October 27, 2016

To: Altaf Bukhari, P.E.
City of Tampa

From: Jason Collins, Ph.D., P.E., AICP
ADEAS-Q

RE: Doyle Carlton Drive & Laurel Street Intersection Analysis
Summary Memorandum

This memorandum summarizes the feasibility analysis to improve the Doyle Carlton Drive & Laurel Street intersection. Doyle Carlton Drive serves as an important north-south thoroughfare for destinations adjacent to the developing Arts and Riverwalk sections of Downtown. While there is an emphasis for improved pedestrian and multi-modal connectivity in this area, the Laurel Street intersection at Doyle Carlton Drive has an auto-centric suburban style infrastructure and traffic control. The current infrastructure is outdated and in conflict with the complete street objectives for this redeveloping neighborhood. This project evaluates which options are technically feasible to better accommodate other modes of travel more safely and to improve aesthetics.

This memorandum summarizes the following activities that were completed under this task:

- Traffic Operations Analysis
- Preliminary Designs
- Cost Estimation

TRAFFIC OPERATIONS ANALYSIS

A detailed analysis of traffic operations was performed for the intersection of Doyle Carlton Drive & Laurel Street to help compare the proposed alternatives. The current intersection provides a high degree of priority to motor vehicle traffic, with poor accommodations for people walking and riding bicycles. The purpose of this analysis was to identify opportunities to provide a high level of services for all modes of travel.

Traffic counts were performed at the intersection on a weekday in April 2015 during the morning, midday, and afternoon peak periods. From these counts it was determined that the afternoon peak is the highest traffic period of the day, specifically the hour beginning at 4:30 PM. This PM peak-hour count was adjusted to peak season, and 20 years of projected traffic growth was added at 1% per year to produce year 2035 peak-season, peak-hour traffic volumes. These volumes were analyzed for three proposed configurations:

1. No Build
2. All-Way Stop Control (AWSC): Remove right-turn flares, change traffic control, add bicycle facilities
3. Roundabout: Remove right-turn flares, convert to roundabout traffic control, add bicycle facilities

Relatively low traffic volumes at this intersection make the existing turn lanes unnecessary, even with projected future traffic growth in the area. Configurations 2 and 3 assume the conversion of all four approaches to single-lane approaches. The addition of buffered bicycle lanes across the Laurel Street Bridge and the addition of standard bicycle lanes on the other three legs of the intersection were also considered. The following table summarizes the findings of the analysis, including a basic assessment of conditions for people walking and bicycling:

Traffic Operations Summary

Configuration	*Vehicle Delay (s)*	*Level of Service*	*Volume-to-Capacity Ratio*	*Number of Legs with Bicycle Lanes*	*Avg. Ped Crossing Distance (ft)*
No Build	7.3	A	0.37[A]	½	88
AWSC	11.7	B	0.50[A]	4	38
Roundabout	6.1	A	0.31[B]	4	29

A: HCM 2010 analysis (Synchro)
B: 2010 FHWA Roundabouts Guide methodology

One potential site constraint noted is the adjacent Laurel Street Drawbridge, which lifts to allow certain river traffic to pass. Bridge lifts typically require 10-15 minutes for each opening, but can last up to 20 minutes, which potentially results in significant vehicle queuing. However, it was reported that the Laurel Street Bridge typically opens less than one occurrence per week.

A particular limitation of roundabouts is the potential for downstream bottlenecks to result in queues blocking the entire intersection, preventing any traffic from moving. Traffic simulation was performed using *Synchro/SimTraffic* software to study the effects of bridge lift blockage between alternatives. In each simulation run the time elapsed for five (5) and eight (8) vehicles departing the intersection westbound toward the bridge was measured. These numbers were chosen because there would be space for approximately 5 vehicles between the bridge gate and the roundabout before vehicles would begin queueing into the roundabout, and approximately 3 additional vehicles could queue along the outside of the roundabout before blocking the southbound approach. Based on ten (10) simulation runs, the average time elapsed to 5 queued vehicles was 61 seconds (standard deviation of 22 seconds), while the average time elapsed to 8 queued vehicles was 105 seconds (standard deviation of 25 seconds). There were 8 or more vehicles queued within two minutes for 8 of the 10 runs, and within 2.5 minutes for all ten simulation runs.

Blockage exceeding 2.5 minutes may gridlock a roundabout. One potential countermeasure is considering a gate to block the westbound departure from the roundabout intersection. Together with "Do Not Block

Intersection" signage, these measures may assist the traffic function during a drawbridge opening without requiring significant modifications to the design.

