City of Fort Lauderdale

Las Olas Boulevard Mobility Study



Tindale-Oliver
&
Associates, Inc.
Planning and Engineering

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Executive Summary

Tindale-Oliver & Associates, Inc. (TOA) was retained by the City of Fort Lauderdale to provide recommendations to address the traffic circulation, safety, multimodal mobility, and quality-of-life issues along the Las Olas Boulevard corridor from just west of the Himmarshee Canal to the Intracoastal Waterway Bridge. The study also includes the Colee Hammock neighborhood for the purpose of assessing and developing strategies to mitigate the adverse impacts of neighborhood cut-through traffic. Key issues addressed in this study include:

1. High traffic volumes, mixture of business access and thru traffic trip-making, and off-peak period travel speeds adversely impact the safety of pedestrians, cyclists, and motorists attempting to navigate Las Olas Boulevard.
2. Traffic traversing the Colee Hammock neighborhood between Broward Boulevard and Las Olas Boulevard uses local neighborhood streets to avoid signal delay encountered along 15th Avenue, the designated collector roadway.

Study objectives to resolve these issues include:

A. Identify strategies to manage travel speeds along Las Olas Boulevard.
B. Identify strategies to provide for bicycle and pedestrian mobility along and across Las Olas Boulevard.
C. Assess general safety issues and evaluate the extent to which design and operational safety best-practices may be implemented along the corridor.
D. Recommend operational and design strategies to reduce delay for drivers making the "Z" movement between Broward Boulevard and Las Olas Avenue along 15th Avenue while promoting the safety of all roadway users.
E. Identify traffic calming strategies to discourage high-speed cut-thru traffic along 12th, 13th, 16th, and 17th Avenues while minimizing the impact of these strategies on the convenience and mobility of Colee Hammock neighborhood residents.
F. Consider strategies for safely and efficiently managing traffic during special events which close Las Olas Boulevard to thru-traffic west of the study area.
G. Consider strategies to reduce truck traffic on Las Olas Boulevard west of the study area.

Recommendations developed to meet the study objectives are categorized as short, medium, and longer-term based on the relative cost and complexity of each recommendation. It is anticipated that short-term recommendations can generally be implemented within six-months to a year pending funding availability. It is anticipated mid-term and longer-term recommendations will take a year or more to implement since additional design work, more detailed cost estimation, financial programming, and public outreach and interagency coordination will be necessary.

The table on the following page summarizes the key study recommendations. Dark blue circles indicate that the recommendation is intended to directly address the corresponding goal(s). Light blue circles indicate that the recommendation promotes the corresponding goal(s) as an ancillary benefit of addressing other (primary) goals.

Attention is directed to the fact that in some cases, the effectiveness of shorter-term recommendations may enable more costly, longer-term recommendations to be deferred. As such, post implementation observation/follow-up is recommended at each stage.

Short Term Recommendations **Estimated Implementation Cost:** **$ 52,500 - $105,000** ● Directly addresses corresponding goal(s) ○ Supports corresponding goal(s) as an ancilary benefit	**Issue #1: Lack of Multimodal Mobility along Las Olas Boulevard**			**Issue #2: Congestion and Cut-through Traffic in the Colee Hammock Neighborhood**			
	A Manage Las Olas Travel Speeds	B Bicycle and Pedestrian Mobility Enhancement	C Safety Best Practices	D Reduce Delay for "Z" Movement	E Colee Hammock Traffic Calming	F Special Event Management	G Reduce Las Olas Truck Traffic
Modify signal timings at the intersections of SE 15th Avenue and Broward Boulevard and SE 15th Avenue and Las Olas Boulevard.	○			●		○	○
Enhance crosswalk markings and provide supplemental signs, pavement markings, and warning devices along Las Olas Boulevard.		○	●				
Provide shared lane arrow markings along Las Olas Boulevard.		●	○				
Provide enhanced crosswalk lighting at SE 15th Avenue and Las Olas Boulevard.			●				
Provide enhanced speed limit sign/speed feedback signto reinforce the 30 mph speed along Las Olas Boulevard west of SE 17th Way	●	○	●				
Consider removing the north-south stop control at SE 15th Avenue and SE 2nd Street pending outcome of signal timing modifications.				●			
Modify the centerline and stop bar placement at the south leg of SE 15th Avenue and Broward Boulevard to facilitate truck turning movements.							●
Provide a special event scenario signal timing plan.						●	

