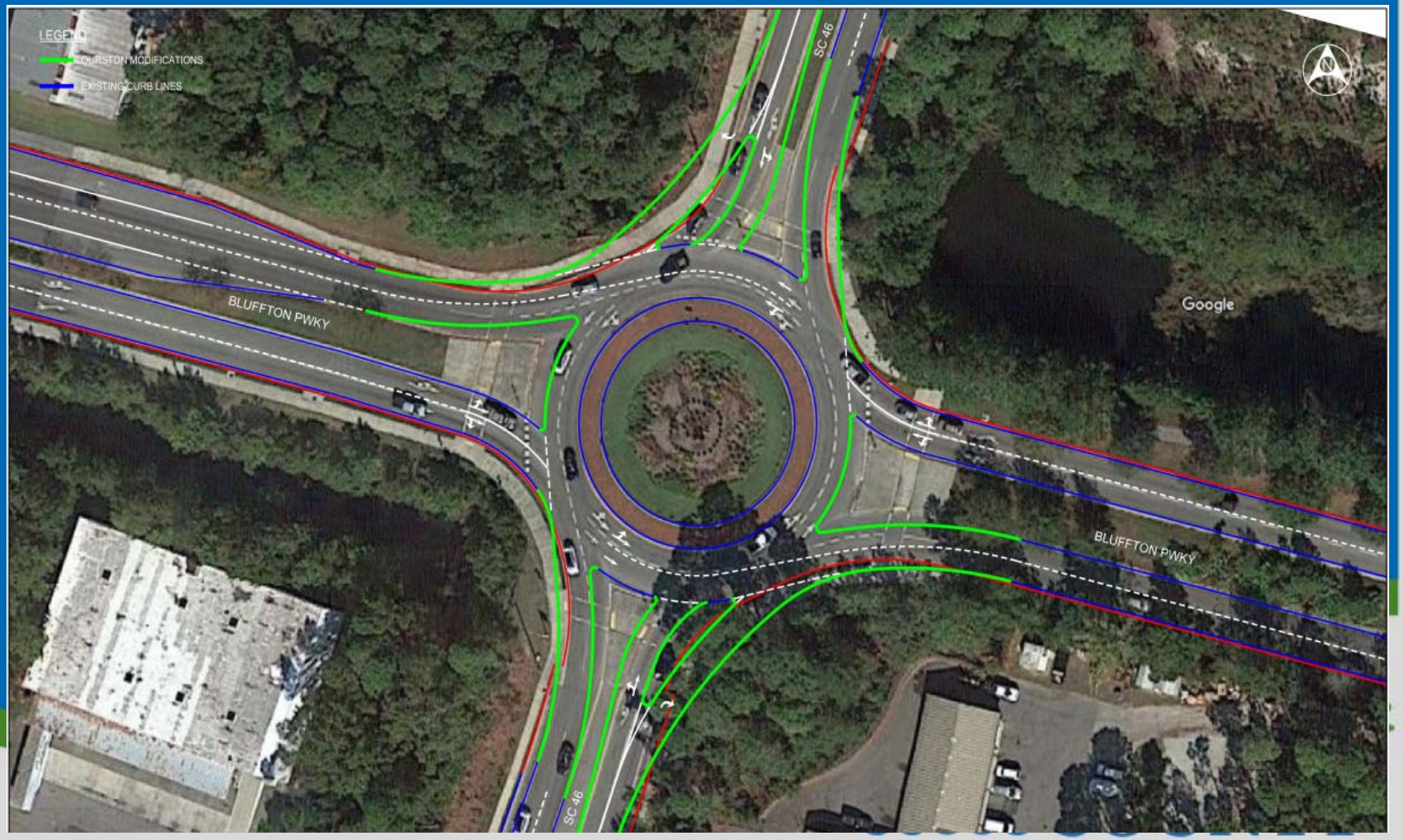
Low/Immediate Countermeasures

- Improved lane signs and marking
- Aggressive education

BEAUFORT COUNTY

Medium Countermeasure

2x1 Hybrid Roundabout



Medium Countermeasure

2x1 Hybrid Roundabout

			SB SC 46		EB Bluffton Pkwy	NB SC 46		WB Bluffton Pkwy
	Lane Group		LT	R	LTR	LT	R	LTR
ARCADY 9.0	AM Peak	LOS	B	A	B	D	C	A
		Queue (ft)	100	25	725	425	150	50
		v/c	0.45	0.17	0.86	0.78	0.54	0.52
		Delay (s)	**10.1**	**6.7**	**14.3**	**34.9**	**17.7**	**4.6**
	PM Peak	LOS	D	E	A	E	A	C
		Queue (ft)	300	650	75	725	75	650
		v/c	0.72	0.85	0.64	0.86	0.37	0.85
		Delay (s)	**26.5**	**45.5**	**5.8**	**35.6**	**8.7**	**15.4**

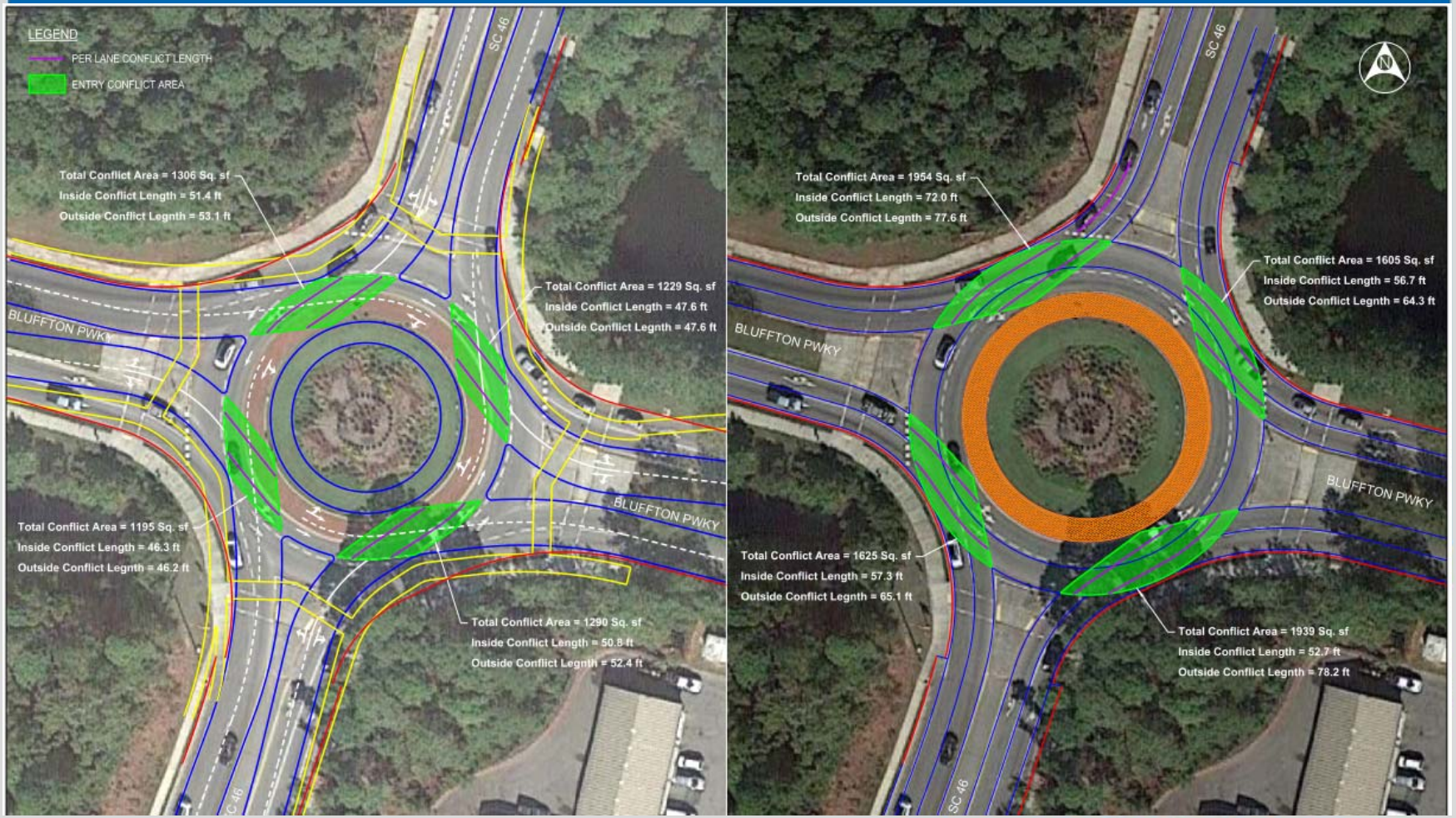
LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle

- Poor Operations
- No Residual Capacity

BEAUFORT COUNTY

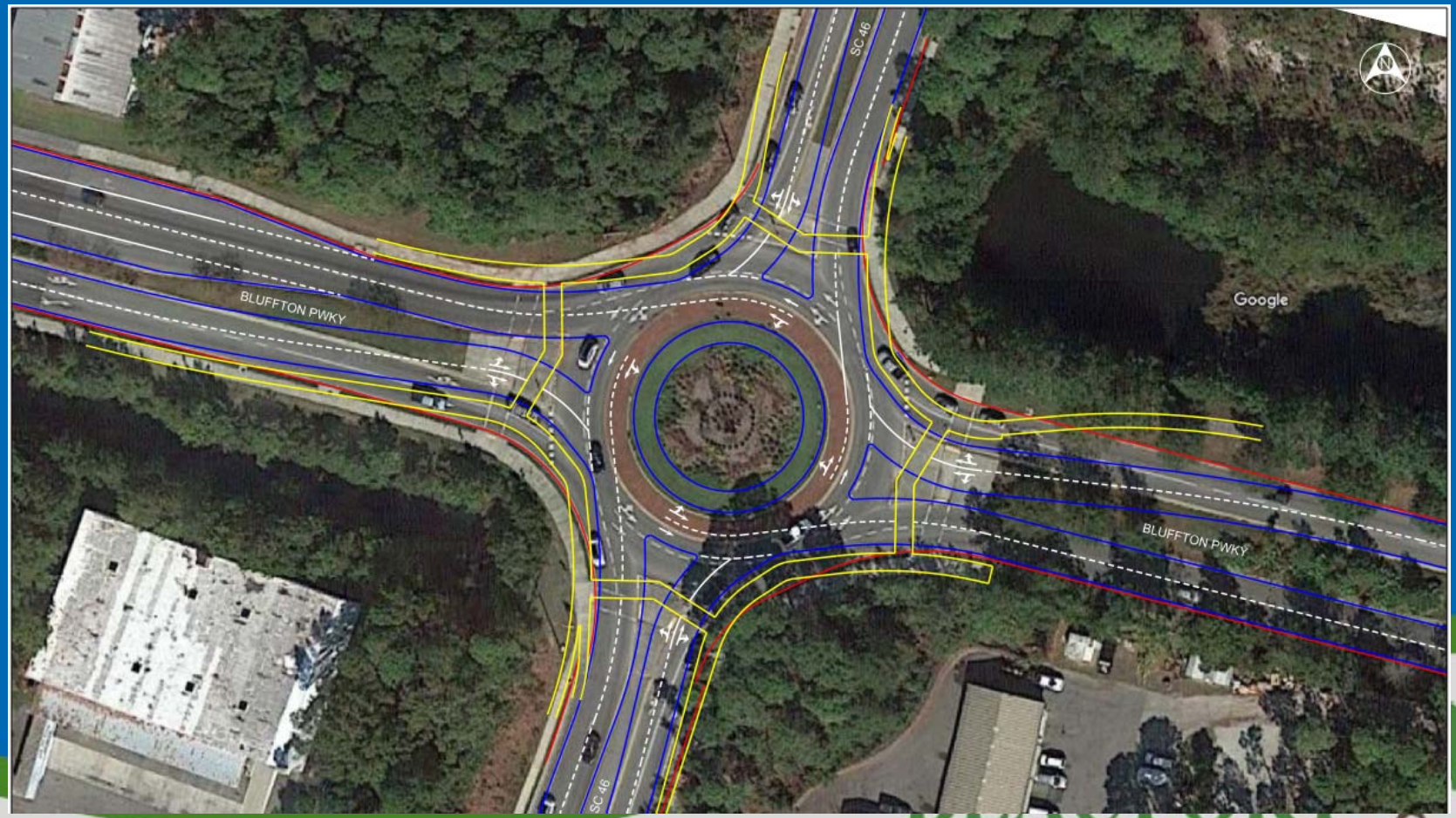
High Countermeasure
Full Rebuild Roundabout