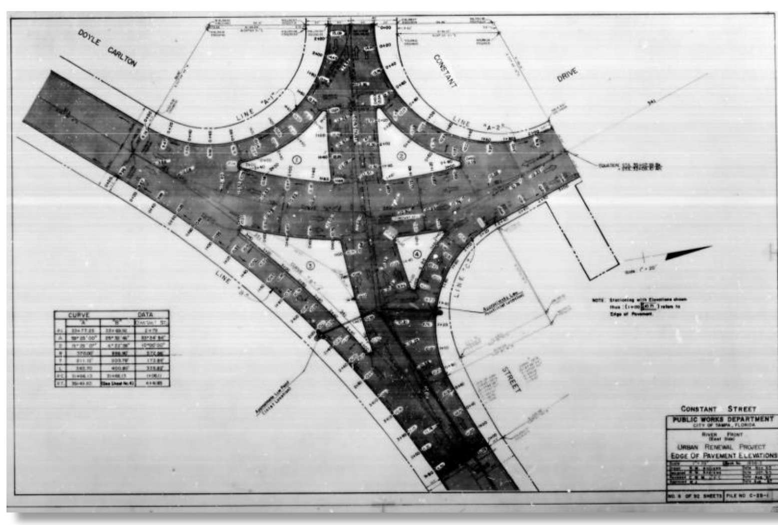
However, full intersection blockage from a bridge lift can be anticipated for all three alternative configurations, and the roundabout does not perform markedly worse than the other configurations in this drawbridge scenario. A 20-minute blockage was simulated for each configuration, and blockage occurred in each scenario within 5 minutes. The AWSC performs the worst of the three configurations because of its assumed lack of turn lanes.

It is suggested to evaluate these measures in more detail upon the construction design of the intersection. Furthermore, it is suggested that the anticipated frequency of the drawbridge operation be factored when considering the different alternatives.

DESIGN CONSIDERATIONS

The design effort was completed in conjunction with the traffic operations analysis. Plan views of the potential alternatives within the public right-of-way for the intersection were completed. Two build alternatives are assumed. Alternatives consider using new geometry, potential lane modifications, landscaping, and other improvements where feasible. Alternatives were provided with transparency to help compare existing conditions. The drawings were developed using Sketch-up software.

The original template of the intersection was originally designed in 1967 as both Doyle Carlton Drive and Laurel Street with four lanes at the intersection. This, together with the right-turn lane flares located at each approach, provide a large vehicle footprint for this stop controlled intersection. This large footprint limits the accessibility for both pedestrians and bicyclists. Converting the intersection to an improved AWSC traffic control or to a roundabout has the ability to create 10,000-14,000 square feet of additional green space.



Previous 1967 design.

The AWSC alternative provides a more-straightforward conversion with less disruption to the existing infrastructure. More of the existing curb line can be preserved at the existing approach angles, which reduces construction costs. This also allows an additional 36 parking spaces compared to existing conditions near the intersection. Bicycle lanes can also be provided in each direction on both streets. Curb extensions can be added to each approach to further reduce the pedestrian crossing distances, reduce speeding, and to provide more green space.

The roundabout alternative requires a complete reconstruction of the intersection. However, this provides a clean template from which to design the intersection. A standard 105 foot inscribed diameter was identified for this concept to help preserve slow speeds, but to also provide operation flexibility. The roundabout has the ability to manage greater traffic volumes in the long-range future, while also providing a permanent traffic calming effect to reduce speeds through the intersection. More green space can be achieved with the roundabout, while also providing the ability of “gateway” artwork or landscaping within the center island. U-turns can be more easily accommodated than the other alternatives. About 13 additional on-street parking spaces near the intersection are anticipated with the roundabout alternative. Bicycle lanes are provided in each direction where the bicyclist has the option to travel through the intersection on the vehicle lane or on wide sidewalk connections around intersection.

The following pages show the preliminary designs developed for the All-Way Stop Controlled and the Roundabout alternatives, in addition to showing existing conditions.

COST ESTIMATES

Long range cost estimates were prepared for each of the proposed build alternatives. Long-range Florida Department of Transportation (FDOT) cost references specific to Hillsborough County were referenced.

In summary, the All-Way Stop Control alternative has a significantly lower cost than the Roundabout. This is primarily due to the Roundabout requiring a complete reconstruction of the intersection. However, this Roundabout cost was identified to be lower than what many other modern roundabouts can cost in urban areas. That is because this particular roundabout does not require additional public right-of-way, and that the Roundabout is not anticipated to directly impact most of the other underground utilities. Provided below is a comparative cost summary between the AWSC and Roundabout alternatives. The following pages provide more specific detail on how the cost estimates were developed.

Summary of Cost Estimates

Alternative	Construction	Total Cost
Convert to All-Way Stop Control, add curb extensions, remove right-turn flares, add bicycle facilities	$170,000	$238,000
Convert to Roundabout traffic control, remove right-turn flares, add bicycle facilities	$426,000	$597,000

A comparative analysis of the effectiveness between the proposed alternatives was also completed following the Florida DOT Three-Step Analysis Methodology Approach. This was completed using the available data provided by the City to compare the lifecycle benefit/cost ratio between the two alternatives. In summary, this Approach identified the AWSC alternative as having more benefit, primarily due to the lower cost than the Roundabout. Additional detail/worksheets from the Florida DOT Approach are provided on the following pages.

CONCLUSION

Based upon this analysis, both proposed alternatives (AWSC or Roundabout) provide a high level of service to motor vehicle traffic while dramatically improving the intersection for people walking and bicycling. Both alternatives also provide significant opportunities for a strong connection with the recently completed Tampa Riverwalk, and for the replacement of the underutilized right-turn flares with landscaping, public amenities, or developable space.

Neither alternative results in markedly different operations during a drawbridge lift as compared to the No Build alternative, except for the AWSC if space is not reserved to allow northbound right turns to bypass a queue. The anticipated frequency of the drawbridge operation should be factored when considering the different alternatives. The AWSC alternative does provide the greater amount of new on-street parking.