Mid-Term Recommendations **Estimated Implementation Cost:** **$1,350,000 - $2,700,000** ● Directly addresses corresponding goal(s) ○ Supports corresponding goal(s) as an ancilary benefit	**Issue #1: Lack of Multimodal Mobility along Las Olas Boulevard**			**Issue #2: Congestion and Cut-through Traffic in the Colee Hammock Neighborhood**			
	A Manage Las Olas Travel Speeds	B Bicycle and Pedestrian Mobility Enhancement	C Safety Best Practices	D Reduce Delay for "Z" Movement	E Colee Hammock Traffic Calming	F Special Event Management	G Reduce Las Olas Truck Traffic
Modify Las Olas Boulevard @ SE 15th Avenue to eliminate the westbound left-turn movement and convert the inside lane to right-turn-only.				●		○	○
Implement a "road diet" along Las Olas Boulevard west of SE 15th Avenue.	○	●	○				○
Install parking bays/curb bulb-outs and raised intersections in the Colee Hammock neighborhood.		○			●		

Longer-Term Recommendations **Estimated Implementation Cost:** **$185,000 - $370,000** ● Directly addresses corresponding goal(s) ○ Supports corresponding goal(s) as an ancilary benefit	**Issue #1: Lack of Multimodal Mobility along Las Olas Boulevard**			**Issue #2: Congestion and Cut-through Traffic in the Colee Hammock Neighborhood**			
	A Manage Las Olas Travel Speeds	B Bicycle and Pedestrian Mobility Enhancement	C Safety Best Practices	D Reduce Delay for "Z" Movement	E Colee Hammock Traffic Calming	F Special Event Management	G Reduce Las Olas Truck Traffic
Reconstruct the north leg of SE 15th Avenue at Las Olas Boulevard to provide for a 2nd southbound lane.				●		○	○
Modify the curb radius of the southwest corner of Broward Boulevard and SE 15th Avenue; consider removing thru-truck prohibition on SE 15th Avenue.							●

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Study Overview and Objectives

Tindale-Oliver & Associates, Inc. (TOA) was retained by the City of Fort Lauderdale to provide recommendations to address the traffic circulation, safety, multimodal mobility, and quality-of-life issues along the Las Olas Boulevard corridor from just west of the Himmarshee Canal to the Intracoastal Waterway Bridge. The study also includes the Colee Hammock neighborhood for the purpose of assessing and developing strategies to mitigate the adverse impacts of neighborhood cut-through traffic.

Based guidance from the "We Are Connected" component of the Fast Forward Fort Lauderdale 2035 Vision, briefings provided by Transportation & Mobility Department staff, and review of summary comments from past public outreach activities conducted by the City, the major issues and corresponding objectives shown to the right were defined.

To address these Issues/Objectives, this study includes the following components:

- Assessment of Traffic Conditions and Design Issues
- Recommended Solutions
  - Short-Term
  - Mid-Term
  - Longer-Term
- Technical Appendices

A map of the study area is shown as Figure 1 on the following page.

Issue: High traffic volumes, mixture of business access and thru traffic trip-making, and off-peak period travel speeds adversely impact the safety of pedestrians, cyclists, and motorists attempting to navigate Las Olas Boulevard.

Objectives:

- Identify strategies to manage travel speeds along Las Olas Boulevard.
- Identify strategies to provide for bicycle and pedestrian mobility along and across Las Olas Boulevard.
- Assess general safety issues and evaluate the extent to which design and operational safety best-practices may be implemented along the corridor.