Proposed **Existing**



High Countermeasure

Full Rebuild Roundabout



BEAUFORT COUNTY

High Countermeasure

Residual Capacity Past 2017 Traffic Demand

- Estimated 2% compound traffic growth
- Modified roundabout will have residual capacity
- 16% Residual Capacity ~ approx. 8 years

BEAUFORT COUNTY

Conclusions, Recommendations and Approximate Costs

- 50% reduction of crashes per year would need to be achieved for this roundabout to perform within the range of national expected average number of crashes
- High cost, full rebuild, countermeasure should be implemented
- Include improved signing and markings
- Widespread driver education
- Cost ~ $1,500,000

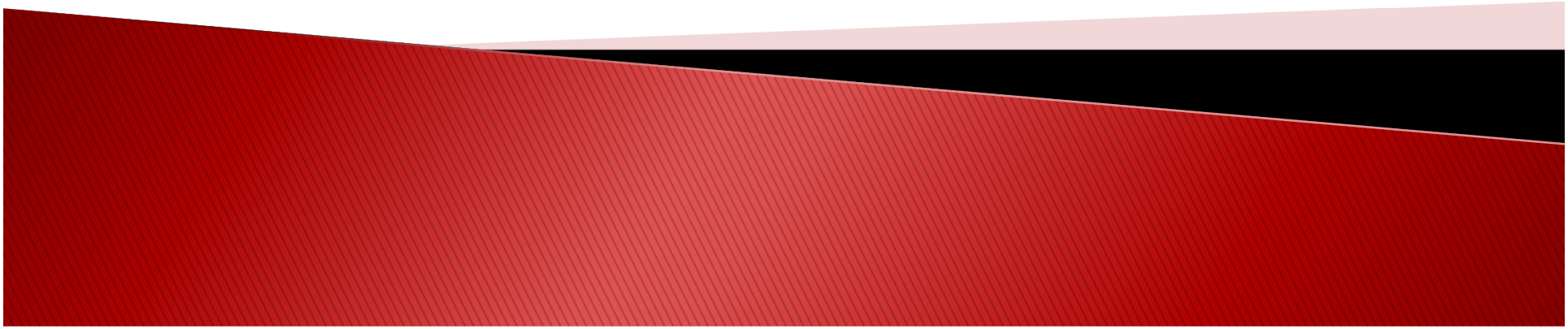
BEAUFORT COUNTY

Topic:	Bluffton Parkway at SC 46 Roundabout Review
Date Submitted:	February 12, 2018
Submitted By:	Mark Lenters
Venue:	Public Facilities Committee

Topic: Bluffton Parkway at SC 46 Roundabout Review
Date Submitted: February 12, 2018
Submitted By: Mark Lenters
Venue: Public Facilities Committee

Bluffton Parkway at SC 46 Roundabout In-Service Review

Mark Lenters – Ourston



Study Methodology

1. Collision Analysis
2. Geometric Conformance Review (cursory)
3. Operational Analysis (cursory)
4. List of Identified Deficiencies (Office Review)
5. Site Visit – verification of deficiencies
6. Development of Countermeasures
7. Documentation/Reporting

Before and After Striping Change Crash Analysis

	AADT	Total crashes per year	Crash Rate	Quadrant Crash Rate				FYRW/IMP LC %
				NE	SE	SW	NW	
Before	14,500	35.8	6.9	2.9	2.8	0.9	1.6	38/62 %
After	22,000	30.8	4.0	1.4	1.5	1.1	1.5	42/58 %

- Reduction of ~6 crashes per year
- Quadrant Crash Rate stabilized around 1.3 even with an increase in volume
- However, roundabout is still crash prone and above national averages

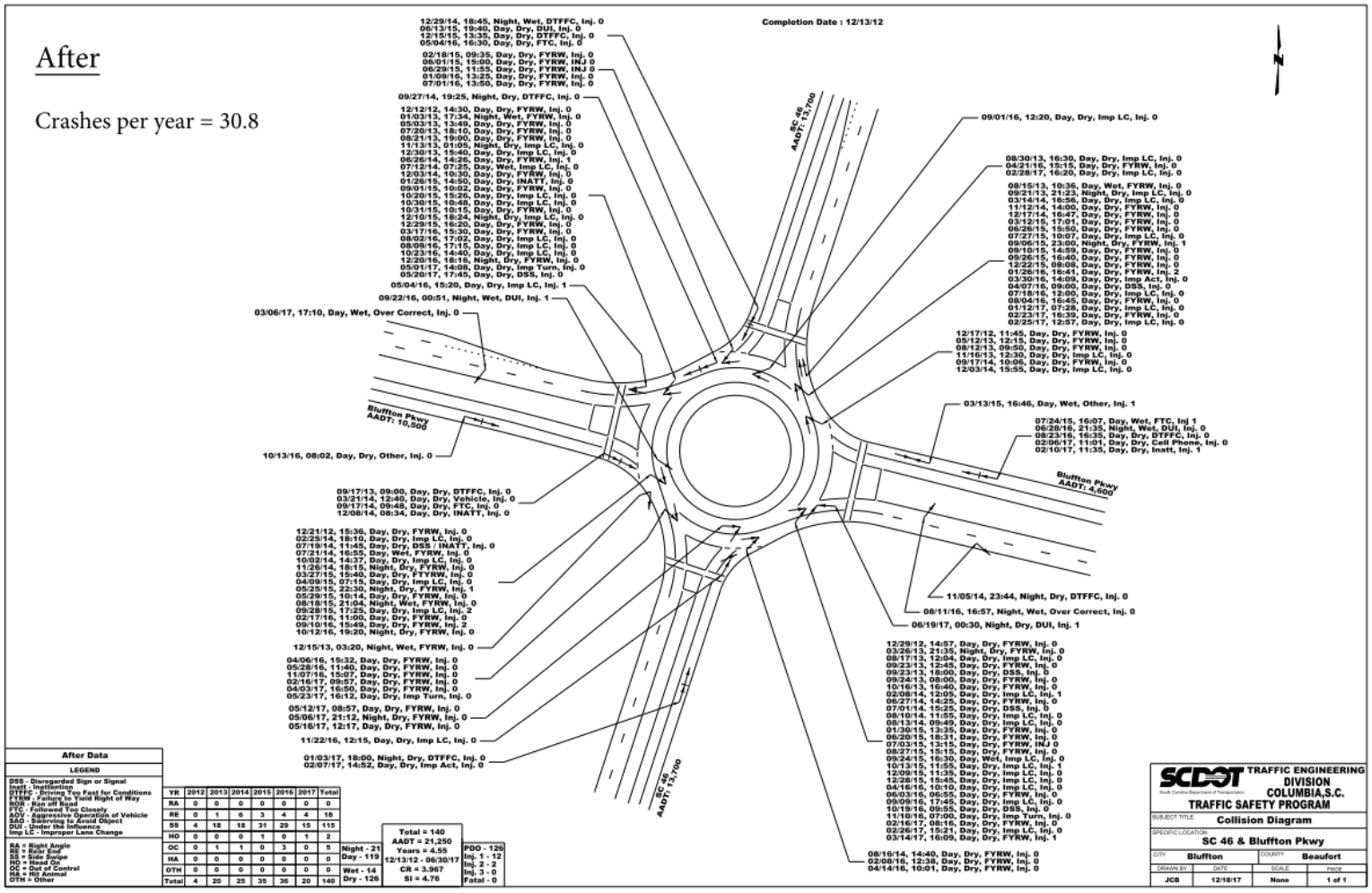
Crash Analysis

	Total	2012	2013	2014	2015	2016	2017
Total crashes	**140**	**4**	**20**	**25**	**35**	**36**	**20**
Injury	**15**	0	0	2	6	4	3
Fatal	**0**	0	0	0	0	0	0
Rear-end	**18**	0	1	6	3	4	4
Angle*	**0**	0	0	0	0	0	0
Sideswipes**	**115**	4	18	18	31	29	15
Head-On	**2**	0	0	0	1	0	1
Single Vehicle	**5**	0	1	1	0	3	0