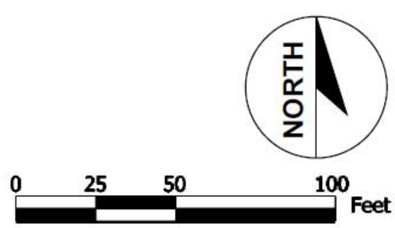
The Roundabout provides a greater cost due to the need to reconstruct the intersection, but also provides other benefits, such as the ability to accommodate more traffic, more green spaces, U-turns within the intersection, and the ability to provide gateway artwork within the center island. Therefore, the following activities are suggested for consideration:

1) Identify appropriate funding programs and eligible grants for this intersection
2) Determine the preferred alternative with public/stakeholder involvement
3) Proceed with survey, final design, and construction

Preliminary Designs of Different Alternatives

Concept Only. Subject to more detailed survey and engineering.

Traffic Summary: Existing Conditions
LOS A, 7.3s/veh
Max V/C = 0.37



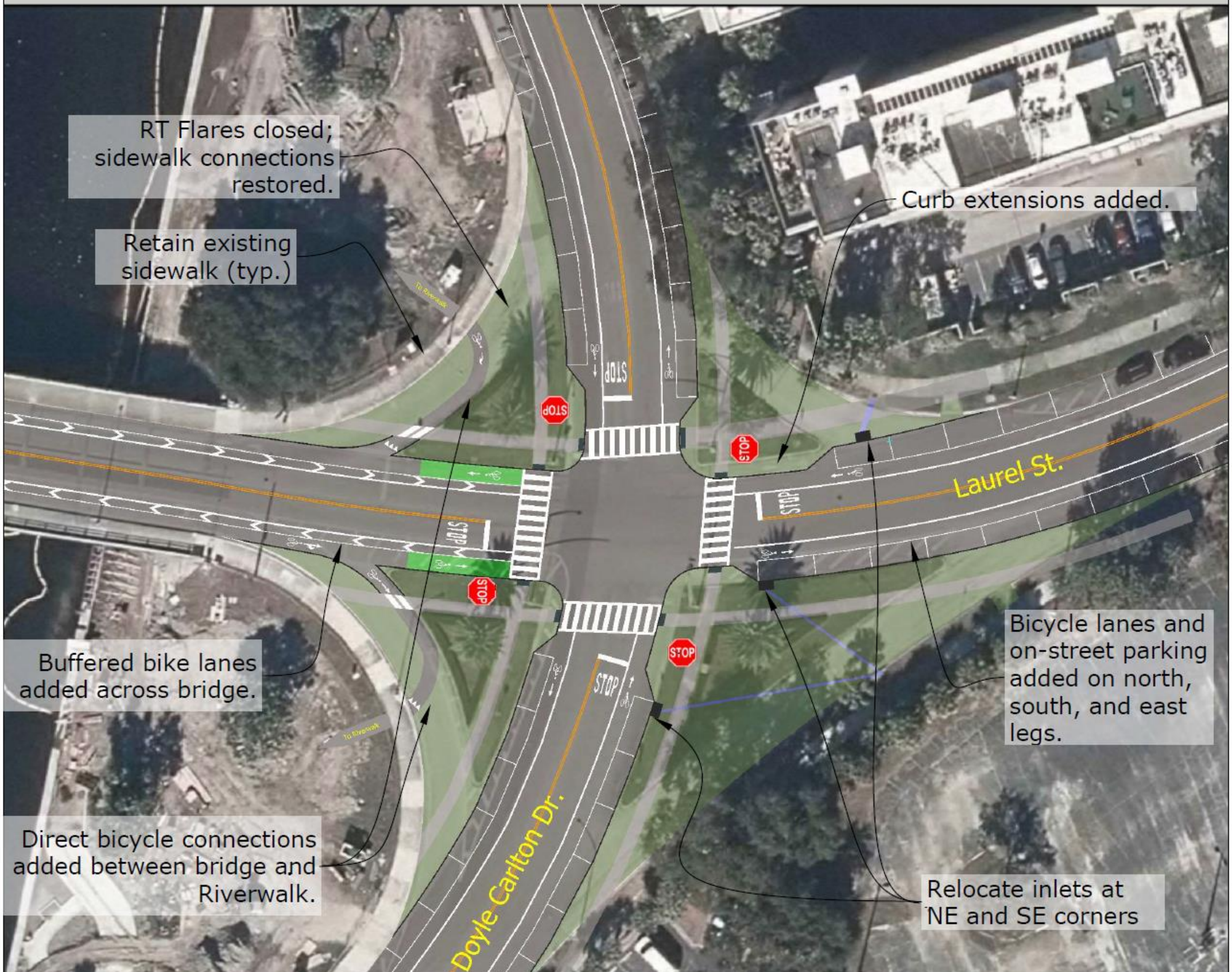
ADEASQ TRANSPORTATION ENGINEERING + PLANNING

City of Tampa Florida

W. Laurel St. & Doyle Carlton Dr.
Alternatives Analysis
Existing Conditions

D.B. AJB
C.B. JSC
Rev. 10/20/16

Concept Only. Subject to more detailed survey and engineering.