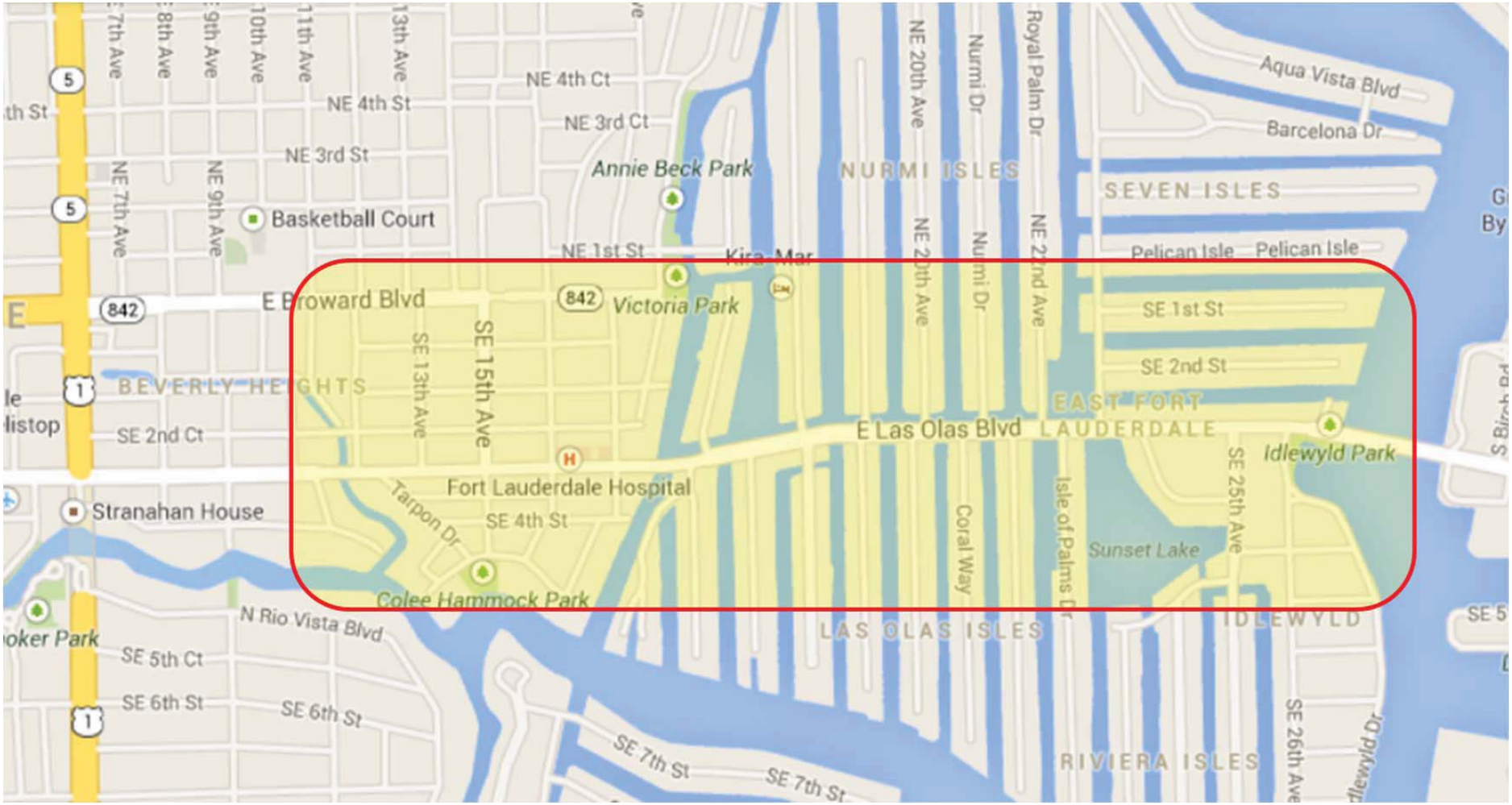
Issue: Traffic traversing the Colee Hammock neighborhood between Broward Boulevard and Las Olas Boulevard uses local neighborhood streets to avoid signal delay encountered along 15th Avenue, the designated collector roadway.

Objectives:

- Recommend operational and design strategies to reduce delay for drivers making the "Z" movement between Broward Boulevard and Las Olas Avenue along 15th Avenue while promoting the safety of all roadway users.
- Identify traffic calming strategies to discourage high-speed cut-thru traffic along 12th, 13th, 16th, and 17th Avenues while minimizing the impact of these strategies on the convenience and mobility of Colee Hammock neighborhood residents.
- Consider strategies for safely and efficiently managing traffic during special events which close Las Olas Boulevard to thru-traffic west of the study area.
- Consider strategies to reduce truck traffic on Las Olas Boulevard west of the study area.

Study Overview and Objectives

Study Area Map:



Assessment of Traffic Conditions and Design Issues

The assessment process included evaluation of traffic data provided by the City of Fort Lauderdale as well as field observations conducted from August 6–8, 2013. This information was used to quantitatively and qualitatively assess the following elements:

- Colee Hammock Neighborhood Cut-Through Traffic
- Study Area Traffic Operations/Level-of-Service (LOS)
- Multimodal Mobility/Safety Conditions
- Roadway Design/Geometric Issues/Constraints

Colee Hammock Neighborhood Cut-Through Traffic Analysis

The geography of downtown Fort Lauderdale requires that Las Olas Boulevard and Broward Boulevard work in tandem to convey people and goods from east to west across the study area. This results in what is known as a "Z" movement, in which traffic generally traveling in an east-west orientation must make a north-south jog to complete its trip.