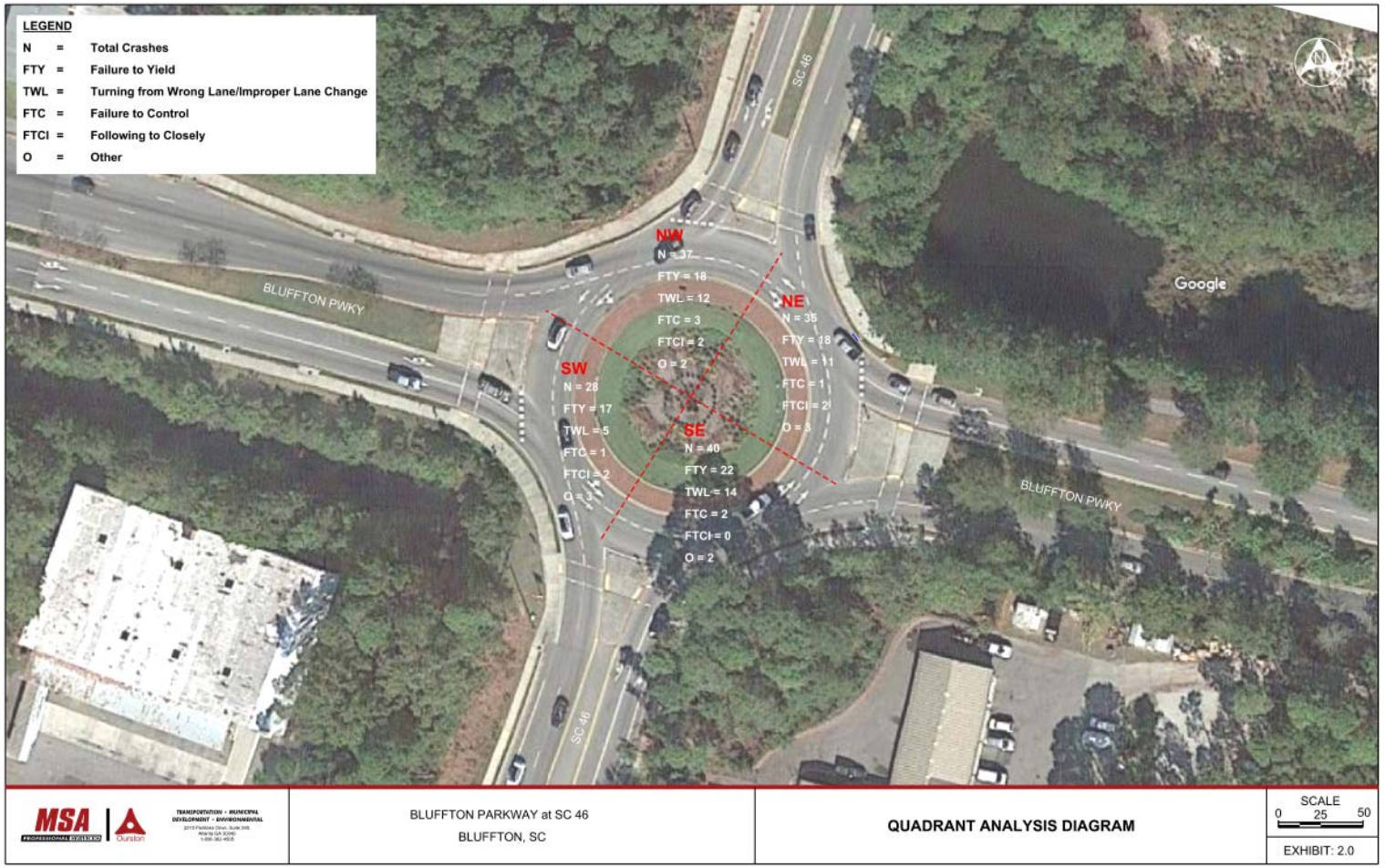
*Angle collisions include Left-turn opposing, Left-turn, Right-angle, Angle opposing, Angle similar direction, Turn opposing and Right-turn side

**Sideswipes collisions include Sideswipe same direction, Sideswipe opposite directions and Overtake

Crash Analysis cont.



Crash Analysis cont.



Crash Analysis cont.

Contributing Factor	#
Failure To Control	7
Failure To Yield	**75**
Followed Too Close	6
Improper Lane Change/Passing/Turn	**42**
Other	10
Total	140

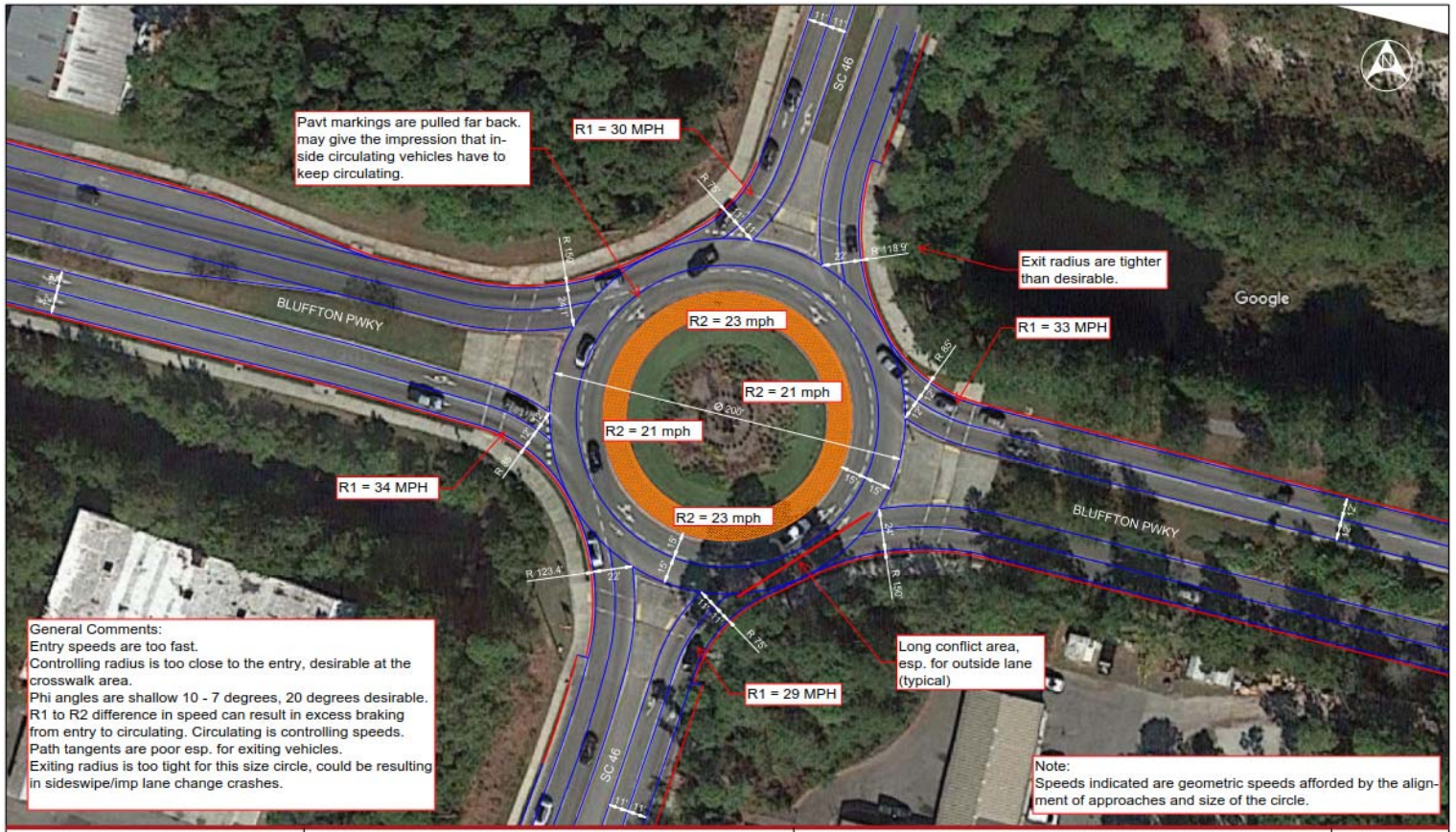
Crash Severity	Site #	% of Total	US %[1]	WI %[2]	MN %[3]	Avg.
Injury/fatality Crash	**15**	**11%**	6.5%	23.6%	8.8%	13.0%
Property Damage Crash	125	89%	93.5%	76.4%	91.2%	87.0%

Crash Analysis cont.

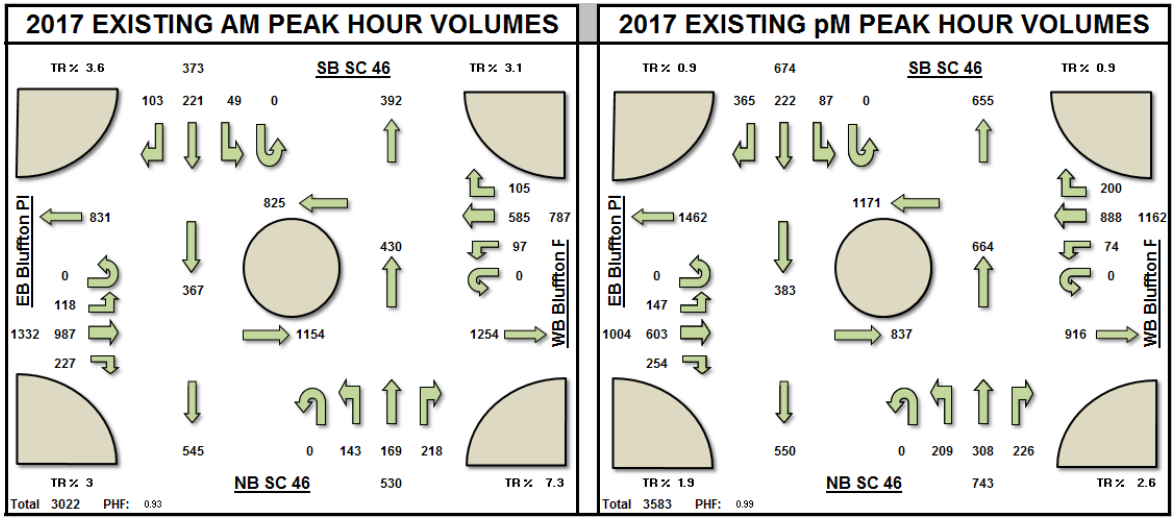
Collision Class	Expected Annual Crashes (NCHRP Model)[5]	95th Percentile Expected Crash Frequency (NCHRP Model)	Expected Annual Crashes (WI Calibrated NCHRP Model 2017)[6]	95th Percentile Expected Crash Frequency (WI Calibrated NCHRP Model 2017)	Expected Annual Crashes (MDOT Safety Performance Functions 2011)[7]	95th Percentile Expected Crash Frequency (MDOT Safety Performance Functions 2011)	Recorded Annual Freq. of Crashes (2012 to 2017)
Total Crashes	6.6	17.7	5.1	15.2	1.9	5.4	30.8
Injury Crashes	0.5	1.2	1.2	3.2	0.2	0.5	3.3

Collision Class	Site Crash Rate (2012 to 2017)	NCHRP Expected Crash Rate[5]	WI Expected Crash Rate[6]	MN Expected Crash Rate[7]
Total Crashes	4.0 MEV	0.9 MEV	0.7 MEV	0.2 MEV
Injury Crashes	0.43 MEV	0.06 MEV	0.15 MEV	0.03 MEV

Geometric Conformance Review



Operational Analysis



			SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
ARCADY 9.0	AM Peak	LOS	A	B	A	A
		Queue (ft)	25	225	50	25
		v/c	0.31	0.81	0.56	0.50
		Delay (s)	**4.0**	**10.5**	**7.8**	**4.1**
	PM Peak	LOS	A	A	A	B
		Queue (ft)	50	25	25	200
		v/c	0.67	0.61	0.62	0.79
		Delay (s)	**9.7**	**5.0**	**7.0**	**10.6**

LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle

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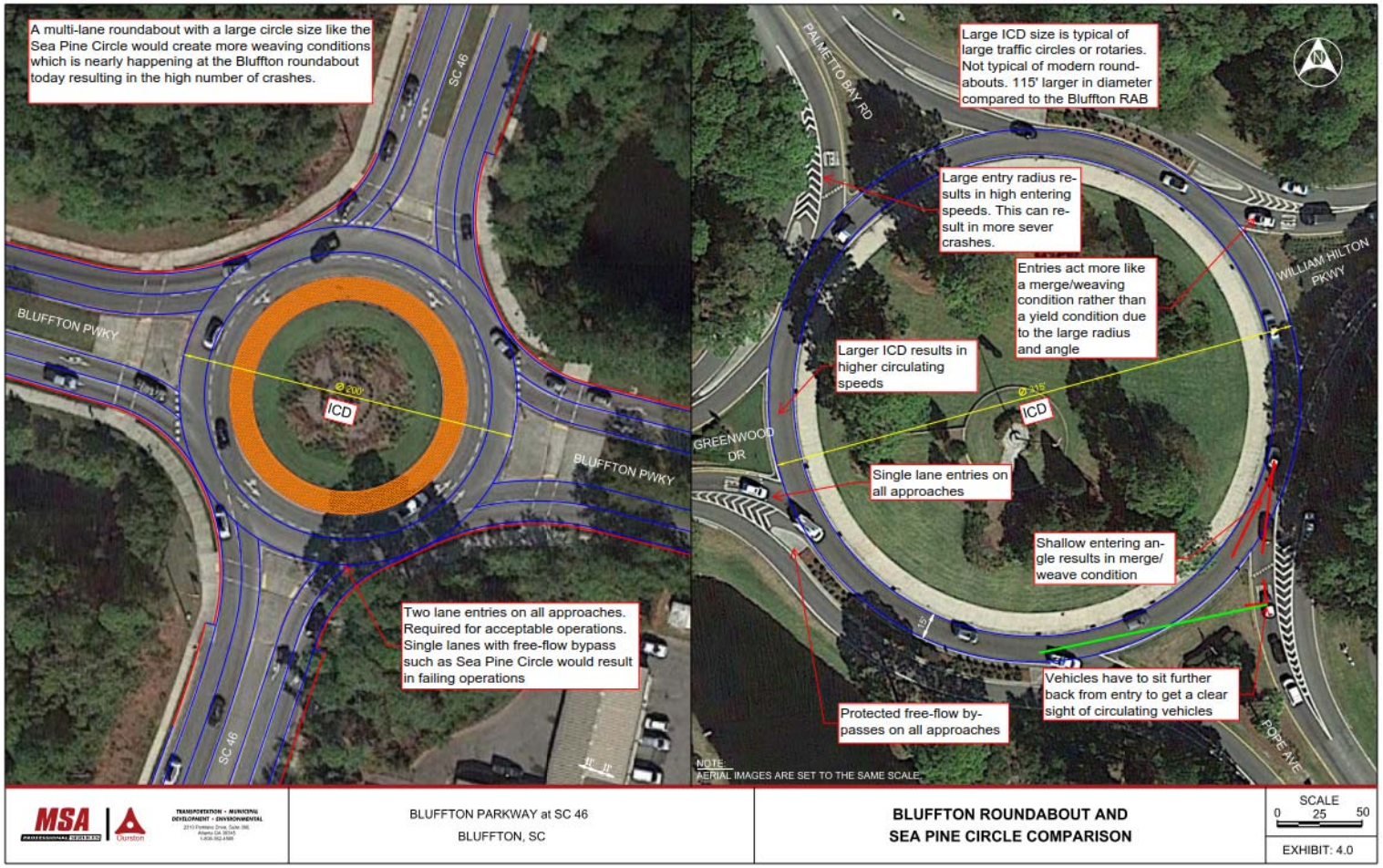
Site Visit

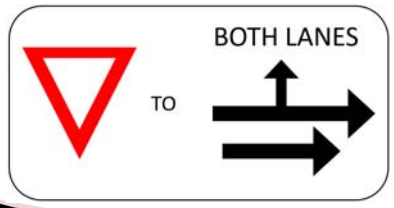
- Drivers had trouble navigating the large conflict area – Drivers had trouble anticipating acceptable gaps to enter
- Poor night time lighting
- No exit guide signs for identification and navigation to downstream destinations
- No overhead lane designation signage for added conspicuity and improved lane choice
- Reduce height of roundabout chevrons on the central island (less that 5ft. is not unreasonable, especially with modern vehicle headlamps
- Shorten exit stripes, so that the lane line does not need to be crossed by a vehicle on the inside (left) lane and exiting.
- The Sea Pine circle is single-lane with free-flow bypasses on all approaches, much larger
  - Queues stretch more than a quarter mile during peak periods
  - The circle would be crash prone if multi-lane
  - It is not possible to reduce the Bluffton roundabout to single lane due to the higher traffic demands there

Sea Pine Circle Comparison



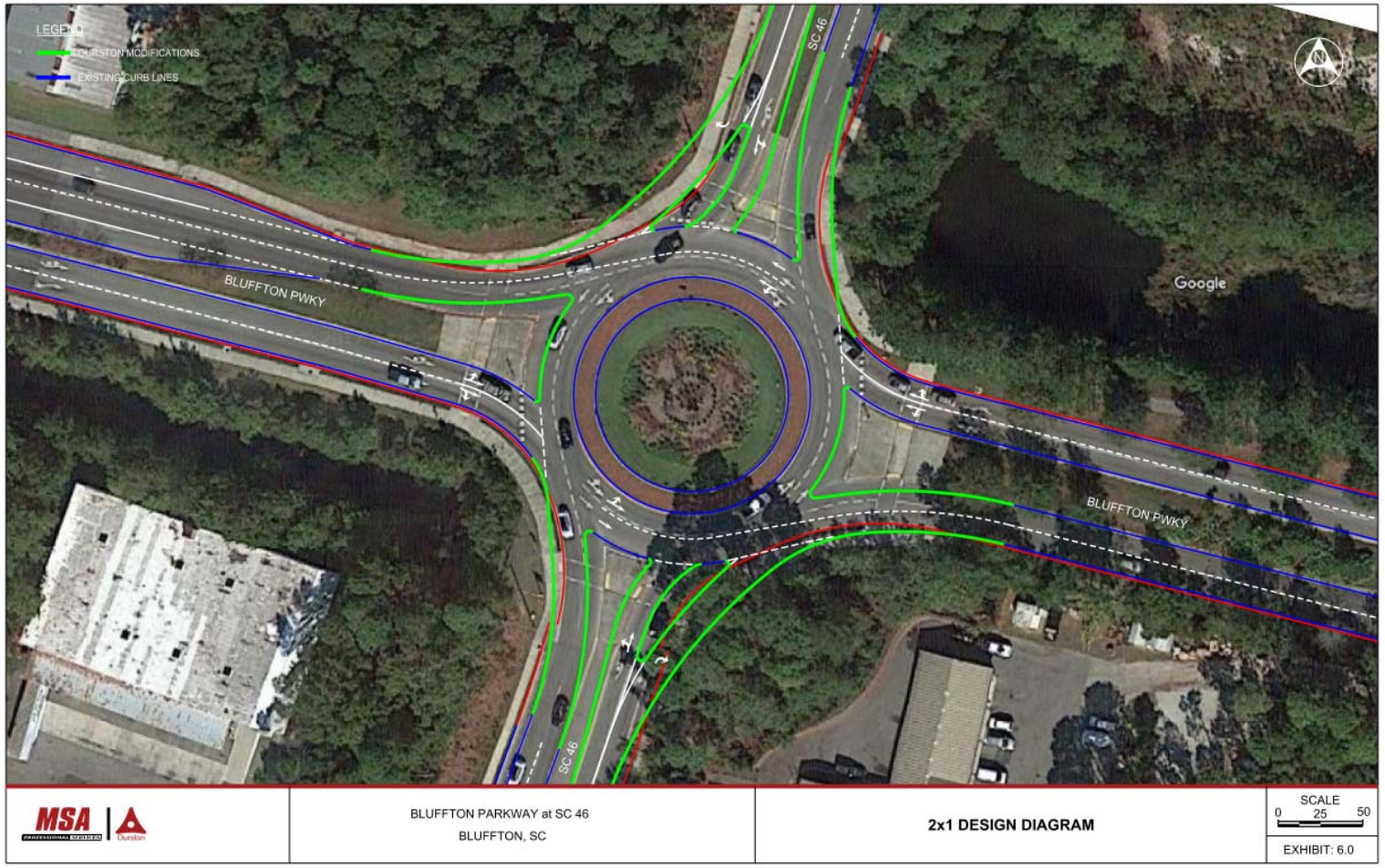
Low/Immediate Countermeasures

- Improved Sign and Marking
- Education
- Red Colored Conflict Area



Medium Countermeasure

2x1 Hybrid Roundabout



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Medium Countermeasure

2x1 Hybrid Roundabout

			SB SC 46		EB Bluffton Pkwy	NB SC 46		WB Bluffton Pkwy
	Lane Group		LT	R	LTR	LT	R	LTR
ARCADY 9.0	AM Peak	LOS	B	A	B	D	C	A
		Queue (ft)	100	25	725	425	150	50
		v/c	0.45	0.17	0.86	0.78	0.54	0.52
		Delay (s)	**10.1**	**6.7**	**14.3**	**34.9**	**17.7**	**4.6**
	PM Peak	LOS	D	E	A	E	A	C
		Queue (ft)	300	650	75	725	75	650
		v/c	0.72	0.85	0.64	0.86	0.37	0.85
		Delay (s)	**26.5**	**45.5**	**5.8**	**35.6**	**8.7**	**15.4**

LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle

- Poor Operations
- No Residual Capacity

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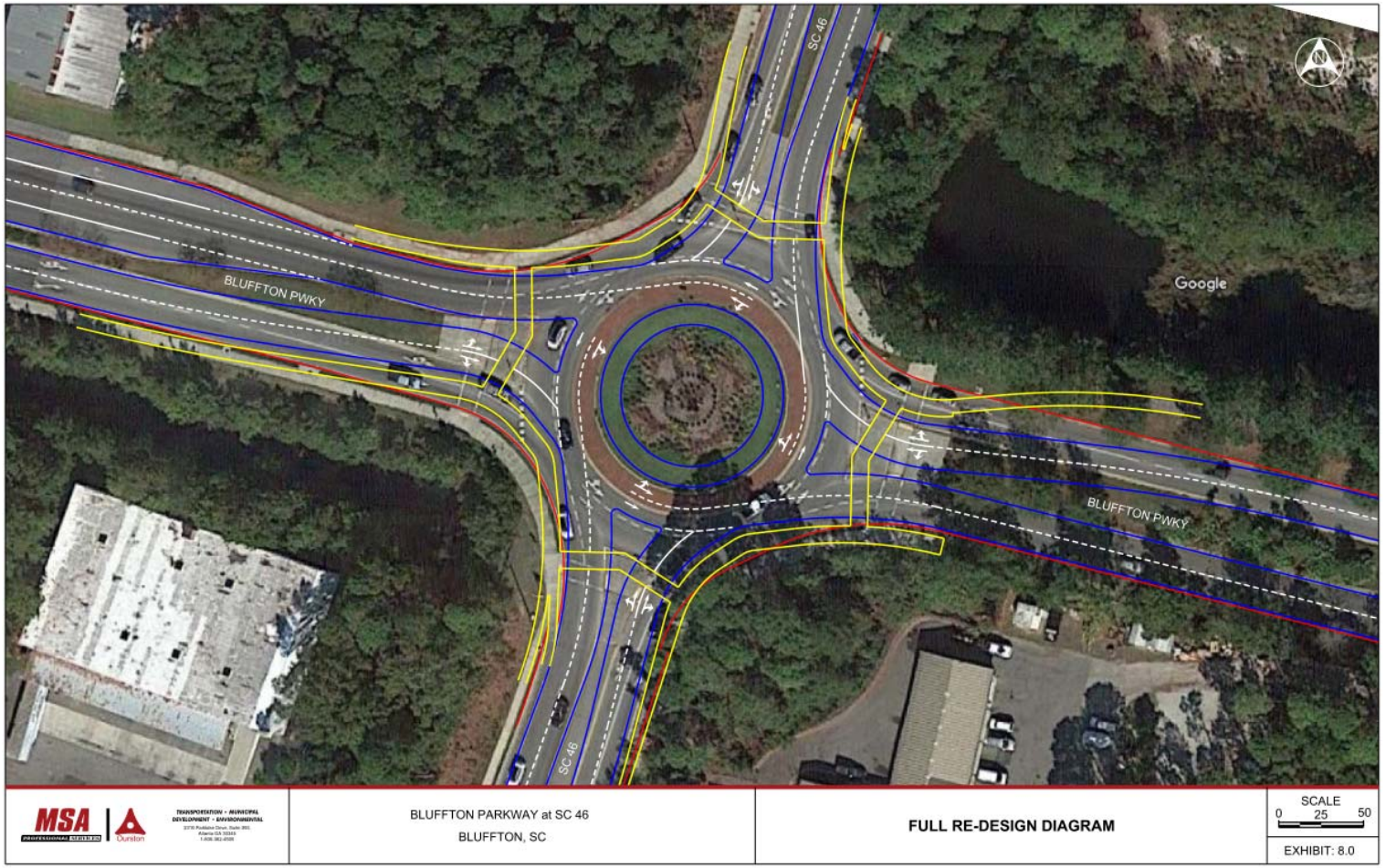
High Countermeasure

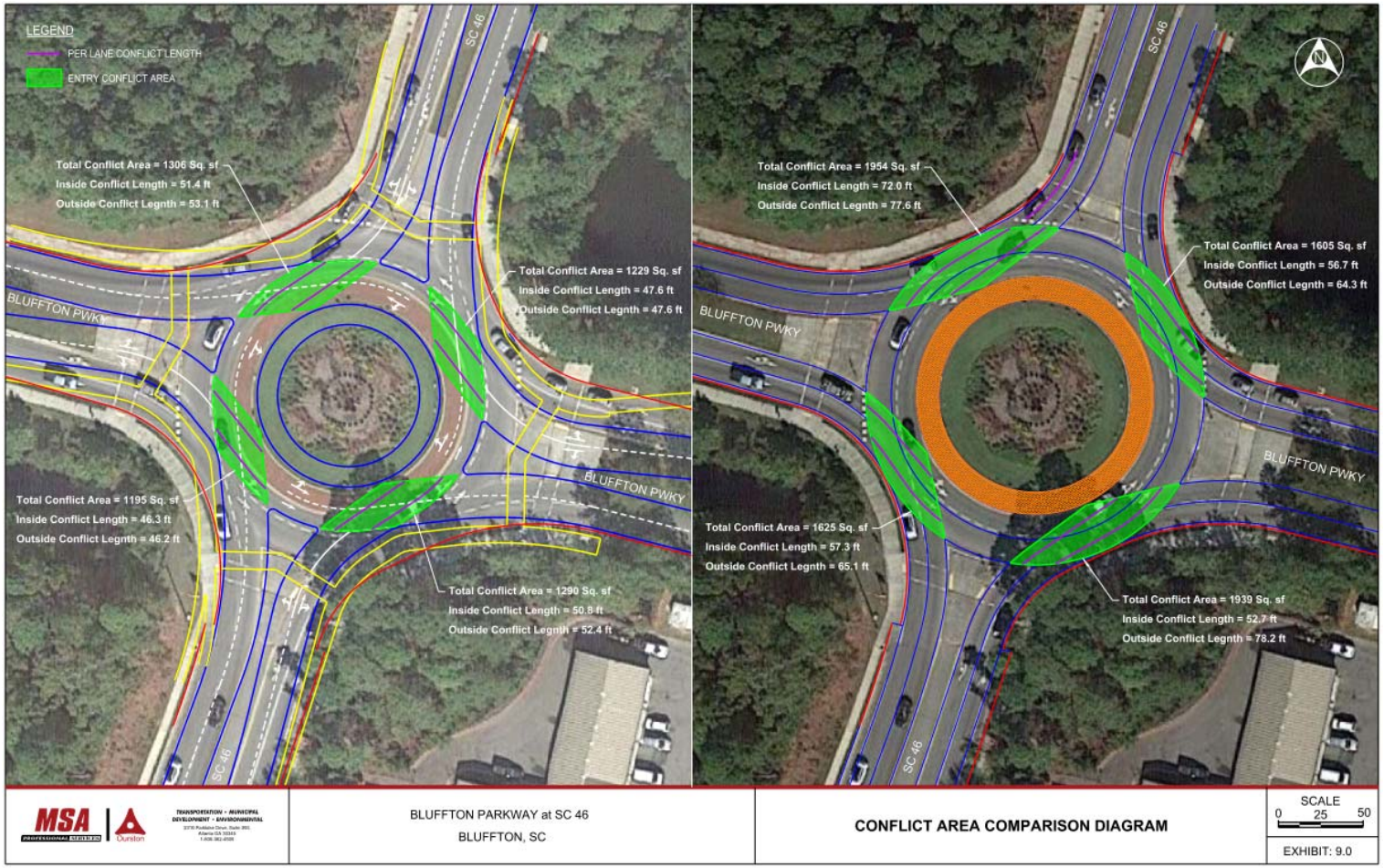
Full Rebuild Roundabout



MSA PROFESSIONAL SERVICES | Ourston

High Countermeasure

Full Rebuild Roundabout



High Countermeasure

Full Rebuild Roundabout

			SB SC 46	EB Bluffton Pkwy	NB SC 46	WB Bluffton Pkwy
ARCADY 9.0	AM Peak	LOS	A	A	A	A
		Queue (ft)	25	150	50	25
		v/c	0.30	0.78	0.56	0.48
		Delay (s)	**3.8**	**8.7**	**7.8**	**3.8**
	PM Peak	LOS	A	A	A	A
		Queue (ft)	50	25	25	150
		v/c	0.67	0.58	0.60	0.77
		Delay (s)	**9.6**	**4.6**	**6.6**	**9.4**

LOS Source: 2010 Highway Capacity Manual - Unsignalized Intersections Delay in Seconds
Queue represents 95th percentile queue per lane, 25 feet per vehicle

- Acceptable Operations
- 16% Residual Capacity

Conclusions, Recommendations and Approximate Costs

- 50% reduction of crashes per year would need to be achieved for this roundabout to perform within the range of national expected average number of crashes
- High cost, full rebuild, countermeasure should be implemented
- Include improved signing and markings
- Widespread driver education
- Cost $1,500,000 to $2,000,000

Topic:	Government Complex New Office Building Preliminary Design
Date Submitted:	February 12, 2018
Submitted By:	Beaufort Design Build
Venue:	Public Facilities Committee

Beaufort County Government Complex New Office Building

Preliminary Design

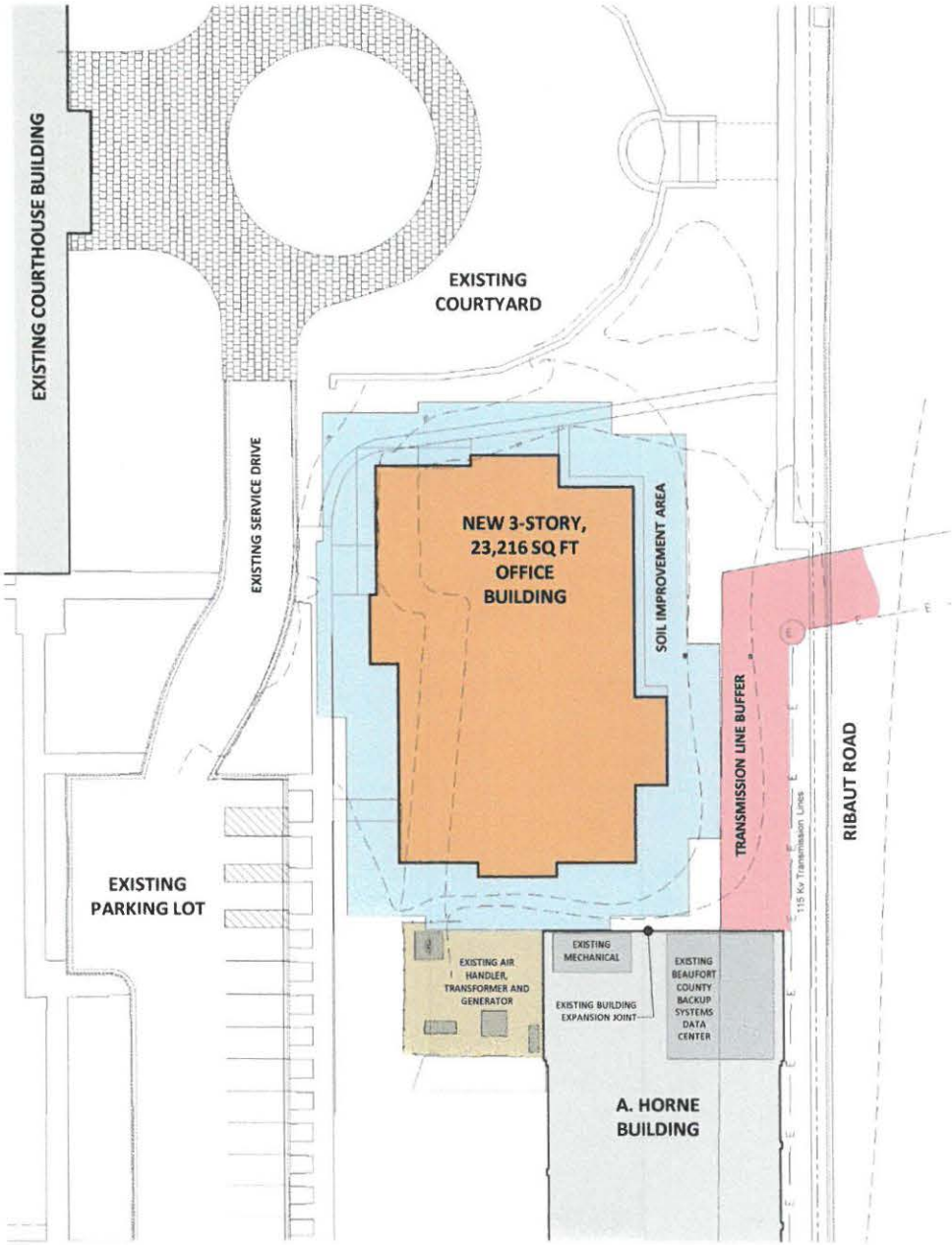
February 12, 2018

Topic:	Government Complex New Office Building Preliminary Design
Date Submitted:	February 12, 2018
Submitted By:	Beaufort Design Build
Venue:	Public Facilities Committee