Traffic Summary: All-Way Stop Control
LOS B, 11.7s/veh
Max V/C = 0.50

Adds 36± on-street parking spaces
Approx. 10,000 s.f. of new green space

NORTH

0 25 50 100 Feet

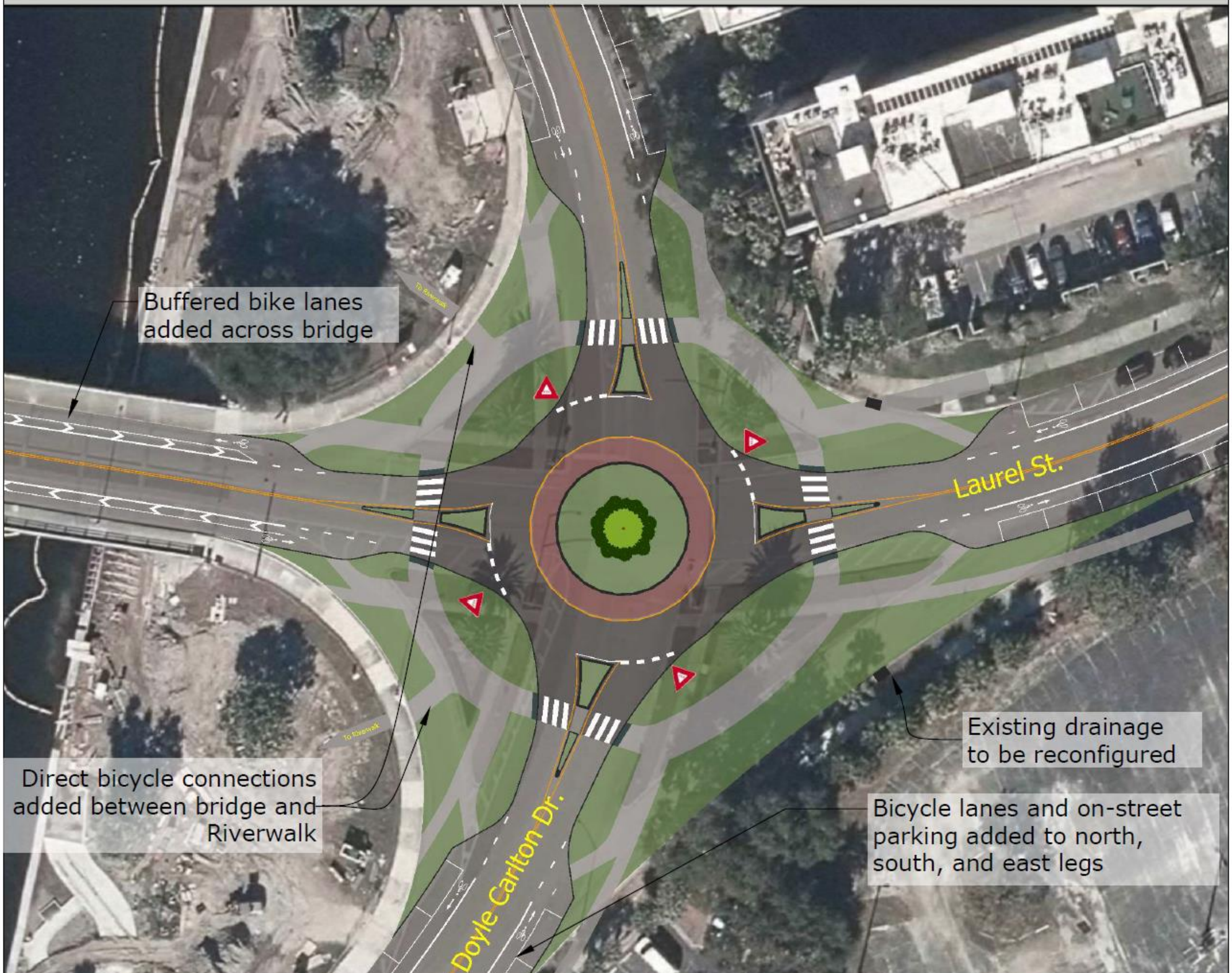
ADEASQ TRANSPORTATION ENGINEERING + PLANNING

City of Tampa Florida

W. Laurel St. & Doyle Carlton Dr.
Alternatives Analysis
All-Way Stop Control (AWSC)

D.B. AJB
C.B. JSC
Rev. 10/20/16

Concept Only. Subject to more detailed survey and engineering.



Traffic Summary: Roundabout
LOS A, 6.1s/veh
Max V/C = 0.31

Adds 13± on-street parking spaces
Approx. 14,000 s.f. of new green space

NORTH

0 25 50 100 Feet

ADEASQ TRANSPORTATION ENGINEERING + PLANNING

City of Tampa Florida

W. Laurel St. & Doyle Carlton Dr.
Alternatives Analysis
Roundabout

D.B. AJB
C.B. JSC
Rev. 10/20/16

Opinion of Probable Costs

Opinion of Probable Cost: Planning-Level

Doyle Carlton Drive & Laurel Street Intersection

	Construction	Total
Convert to AWSC, add curb extensions, remove RT flares, add bicycle facilities	$170,235	$238,328
Convert to roundabout, add bicycle facilities	$426,435	$597,009