The north-south component of the "Z" movement between Broward Boulevard and Las Olas Boulevard can occur at several points, including:

- through downtown along either Andrews Avenue or SE 3rd Avenue
- along US-1
- along SE 8th Avenue
- along the north-south roadways (SE 12th through SE 17th Aves.) through the Colee Hammock neighborhood

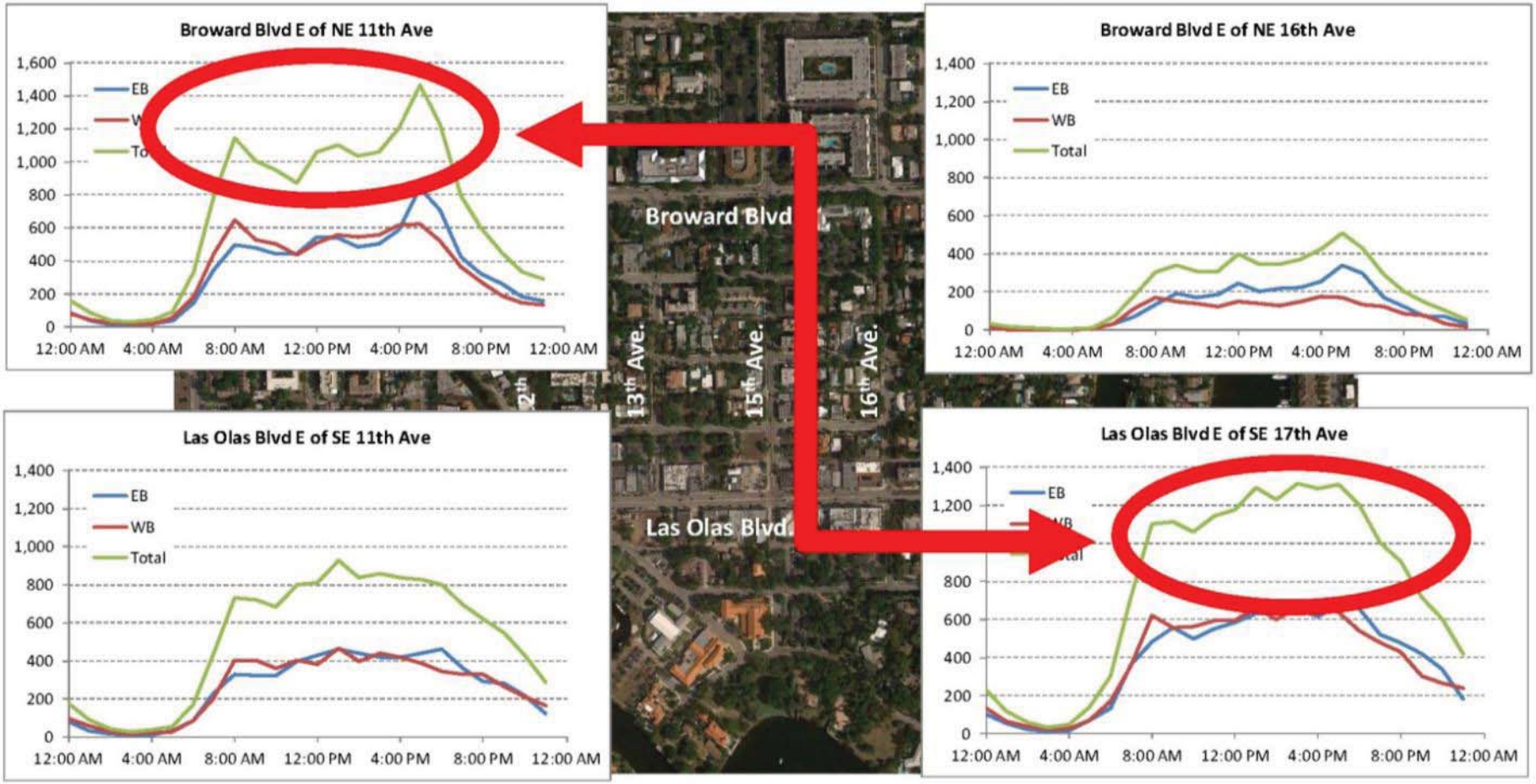
The preference of any given driver between these options is governed primarily by their perception of which route will be the fastest/most convenient. Because traveling through the more built-up part of Las Olas Boulevard (between US-1 and the Himmarshee Canal) and/or through downtown is perceived to be a more complex, slower route than travelling through Collee Hammock, many motorists choose to use this route to fulfill east-west trip purposes. Wayfinding along Broward Boulevard directs traffic bound for A-1-A (the beach) to use SE 15th Avenue. SE 15th Avenue is designated as a "city collector" street and, therefore, is the appropriate route for traffic passing through the neighborhood. However, the City's past outreach/fact-finding initiatives indicate that thru traffic also makes use of other local/neighborhood streets to the east and west of SE 15th Avenue.