SITE IMPROVEMENTS AND SITE ORGANIZATION

Electrical Buffer, Soil Improvements and Existing Structures

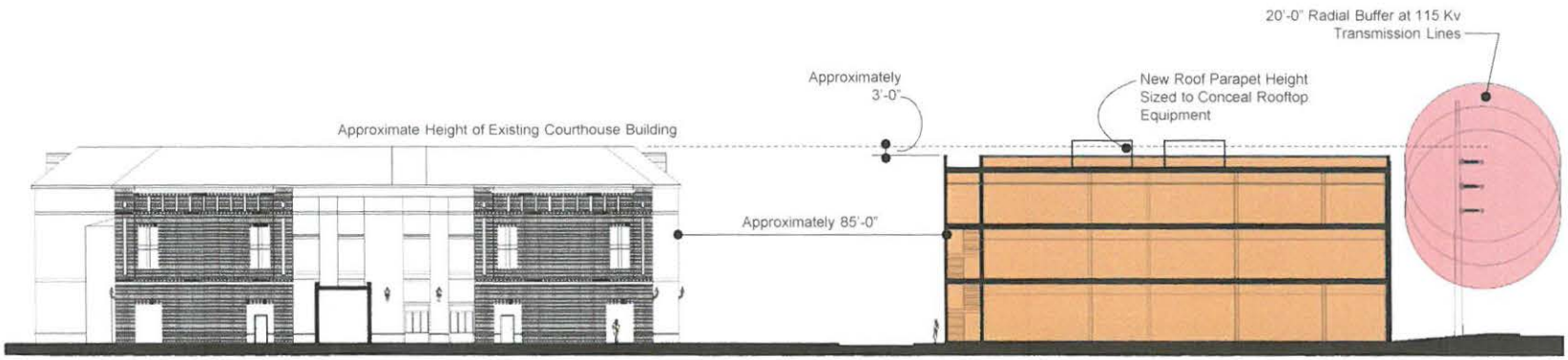
- Existing A. Horne Building will be demolished at an existing building expansion joint
  - 7,923 square feet demolished and 8,629 square feet remains
  - Mechanical room remains
  - Systems data center remains
  - Minimal structural modification
- Existing 115 Kv electrical transmission lines on Ribaut Road require a 20'-0" radial buffer for the new building and for all construction activities
- Liquefiable soils exist to a depth of + 30'-0"
  - Earthquake drains will be utilized to address liquefaction
  - Ground improvement must extend 15'-0" beyond the building footprint
- New footprint relative to demolition of the existing Horne Building represents an increase in impervious surface are of less than 2%. New storm water structures are not required.
- After the new building is occupied, the remainder of the Horne Building will be demolished and a new parking will be constructed. At that time, additional storm wa retention and water quality structures will be provide



SITE IMPROVEMENTS AND SITE ORGANIZATION

Electrical Buffer, Soil Improvements and Existing Structures

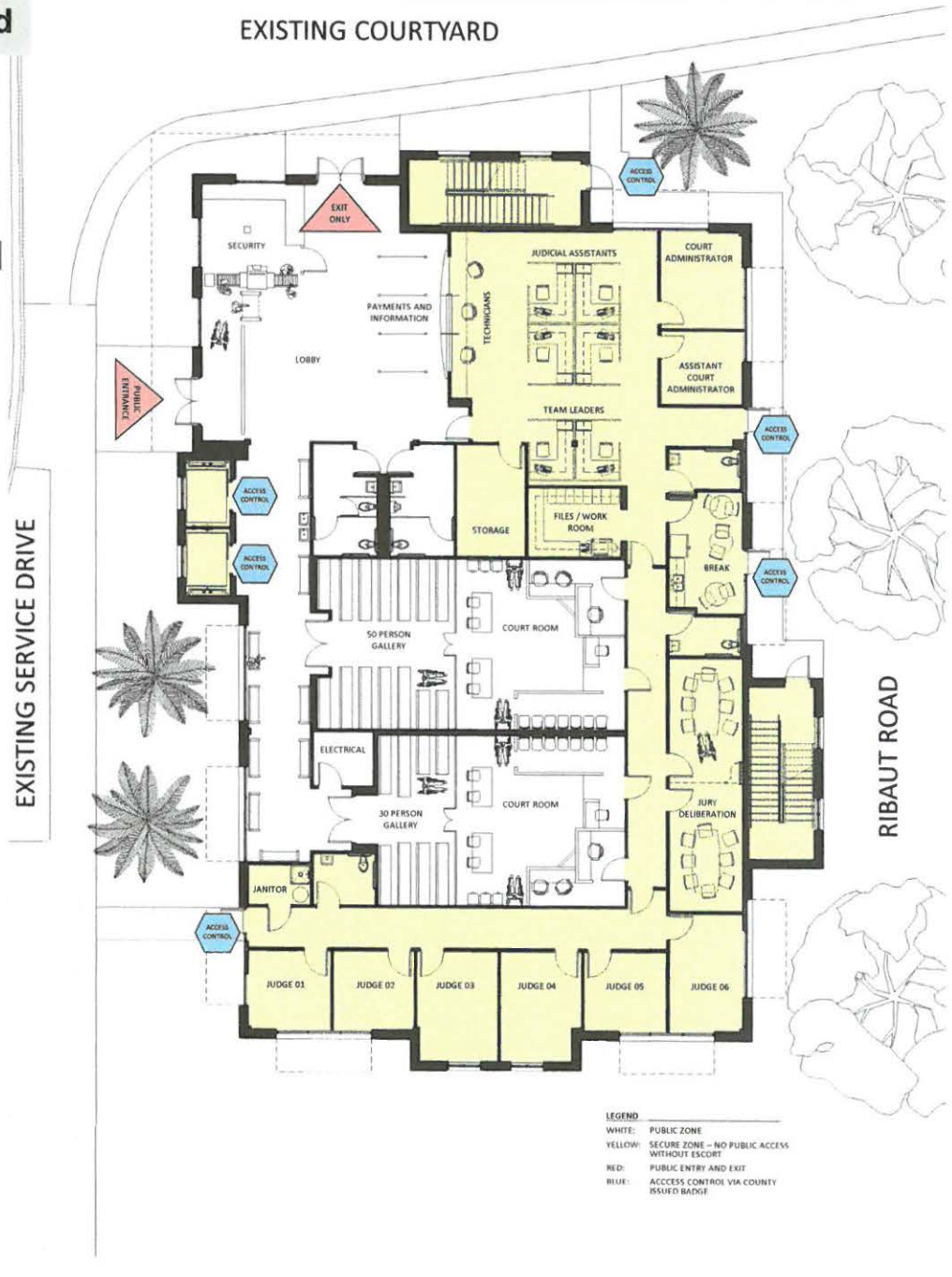
- New building first floor elevation set 6" above the existing concrete curb for accessible access from existing service road and sidewalks
- Low slope roof utilized to keep the new building height lower than the existing Courthouse Building