Calculation Details: All-Way Stop Control (AWSC) with Curb Extensions

Convert to AWSC, add curb extensions, remove RT flare	Item#	Amount	Unit cost	Units	Total	Notes
Minor widening, excludes curbs	N		$15.00	SF		
Pavement removal	N	11,500	$2.00	SF	$23,000	RT flares
Asphalt Pavement	0334-1-13	9	$85.69	TN	$771	Bike Loops Note: 1 Ton=80sf @2"
Mill & Resurface	70-11 + 0334-1-13		$1.41	SF		
Soil and Base preparation	0162 + 0285		$25.00	SY		
Curb removal	N	1,550	$2.00	LF	$3,100	RT flares + curb exts
Curb, Type B	0520-2-2		$48.28	LF		
Curb, Type D	0520-2-4	85	$20.23	LF	$1,720	Bike loop ramps
Curb, Type F	0520-1-10	865	$16.34	LF	$14,134	RT flares+curb exts
Curb, Valley type	0520-3		$18.30	LF		
Remove concrete walkway	N	285	$5.00	SF	$1,425	Ramps at flares + ramps at new curb exts
Concrete walkway	0522-2	197	$43.75	SY	$8,628	RT flares+curb exts
Truncated domes	N	86	$50.00	SF	$4,300	
Concrete driveway	0522-2		$43.75	SY		
Inlet/Catch basin, install to existing system	N	3	$5,000.00	EA	$15,000	
Manhole, replace existing inlet with	0425-2-91	2	$6,269.00	EA	$12,538	Set 1 for RT flare + 1 for SE curb ext
Reinforced concrete pipe, 18" or 24"	N	160	$100.00	LF	$16,000	Set 1 for RT flare + 2 inlets for SE curb ext
Traffic sign, install or relocate	0700-1-11	12	$291.00	EA	$3,492	
Remove light pole/signal pole/cabinet	0646-1-60	9	$167.33	EA	$1,506	4 signal poles, RT flare light poles, cabinet
Remove signal pole/cabinet foundation	N		$2,000.00	EA		
Relocate street light pole	0715-4400		$2,915.00	EA		
Water meter, adjust to grade	N		$200.00	EA		
Valve box, adjust to grade	N		$100.00	EA		
Subsoil excavation	0120-4		$0.53	CF		
Topsoil, 12" depth	0162-1-12	1,278	$5.85	SY	$7,475	
Replant, sod	0570-1-2	1,154	$2.65	SY	$3,058	
Remove pavement markings, 4"	N	2,000	$1.00	LF	$2,000	
Pavement markings, solid 4"	0711-11123	2,200	$2.24	LF	$4,928	
Pavement markings, solid 8"	N	1,200	$2.50	LF	$3,000	
Pavement markings,arrow, white	N		$250.00	EA		
Crosswalk, hi-vis/ladder-style	N	155	$25.00	LF	$3,875	
Tree protection during construction	N		$1,000.00	EA		
Remove street tree	N		$1,000.00	EA		
Install street tree	N		$500.00	EA		
Total Construction Items					$129,950	
Mobilization		5.0%			$6,498	
Traffic Control		5.0%			$6,498	
Contingency		20.0%			$27,290	
Total Construction					**$170,235**	
Survey, design		20%			$34,047	
Construction Engineering		20%			$34,047	
FULL COST					**$238,328**	

<u>Assumptions:</u>

Costs based on FDOT Item Average Unit Cost, 2016, Area 8 where available or Statewide

Measures are contracted as a group for efficient construction costs

Planning-level estimates, standard 20% contingency used for simple construction

Pavement marking costs are assumed to the lift span on the west leg, and 100' from the intersection on the north, south, and east legs

Item # "N" refers to not available in FDOT Item Average Cost or tabulation sheet. Other sources used.

Opinion of Probable Cost: Planning-Level

Doyle Carlton Drive & Laurel Street Intersection

Calculation Details: Roundabout

Convert to roundabout, add bicycle facilities	*Item#*	Amount	Unit cost	Units	Total	Notes
Minor widening, excludes curbs	N		$15.00	SF		
Pavement removal	N	17,920	$2.00	SF	$35,840	RT flares + roundabout islands
Asphalt Pavement	0334-1-13	113	$85.69	TN	$9,644	Note: 1 Ton = 80 sf @2"
Mill & Resurface	70-11 + 0334-1-13		$1.41	SF		
Soil and Base preparation	0162 + 0285	1,206	$25.00	SY	$30,139	
Curb removal	N	1,920	$2.00	LF	$3,840	
Curb, Type B	0520-2-2	226	$48.28	LF	$10,911	Apron
Curb, Type D	0520-2-4	581	$20.23	LF	$11,754	Splitter islands + center island
Curb, Type F	0520-1-10	905	$16.34	LF	$14,788	
Curb, Valley type	0520-3		$18.30	LF		
Remove concrete walkway	N	1,600	$5.00	SF	$8,000	
Concrete walkway	0522-2	1,088	$43.75	SY	$47,590	
Truncated domes	N	164	$50.00	SF	$8,200	
Concrete driveway	0522-2	193	$43.75	SY	$8,458	Apron
Inlet/Catch basin, install to existing system	N	4	$5,000.00	EA	$20,000	Assumed
Manhole, replace existing inlet with	0425-2-91	2	$6,269.00	EA	$12,538	Assumed
Reinforced concrete pipe, 18" or 24"	N	200	$100.00	LF	$20,000	Assumed
Traffic sign, install or relocate	0700-1-11	20	$291.00	EA	$5,820	
Remove light pole/signal pole/cabinet	0646-1-60	5	$167.33	EA	$837	4 RT flare light poles, cabinet
Remove signal pole/cabinet foundation	N	5	$2,000.00	EA	$10,000	4 pole foundations, 1 cabinet foundation
Relocate street light pole	0715-4400	4	$2,915.00	EA	$11,660	4 intersection corners
Water meter, adjust to grade	N	4	$200.00	EA	$800	Assumed
Valve box, adjust to grade	N	4	$100.00	EA	$400	Assumed
Subsoil excavation	0120-4		$0.53	CF		
Topsoil, 12" depth	0162-1-12	1,991	$5.85	SY	$11,648	
Replant, sod	0570-1-2	1,991	$2.65	SY	$5,276	
Remove pavement markings, 4"	N	2,000	$1.00	LF	$2,000	
Pavement markings, solid 4"	0711-11123	2,600	$2.24	LF	$5,824	
Pavement markings, solid 8"	N	1,100	$2.50	LF	$2,750	
Pavement markings,arrow, white	N		$250.00	EA		
Crosswalk, hi-vis/ladder-style	N	106	$25.00	LF	$2,650	
Tree protection during construction	N		$1,000.00	EA		
Remove street tree	N		$1,000.00	EA		
Install street tree	N		$500.00	EA		
Total Construction Items					$301,368	
Mobilization		5.0%			$15,068	
Traffic Control		5.0%			$15,068	
Contingency		30.0%			$94,931	
Total Construction					**$426,435**	
Survey, design		20%			$85,287	
Construction Engineering		20%			$85,287	
FULL COST					**$597,009**	