A key objective of this study is to assess the degree to which cut-through traffic across the Colee Hammock neighborhood impacts local/neighborhood streets and to recommend measures to mitigate the negative impacts of this traffic. To evaluate this, 24-hour traffic counts (included in Appendix A) were collected at the following locations:

- Broward Boulevard east of NE 11th Avenue
- Broward Boulevard east of NE 16th Avenue
- Las Olas Boulevard east of NE 11th Avenue
- Las Olas Boulevard east of NE 16th Avenue
- SE 12th Avenue south of SE 1st Street
- SE 13th Avenue south of SE 1st Street
- SE 15th Avenue south of SE 1st Street
- SE 16th Avenue south of SE 1st Street

The first step in evaluating the magnitude of cut-through traffic was to analyze the overall east-west traffic travel patterns in the area. Figure 1 on the following page illustrates the collected traffic volumes at Broward Boulevard and Las Olas Boulevard east and west of the Colee Hammock neighborhood. Clearly, there is a shift in traffic volumes between Broward Boulevard west and Las Olas Boulevard east; this indicates that for this to happen, traffic volumes need to travel on the north south streets within the Colee Hammock neighborhood.

Figure 1: East-West Travel Patterns



Assessment of Traffic Conditions and Design Issues

The next step in the analysis was to evaluate which roads are currently being used to travel between Broward Boulevard and Las Olas Boulevard. As shown in Figures 2 through 5, the majority (approximately 74%) of traffic volumes are currently using SE 15th Avenue.

Generally, traffic volumes along the three local through streets (SE 12th, 13th and 16th Avenues) is less than 100 vehicles per hour. While this level of traffic volume is generally within the normal parameters for a local/neighborhood street, further analysis was performed to understand how travel along these roads is influenced by congestion along SE 15th Avenue.