FIRST FLOOR - MAGISTRATE'S OFFICE

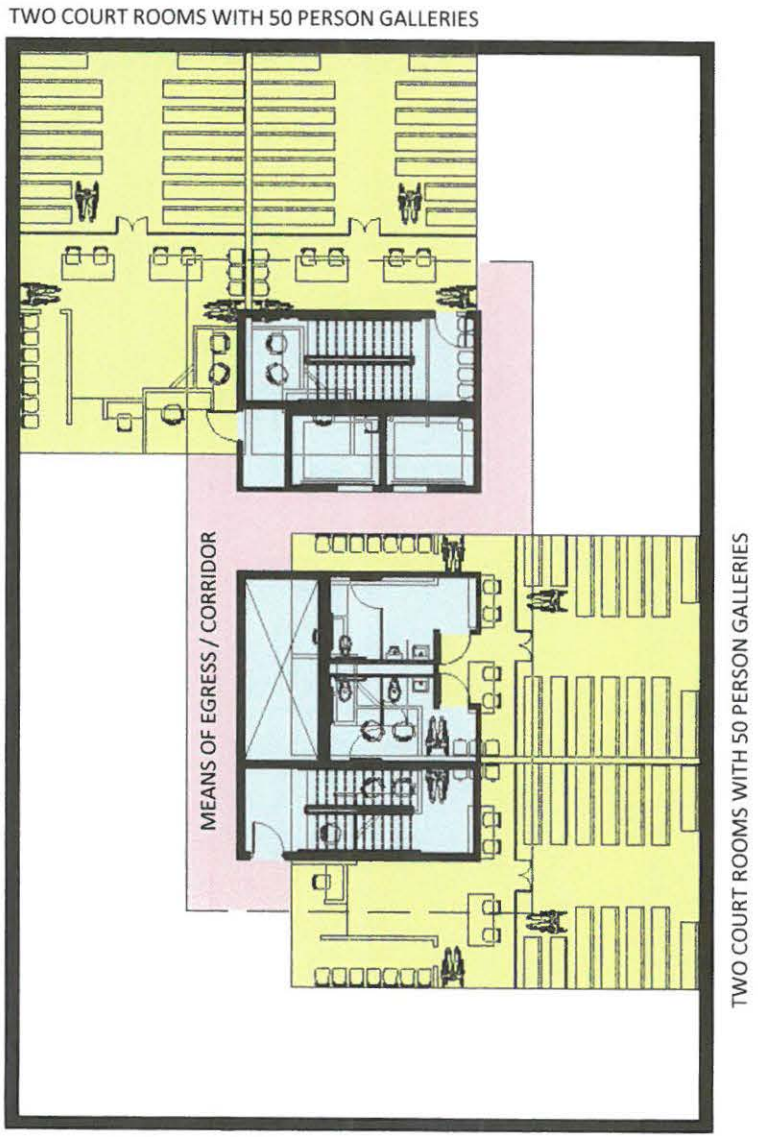
8,000 Gross Square Feet at 75% Utilized

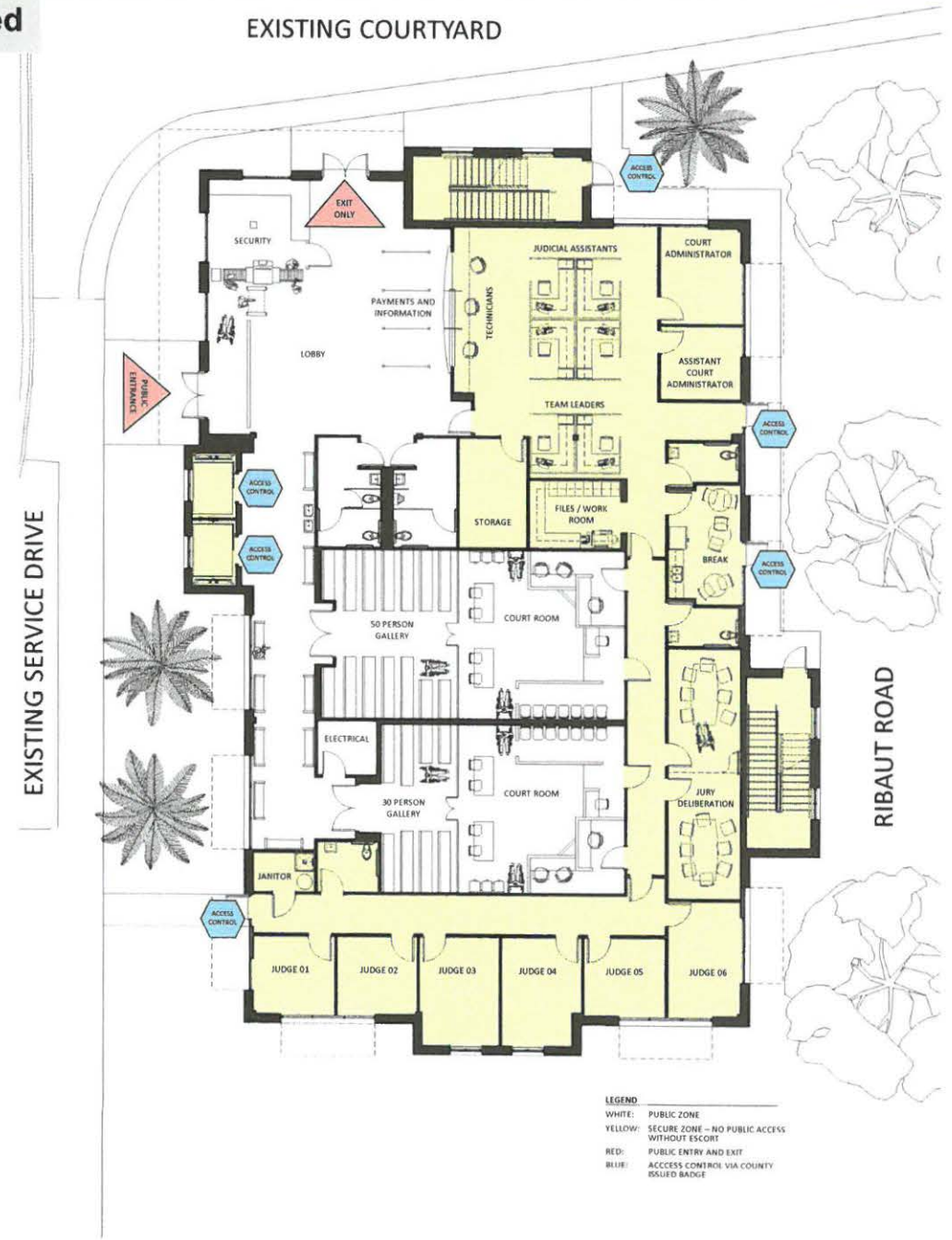
- 8,000 gross square feet
- 75% utilized
- To accommodate the court rooms and their relationship to the lobby , judges offices, etc.; vertical circulation is located outboard (rather than a more traditional central core)
- 12'-0" ceiling height
- Security desk and security screening
- Payment and Information Desk (Technicians)
- Court Room with 50 seat gallery
- Court Room with 30 seat gallery
- Court Rooms follow standards established in the Judicial Conference of the United States, US Courts Design Guide
- 6 Judges Offices
- 2 Jury Deliberation Rooms with folding partition
- Court Administrator's Office
- Assistant Court Administrator's Office
- Judicial Assistants and Team Leaders
- Break Room and Work Room



FIRST FLOOR - MAGISTRATE'S OFFICE

8,000 Gross Square Feet at 75% Utilized





SECOND FLOOR – TAX ASSESSOR'S OFFICE

7,608 Gross Square Feet at 65% Utilized

- 7,608 gross square feet
- 65% utilized
- 10'-0" ceiling height
- Lobby and Waiting
- Reception
- Customer Workstations for looking up tax and parcel records
- Conference and Training Room accessed from public and secure zones
- Director's Office
- Assistant Director's Office
- Assessor, Appraisers and Mapping Staff
- 10-12 Person Conference Room
- Break Room
- Work Room

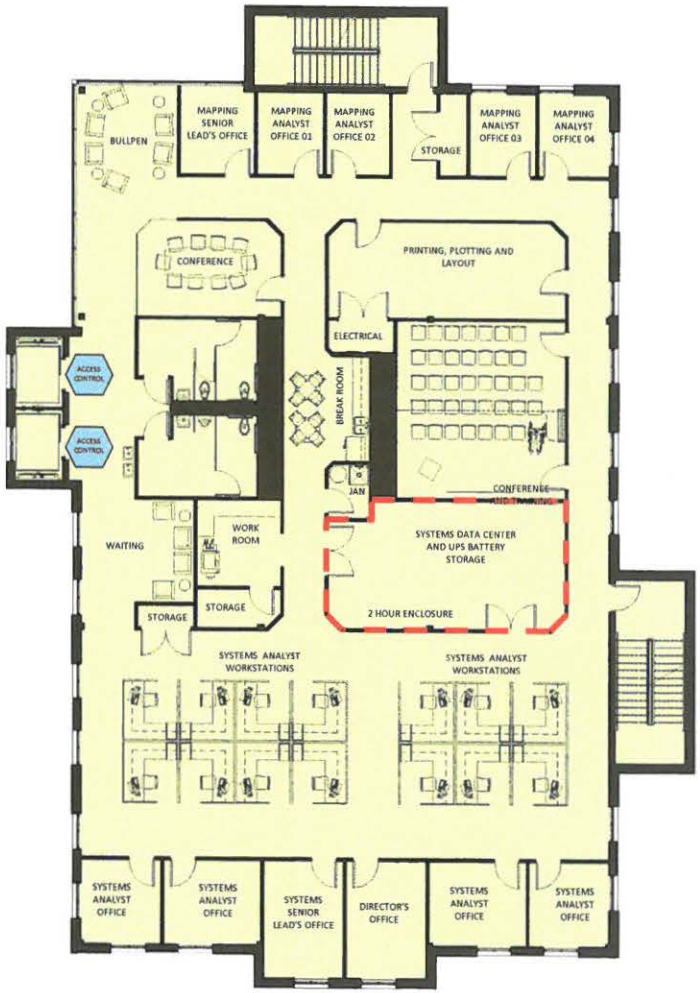
Emergency Management Facilities

- Shower and Lockers
- Storage
- Emergency generator backup

THIRD FLOOR – IT AND GIS OFFICES

7,608 Gross Square Feet at 63% Utilized

- 7,608 gross square feet
- 63% utilized
- Entire floor is secure
- 10'-0" ceiling height
- Entire floor is served by an emergency generator
- Mapping and Applications Director Offices
- Mapping and Systems Senior Lead Offices
- Mapping Analysts Offices
- Systems Analysts Workstations
- Bullpen for informal collaboration
- Mapping Printing, Plotting and Layout Workroom
- Systems Data Center – replaces existing data center in the Horne Building – Separate fire sprinkler system and 2 hour enclosure
- Waiting Area
- 10-12 Person Conference Room
- Two 10-12 Person Conference Rooms with folding partition for expansion
- Shared Break Room
- Shared Work Room



LEGEND

WHITE:	PUBLIC ZONE
YELLOW:	SECURE ZONE – NO PUBLIC ACCESS WITHOUT ESCORT
RED:	PUBLIC ENTRY AND EXIT
BLUE:	ACCCESS CONTROL VIA COUNTY ISSUED BADGE

EXISTING GOVERNMENT COMPLEX BUILDINGS

Brick Veneer, Stucco, Bronze Storefront and Cast Stone

- **Existing Courthouse Building**
  - Gable and low slope roof systems
  - Brick veneer and exterior insulation and finish system (EIFS)
  - Aluminum storefront with bronze finish
  - Bronze tinted glass
- **Existing Administration Building**
  - Forthcoming facade improvement project
  - Gable and low slope roof systems
  - Exterior insulation and finish system (EIFS)
  - Aluminum storefront with bronze finish
  - Bronze tinted glass
- **Existing Detention Center**
  - Gable and low slope roof systems
  - Exterior insulation and finish system (EIFS)
  - Aluminum storefront with bronze finish
  - Bronze tinted glass
- **Sherriff's Office**
  - Low slope roof system
  - Exterior insulation and finish system (EIFS)
  - Aluminum storefront with bronze finish
  - Bronze tinted glass

PROPOSED EXTERIOR DESIGN

View from Courtyard, Looking South

PROPOSED EXTERIOR DESIGN

View from Service Drive Looking North

PROPOSED EXTERIOR DESIGN

View from Ribaut Road Looking South

PROPOSED EXTERIOR DESIGN

View from Parking Lot, Looking North

PROBABLE COST AND SCHEDULE

Probable Construction Cost

- **Total Probable Cost:** **$5,979,740.64**
  - General Requirements: $111,000.00
  - Horne Building Demolition: $259,000.00
  - Soil Improvements: $85,000.00
  - Earthwork and Utilities: $356,000.00
  - Shell and Upfit: $5,168,740.06
- **$258.00 per square foot**
- **Life Cycle Cost Analysis for Selection of Building Systems, Components and Materials**

Projected Schedule

- Final Approval of Preliminary Design by:——02-28-18
- Next Phase: Design Development
- Anticipated Release for Bid:——06-01-18
- Anticipated Receipt of Bids:——07-10-18
- 60 days for contract negotiation
- Anticipated Construction Start:——09-10-18
- 120 Day Construction Period
- Anticipated Occupancy:——07-10-19