Assumptions:

Costs based on FDOT Item Average Unit Cost, 2016, Area 8 where available or Statewide

Measures are contracted as a group for efficient construction costs

Planning-level estimates, 30% contingency used to account for uncertainties of complex construction

Pavement marking costs are assumed to the lift span on the west leg, and 100' from the intersection on the north, south, and east legs

Item # "N" refers to not available in FDOT Item Average Cost or tabulation sheet. Other sources used.

Florida DOT Three Step Roundabout Analysis Methodology Approach

FDOT Level 2 Roundabout b/c Evaluation

1 - MAIN ENTRY

Enter project-specific data into orange cells on this sheet.

Scenario

Type of Comparison	Case 2: Traditional Intersection Option vs. Roundabout Option at site of existing traditional intersection	Choose from list
Existing Control	All-Way Stop Control	Choose from list
Traditional Intersection Option	All-Way Stop Control	Choose from list

Timeframe

Opening Year	2015	Enter year
Life Span	20	Enter life space in years. Maximum life span is 50 years

Safety Inputs

Consider safety costs?	Yes	Choose from list	
Number of Legs	4	Choose from list	
	Major Road	Minor Road	
Opening Year AADT	5,300	2,400	Enter volumes
Design Year AADT	6,400	4,100	Enter volumes
Facility Type (for SPFs)	Urban and Suburban Arterials	Choose from list	
Area Type (for roundabout CMFs)	Urban	Choose from list	
Number of Lanes in Roundabout	1	Choose from list	

For "Urban and Suburban Arterial" facility type:		
Max. number of lanes crossed by pedestrian	2	For any crossing at intersection. If raised island/median, count stages seperately.
Daily Pedestrian Volume	230	Sum of all legs crossed

Existing Crash Data Available?	Yes	Choose from list
Time Span of Record (years):	2	Enter a minimum of 2 years
Total Number of Crashes:	**10**	
- *with Fatalities:*	0	Enter total number for given time span.
- *with Injuries:*	5	Enter total number for given time span.
- *with PDO:*	5	Enter total number for given time span.

For "Urban and Suburban Arterial" facility type:		
Number of Single-Vehicle Crashes	0	Enter total number for given time span. Do not include pedestrian or bicycle crashes.
Number of Multi-Vehicle Crashes	8	Enter total number for given time span. Do not include pedestrian or bicycle crashes.
Number of Vehicle-Pedestrian Crashes	2	Enter total number for given time span.
Number of Vehicle-Bicycle Crashes	0	Enter total number for given time span.

The existing traditional intersection and the traditional intersection option have the same control device, but some geometric differences:

Optional: Enter a CMF for the change associated with the traditional intersection option

Example: Add a left-turn lane to a rural, 3-leg, signalized intersection
-> Enter 0.85 per Table 14-10 of the HSM
If multiple CMFs are applicable, multiply them together before entering into spreadsheet
Use CMFs from HSM Chapter 14 o FHWA's CMF Clearinghouse

Additional safety inputs are located on the "2 - Adjust SPF" tab.

Vehicle Delay

Enter this information on the "3 - DelayENTRY" tab.

Operations and Maintenance

	Roundabout	All-Way Stop Control
Lighting?	Yes	Yes

Capital Costs

Cells in tables below should be left blank if consideration of capital costs is not desired.

Preliminary Engineering	$ 171,000	$ 68,000
Right-of-Way and Utilities		
Construction	$ 426,000	$ 170,000
Total	**$ 597,000**	**$ 238,000**

Unit Costs are listed below. In general, there is no need to change these and default values should be used.
Changes, if made, should be made in blue cells.