Figure 2: SE 12th Avenue S of SE 1st Street

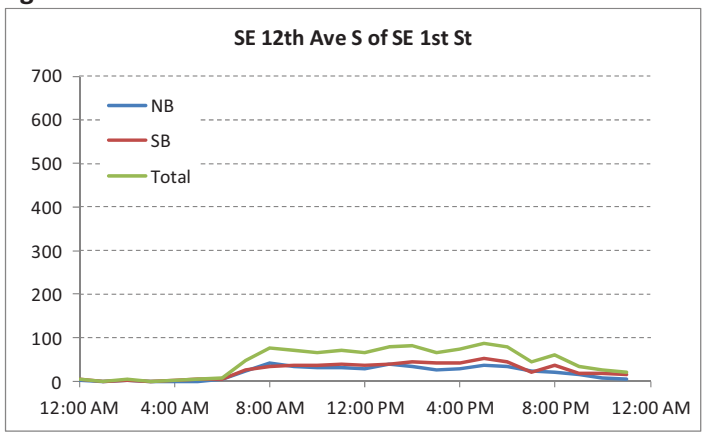


Figure 3: SE 13th Avenue S of SE 1st Street

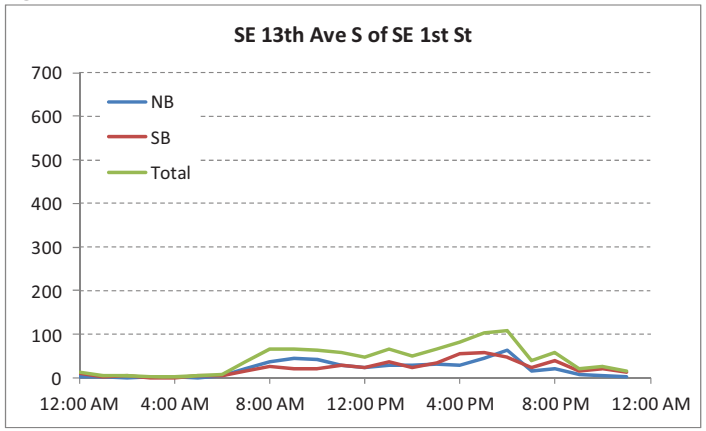


Figure 4: SE 15th Avenue S of SE 1st Street

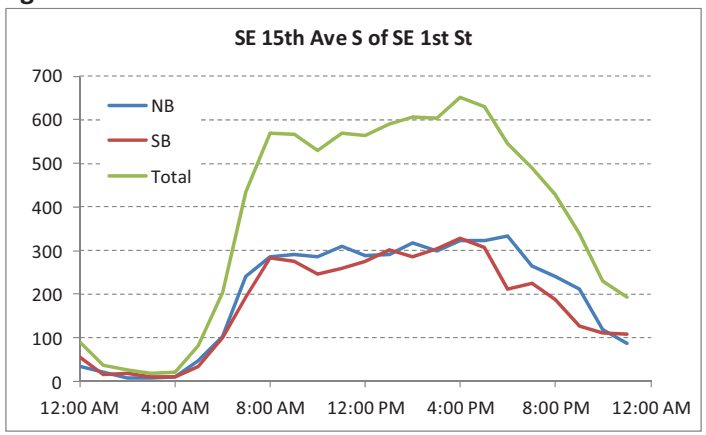
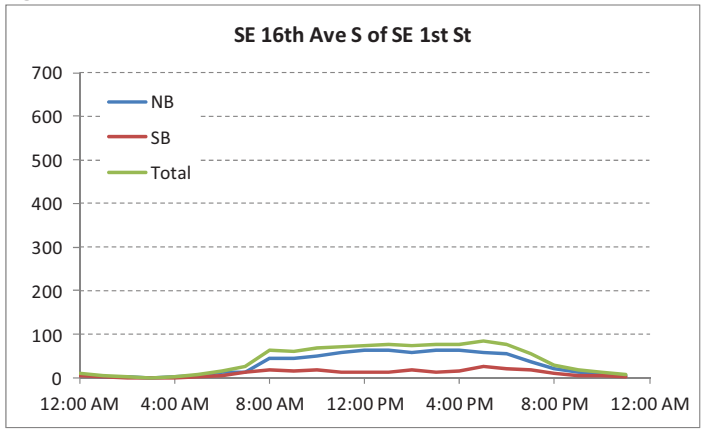


Figure 5: SE 16th Avenue S of SE 1st Street



Assessment of Traffic Conditions and Design Issues

To understand the relationship between the demand for travel on local streets compared with travel along SE 15th Avenue, the fluctuation of the percentage of north-south traffic using streets other than SE 15th Avenue over the course of an average weekday was evaluated.

As shown in Figure 6, the percentage of traffic volume using roads other than SE 15th Avenue remains fairly constant during the day, when traffic volumes are significant (from 8:00 am to 7:00 pm); however, at approximately 5:00 pm, this percentage raises to approximately 33 percent (from approximately 26%). This indicates that when overall demand goes up, vehicles start using roads other than SE 15th Avenue suggesting that congestion along SE 15th Avenue contributes to traffic along the parallel local/neighborhood streets.

To show this relationship more clearly, total north-south traffic volumes were sorted from low to high and graphed against percent of north-south total traffic using roads other than SE 15th Avenue. As Figure 7 shows, as traffic volumes grow, there is a tendency for north-south traffic to use roads other than SE 15th Avenue.

The conclusion from these analyses is that while the overall quantity of cut-through traffic along local streets is not extreme, the use of these streets for thru-trips correlates with the level of congestion on SE 15th Avenue and, therefore, measures to reduce congestion on SE 15th Avenue should help to reduce cut-through traffic on the parallel neighborhood streets.