Because the Project is located in the Boundary Street Redevelopment District; Zoning and Planning approvals will be handled by the City of Beaufort, on a staff level

View from Courtyard Looking South

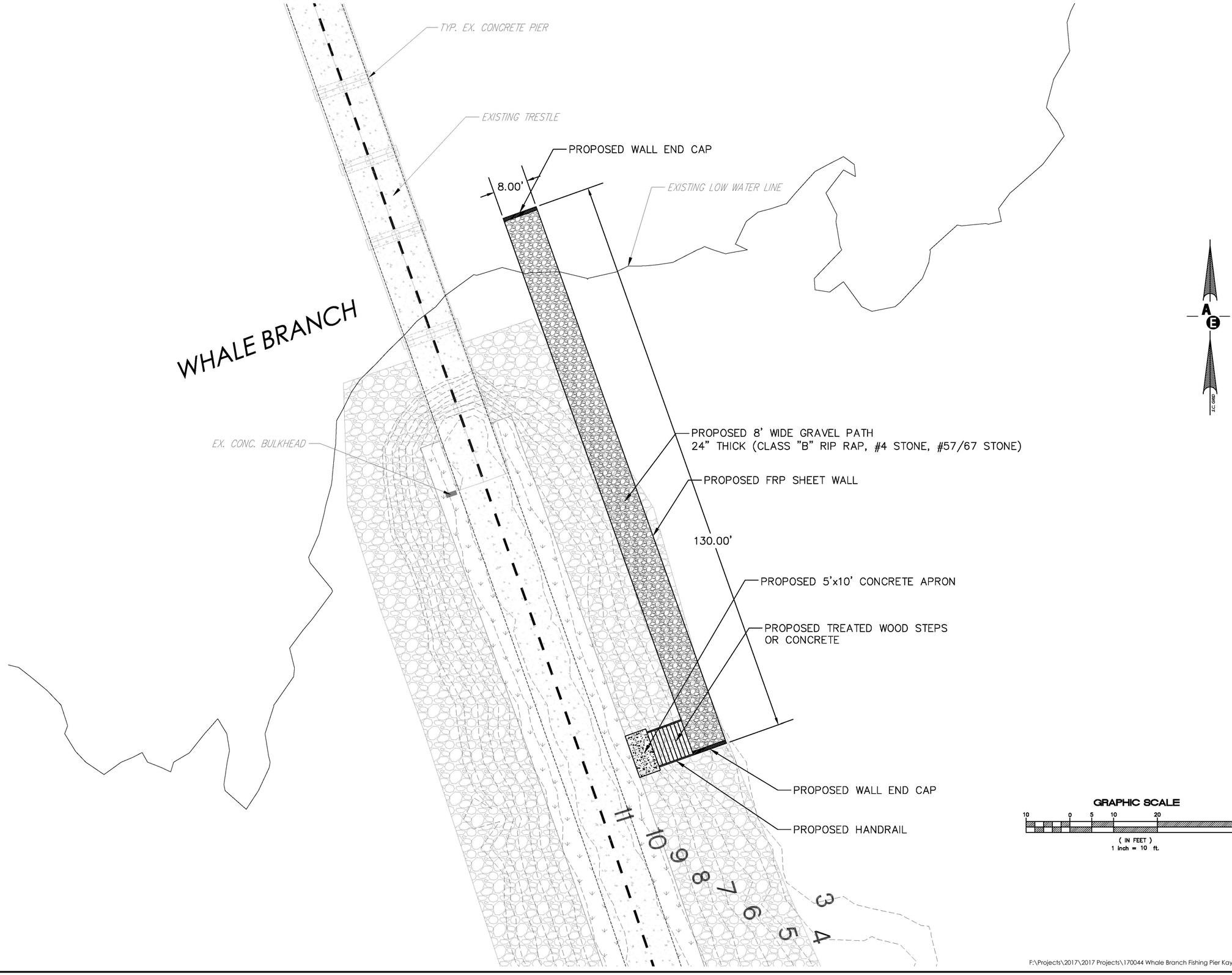
View from Ribaut Road Looking South

Thank You

BEAUFORT DESIGN BUILD

Topic:	Photographs - Whale Branch Kayak Launch
Date Submitted:	February 12, 2018
Submitted By:	Rob McFee
Venue:	Public Facilities Committee

Topic: Photographs - Whale Branch Kayak Launch
Date Submitted: February 12, 2018
Submitted By: Rob McFee
Venue: Public Facilities Committee



PRELIMINARY / NOT FOR CONSTRUCTION

PLAN REVISIONS

NO.	DESCRIPTION:	DATE:	BY:
1	-	-	-
2	-	-	-
3	-	-	-
4	-	-	-
5	-	-	-
6	-	-	-
7	-	-	-
8	-	-	-

SOUTH CAROLINA REGISTERED PROFESSIONAL ENGINEER STEVEN WADE ANDREWS NO. 12860

SOUTH CAROLINA ANDREWS ENGINEERING CO. No. C00008 CERTIFICATE OF AUTHORIZATION

Andrews Engineering
2712 Bull Street Suite A
Beaufort, SC 29902
843.379.2222
Fax 843.379.2223
& Surveying

Preliminary Site Plan
For
Kayak Slip
Seabrook Road
Whale Branch River Pier
Beaufort County, SC

Kayak Slip
Layout Plan

Date Drawn:	10/16/17
Last Revised:	10/17/17
Drawn By:	R. Crosby
Engineer:	S. Andrews

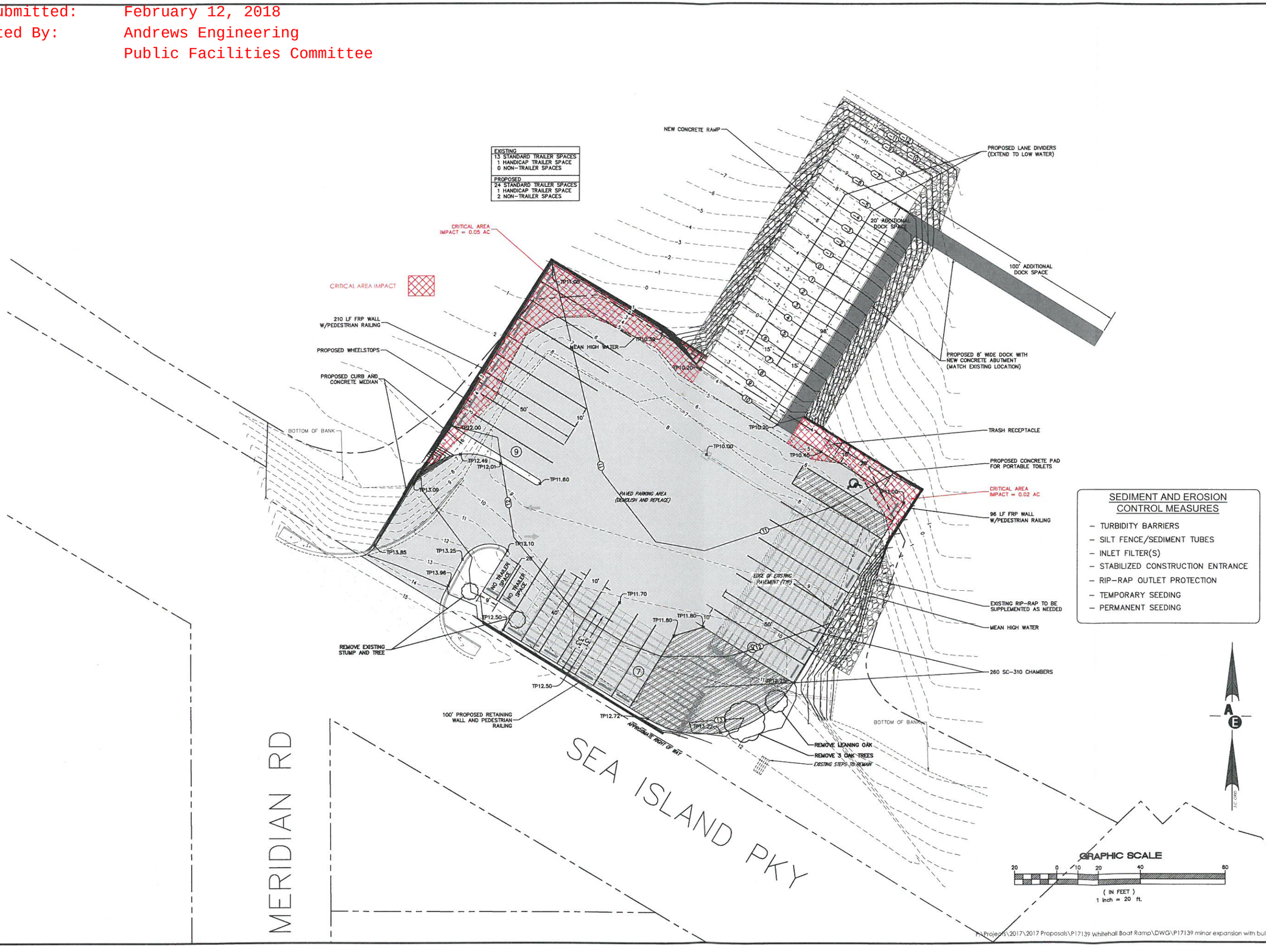
SHEET #: 1

JOB: 170044

F:\Projects\2017\2017 Projects\170044 Whale Branch Fishing Pier Kayak Launch\DWG\170044_kayak slip.dwg

Topic:	Whitehall Boat Ramp
Date Submitted:	February 12, 2018
Submitted By:	Andrews Engineering
Venue:	Public Facilities Committee

Topic: Whitehall Boat Ramp
Date Submitted: February 12, 2018
Submitted By: Andrews Engineering
Venue: Public Facilities Committee



PRELIMINARY / NOT FOR CONSTRUCTION

PLAN REVISIONS

NO.	DESCRIPTION:	DATE:	BY:
1	-	-	-
2	-	-	-
3	-	-	-
4	-	-	-
5	-	-	-
6	-	-	-
7	-	-	-
8	-	-	-

SOUTH CAROLINA PROFESSIONAL ENGINEER REGISTERED STEVEN WADE No. 12850

SOUTH CAROLINA ANDREWS ENGINEERING CO. No. C00006 CERTIFICATE OF AUTHORIZATION

Andrews Engineering & Surveying
2712 Bull Street Suite A
Beaufort, SC 29902
843.379.2222
Fax 843.379.2223

Preliminary Site Plan
For
Whitehall Boat Landing
U.S. Hwy. 21
Lady's Island
Beaufort County, SC

Minor Expansion w/Bulkhead

Date Drawn:	12/01/17
Last Revised:	12/12/17
Drawn By:	Cad Tech
Engineer:	S. Andrews

SHEET #: Opt 2

JOB: P17139

P:\Projects\2017\2017 Proposals\P17139 Whitehall Boat Ramp\DWG\P17139 minor expansion with bulkhead.dwg