Item	Cost	Typ. Cost	Typ. Cost Source
Cost/Fatal-Injury Crash	$ 363,470	$ 363,470	Weighted average of fatal-injury crash costs based on all recorded fatal and injury crashes on the SHS from 2009 to 2013
Cost/PDO Crash	$ 7,600	$ 7,600	FDOT
Cost/Vehicle-Hour Delay	$ 16.79	$ 16.79	2012 Urban Mobility Report by Texas Transportation Institute
Retiming Cost Every 3 Years	$ -	$ -	FDOT. Equals $5000 for signal and $0 for stop-control
Annual Lighting Cost	$ 750	$ 750	*FDOT. Equals $750 if illumination present*
Annual Signal Maintenance Cost	$ -	$ -	FDOT. Equals $2000 for signal and $0 for stop control
Annual Roundabout Landscaping Cost	$ 2,000	$ 2,000	Typical cost
Discount Rate	3.0%	3.0%	Typical for Infrastructure Projects. Opportunity cost of investing in intersection. *Discount rate cannot be zero.*

FDOT Level 2 Roundabout b/c Evaluation

3 - DELAY ENTRY

Enter delay data into orange cells on this sheet.

Consider delay costs? Yes Choose from list

Enter average vehicle occupancy. This is used to convert vehicle delay to person delay.
Vehicle Occupancy 1.59 Average car rate is 1.59 per US Dept. of Energy http://www1.eere.energy.gov/vehiclesandfuels/facts/2010_fotw613.html

Enter the duration in hours of each time period of the day. If delay data is not available for a time period, enter a duration of 0 hours and analyze less than all 24 hours of the day.

	Weekday		Weekend	
AM	0	AM		
PM	1	PM		
Midday		Midday		
Off-Peak1		Off-Peak1		This could be used for hours before the AM Peak or in the evening after the PM Peak
Off-Peak2		Off-Peak2		This could be used for overnight hours
Total	1	Total	0	

Total for weekday and weekend should equal 24 for analysis of all hours of the week, or should equal less than 24 for analysis of certain time periods only. Full day analysis for weekdays and weekends is recommended if sufficient data is available.

Enter the hourly volume (total entering vehicles) for each time period of the day. This is used to convert average delay per vehicle to total delay.
If analysis of certain time periods is not desired, leave cells for that time period blank

	Weekday Opening Year	Weekday Design Year		Weekend Opening Year	Weekend Design Year
AM			AM		
PM	688	826	PM		
Midday			Midday		
Off-Peak1			Off-Peak1		
Off-Peak2			Off-Peak2		
ADT	Requires 24	hour data	ADT	Requires 24	hour data

ADT calculated from the hourly volumes above time period durations below.
Provided for informational purposes and not used in subsequent calculations.

Orange cells in tables below can be left blank if consideration of time period is not desired.
For example, if it is desired to only analyze peak hours, delay entries for midday and off-peak may be left blank.

Orange cells in tables below can be left blank if consideration of time period is not desired.
Leave all cells in weekend tables below blank if consideration of weekend delay is not desired.

Weekday

Roundabout

	AM Delay sec/veh	PM Delay sec/veh	Midday Delay sec/veh	Off-Peak1 Delay sec/veh	Off-Peak2 Delay sec/veh
2015		6.1			
2035		6.1			

All-Way Stop Control

	AM Delay sec/veh	PM Delay sec/veh	Midday Delay sec/veh	Off-Peak1 Delay sec/veh	Off-Peak2 Delay sec/veh
2015		11.7			
2035		11.7			

Weekend

Roundabout

	AM Delay sec/veh	PM Delay sec/veh	Midday Delay sec/veh	Off-Peak1 Delay sec/veh	Off-Peak2 Delay sec/veh
2015					
2035					

All-Way Stop Control

	AM Delay sec/veh	PM Delay sec/veh	Midday Delay sec/veh	Off-Peak1 Delay sec/veh	Off-Peak2 Delay sec/veh
2015					
2035					

These cells calculate daily totals. No data entry here.

Roundabout

Weekday Total - Entire Day OR Sum of Hours Entered Vehicle Delay (in sec)	Weekday Total Person Delay (in sec)
4,197	6,673
5,039	8,011

All-Way Stop Control

Weekday Total - Entire Day OR Sum of Hours Entered Vehicle Delay (in sec)	Weekday Total Person Delay (in sec)
8,050	12,799
9,664	15,366

These cells calculate daily totals. No data entry here.

Roundabout

Weekend Total - Entire Day OR Sum of Hours Entered Vehicle Delay (in sec)	Weekend Total Person Delay (in sec)
0	0
0	0

All-Way Stop Control

Weekend Total - Entire Day OR Sum of Hours Entered Vehicle Delay (in sec)	Weekend Total Person Delay (in sec)
0	0
0	0

FDOT Level 2 Roundabout b/c Evaluation

Annual Costs	Roundabout		All-Way Stop Control	
Safety	**Predicted Annual Crashes**	**Safety Cost**	**Predicted Annual Crashes**	**Safety Cost**
Predicted Fatal/Injury Crashes	2.50	$ 908,675	2.50	$ 908,675
Predicted PDO Crashes	2.50	$ 19,000	2.50	$ 19,000
	Annual Costs of Predicted Crashes	**$ 927,675**	***Annual Costs of Predicted Crashes***	**$ 927,675**
Delay	**Annual Intersection Delay (person-hrs)**	**Delay Cost**	**Annual Intersection Delay (person-hrs)**	**Delay Cost**
Average Annual Person (in Vehicle) Delay	530	**$ 6,665**	1017	**$ 12,784**
Operation and Maintenance	**Operation and Maintenance**	**O&M Cost**	**Operation and Maintenance**	**O&M Cost**
Annualized Cost of Signal Retiming		$ -	Signal Retiming Every 3 Years	$ -
Annual Cost of Illumination	Intersection Illumination	$ 750	Intersection Illumination	$ 750
Annual Cost of Maintenance	Landscaping Costs	$ 2,000	Signal Maintenance Costs (power outage, detection, etc.)	$ -
	Total Annual Operation and Maintenance Costs	**$ 2,750**	***Total Annual Operation and Maintenance Costs***	**$ 750**
Initial Capital Costs	**Total Capital Costs**	**Cost**	**Total Capital Costs**	**Cost**
Preliminary Engineering		$ 171,000		$ 68,000
Right-of-way and Utilities		$ -		$ -
Construction		$ 426,000		$ 170,000