Figure 6: North-South Traffic Volume Distributions Among North-South Roads

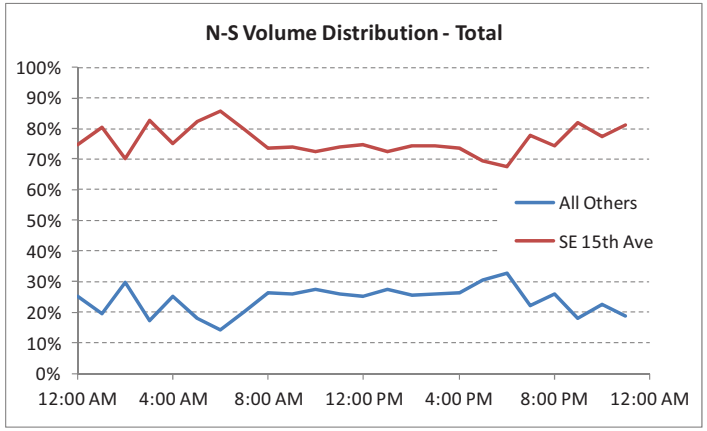
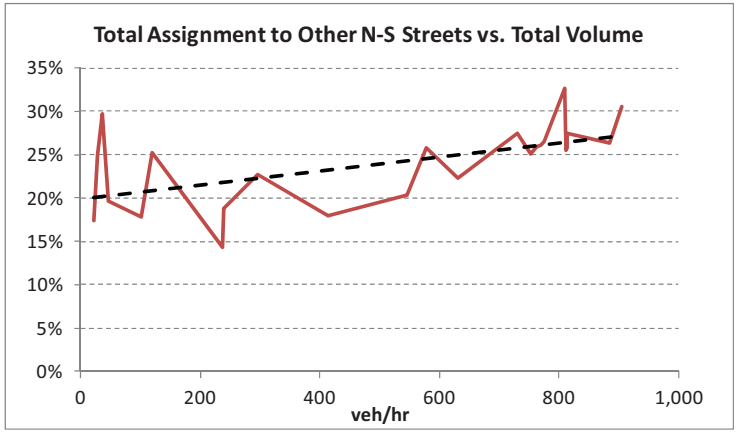


Figure 7: North-South Traffic Volume Distributions Among North-South Roads vs. Total North-South Traffic Volumes



Assessment of Traffic Conditions and Design Issues

Existing Traffic Operations/LOS Analysis

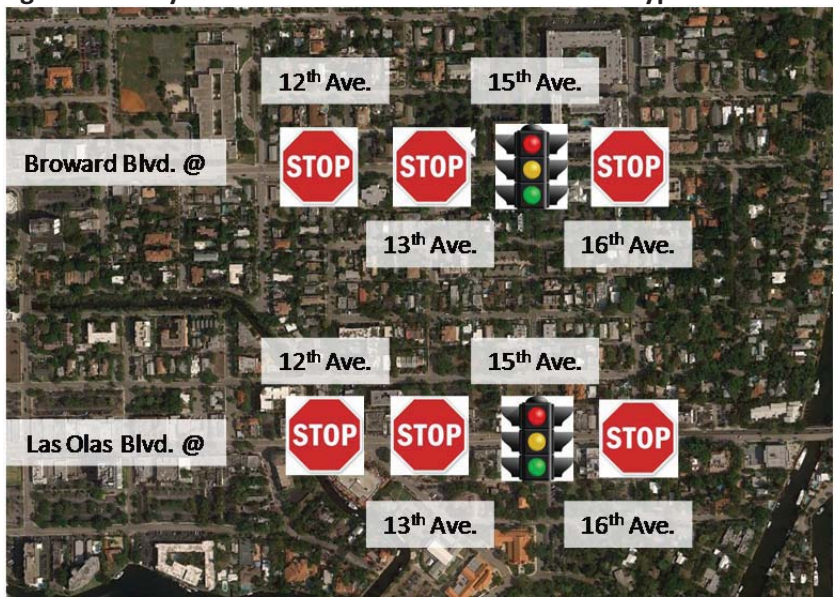
To analyze existing operating conditions in the study area, AM (from 7:00 am to 8:00 am) and PM (from 4:00 pm to 6:00 pm) peak-hour turning movement counts (included in Appendix A) were reviewed at the following intersections:

- Broward Boulevard at SE 11th Avenue
- Broward Boulevard at SE 12th Avenue
- Broward Boulevard at SE 15th Avenue
- Broward Boulevard at SE 16th Avenue
- Las Olas Boulevard at SE 11th Avenue
- Las Olas Boulevard at SE 12th Avenue
- Las Olas Boulevard at SE 15th Avenue
- Las Olas Boulevard at SE 16th Avenue

Turning movement counts were adjusted using FDOT's peak season conversion factors (PSCF) to reflect peak-season conditions. Intersection analyses were performed for the AM and PM peak hour conditions using the latest version of Synchro (Highway Capacity Software Methodology). The results of the unsignalized (stop-controlled) intersection analyses are summarized in Table 1, and worksheets documenting the analysis can be found in Appendix B.