*Delay cost is based upon a 1 hour analysis period.

Total Discounted Life Cycle Costs (2015 - 2035)	Roundabout		All-Way Stop Control	
Safety	**Total Predicted Crashes**	**Safety Cost**	**Total Predicted Crashes**	**Safety Cost**
Predicted Fatal/Injury Crashes	50.00	$ 13,518,789	50.00	$ 13,518,789
Predicted PDO Crashes	50.00	$ 282,672	50.00	$ 282,672
	Total Costs of Predicted Crashes	**$ 13,801,461**	***Total Costs of Predicted Crashes***	**$ 13,801,461**
Delay	**Total Intersection Delay (person-hrs)**	**Delay Cost**	**Total Intersection Delay (person-hrs)**	**Delay Cost**
Total Person (in Vehicle) Delay	11136	**$ 139,972**	21358	**$ 268,471**
Operation and Maintenance	**Operation and Maintenance**	**O&M Cost**	**Operation and Maintenance**	**O&M Cost**
Annualized Cost of Signal Retiming		$ -	Signal Retiming Every 3 Years	$ -
Annual Cost of Illumination	Intersection Illumination	$ 11,158	Intersection Illumination	$ 11,158
Annual Cost of Maintenance	Landscaping Costs	$ 29,755	Signal Maintenance Costs (power outage, detection, etc.)	$ -
	Total Annual Operation and Maintenance Costs	**$ 40,913**	***Total Annual Operation and Maintenance Costs***	**$ 11,158**
Initial Capital Costs	**Total Capital Costs**	**Cost**	**Total Capital Costs**	**Cost**
Preliminary Engineering		$ 171,000		$ 68,000
Right-of-way and Utilities		$ -		$ -
Construction		$ 426,000		$ 170,000
	Total Initial Capital Costs	**$ 597,000**	***Total Initial Capital Costs***	**$ 238,000**
Total Life Cycle Costs (Opening Year $)	**Net Present Value**	**$ 14,579,347**	**Net Present Value**	**$ 14,319,091**
		Roundabout		All-Way Stop Control

*Delay cost is based upon a 1 hour analysis period.

Life Cycle Benefit/Cost Ratio		
Safety Benefit of a Roundabout	$ -	
Delay Reduction Benefit of a Roundabout	$ 128,499	
Total Benefits	**$ 128,499**	
Added Operations&Maintenance Costs of a Roundabout	$ 29,755	
Added Capital Costs of a Roundabout	$ 359,000	
Total Costs	**$ 388,755**	
Life Cycle Benefit/Cost Ratio	**0.3**	**Roundabout Compared to All-Way Stop Control**
	Roundabout not Preferred	

FLORIDA DEPARTMENT OF TRANSPORTATION

STEP 2 - b/c EVALUATION

Prepared by:	*ADEAS-Q*	**Date Prepared:**	***10/20/2016***
Financial Project ID:	*n/a*	**Project Name:**	***Laurel/Doyle Carlton***
FAP No.:	*n/a*	**State Road:**	***n/a***
County:	*Hillsborough*	**Intersecting Rd:**	***Intersection Project***

ANNUAL COSTS		
	Roundabout	All-Way Stop Control
Safety Cost (Crashes)	$ 927,675	$ 927,675
Delay Cost	$ 6,665	$ 12,784
O & M Cost	$ 2,750	$ 750

Initial Capital Cost		
Preliminary Engineering	$ 171,000	$ 68,000
Right-of-way and Utilities	$ -	$ -
Construction	$ 426,000	$ 170,000

TOTAL DISCOUNTED LIFE CYCLE COSTS (OPENING YEAR)		
	Roundabout	All-Way Stop Control
Safety Cost (Crashes)	$ 13,801,461	$ 13,801,461
Delay Cost	$ 139,972	$ 268,471
O & M Cost	$ 40,913	$ 11,158
Initial Capital Cost	$ 597,000	$ 238,000
Total Life Cycle Costs	$ 14,579,347	$ 14,319,091

LIFECYCLE BENEFIT/COST RATIO	
Safety Benefit of a Roundabout	$ -
Delay Reduction Benefit of a Roundabout	$ 128,499
Total Benefit	$ 128,499
Added O & M Costs of a Rondabout	$ 29,755
Added Capital Costs of a Roundabout	$ 359,000
Total Cost	$ 388,755
Life Cycle Benefit/Cost Ratio	**0.3**

Advance to Level 3 Geometric and Operational Analysis: ☐ YES ☐ NO

Approved by: ☐ DDE or ☐ DTOE

Signature:____ Date:______________________________