As shown in Tables 1a and 1b on the following pages, all unsignalized intersections are estimated to perform satisfactory during AM and PM peak-hour conditions.

Figure 8: Analyzed Intersections and Traffic Control Type



Assessment of Traffic Conditions and Design Issues

Table 1a: Unsignalized Intersection LOS Analysis Summary—AM Peak-Hour Existing Conditions

Intersection	Measure	Movement											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Broward Blvd at 12th Ave	V/C	0.01	0.22	0.13	0.02	0.36	0.20	n/a	0.13	n/a	n/a	0.26	n/a
	Delay [sec]	10.0	Note 1	Note 1	8.7	Note 1	Note 1	n/a	16.3	n/a	n/a	20.6	n/a
	LOS	A	Note 1	Note 1	A	Note 1	Note 1	n/a	C	n/a	n/a	C	n/a
Broward Blvd at 13th Ave	V/C	n/a	0.21	0.12	0.03	0.19	n/a	n/a	0.10	n/a	n/a	n/a	n/a
	Delay [sec]	n/a	Note 1	Note 1	8.6	Note 1	n/a	n/a	12.5	n/a	n/a	n/a	n/a
	LOS	n/a	Note 1	Note 1	A	Note 1	n/a	n/a	B	n/a	n/a	n/a	n/a
Broward Blvd at 16th Ave	V/C	n/a	0.07	0.02	n/a	0.16	n/a	n/a	0.03	n/a	n/a	0.18	n/a
	Delay [sec]	n/a	Note 1	Note 1	n/a	Note 1	n/a	n/a	9.0	n/a	n/a	10.7	n/a
	LOS	n/a	Note 1	Note 1	n/a	Note 1	n/a	n/a	A	n/a	n/a	B	n/a
Las Olas Blvd at 12th Ave	V/C	0.01	0.17	n/a	n/a	0.21	0.11	n/a	n/a	n/a	n/a	0.10	n/a
	Delay [sec]	0.4	Note 1	n/a	n/a	Note 1	Note 1	n/a	n/a	n/a	n/a	13.2	n/a
	LOS	A	Note 1	n/a	n/a	Note 1	Note 1	n/a	n/a	n/a	n/a	B	n/a
Las Olas Blvd at 13th Ave	V/C	0.01	0.12	n/a	n/a	0.21	0.11	n/a	n/a	n/a	n/a	0.04	n/a
	Delay [sec]	0.9	Note 1	n/a	n/a	Note 1	Note 1	n/a	n/a	n/a	n/a	10.0	n/a
	LOS	A	Note 1	n/a	n/a	Note 1	Note 1	n/a	n/a	n/a	n/a	A	n/a
Las Olas Blvd at 16th Ave	V/C	0.01	0.18	Note 1	0.00	0.29	n/a	n/a	0.03	n/a	n/a	0.12	n/a
	Delay [sec]	0.3	Note 1	Note 1	0.1	Note 1	n/a	n/a	16.7	n/a	n/a	27.0	n/a
	LOS	A	Note 1	Note 1	A	Note 1	n/a	n/a	C	n/a	n/a	D	n/a

Note 1: Uninterrupted movement

Table 1b: Unsignaized Intersection LOS Analysis Summary—AM Peak-Hour Existing Conditions

Intersection	Measure	Movement											
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Broward Blvd at 12th Ave	V/C	0.02	0.29	0.15	0.01	0.32	0.16	n/a	0.09	n/a	n/a	0.09	n/a
	Delay [sec]	9.5	Note 1	Note 1	9.2	Note 1	Note 1	n/a	13.9	n/a	n/a	15.2	n/a
	LOS	A	Note 1	Note 1	A	Note 1	Note 1	n/a	B	n/a	n/a	C	n/a
Broward Blvd at 13th Ave	V/C	n/a	0.35	0.21	0.04	0.17	n/a	n/a	0.26	n/a	n/a	n/a	n/a
	Delay [sec]	n/a	Note 1	Note 1	10.1	Note 1	n/a	n/a	17.9	n/a	n/a	n/a	n/a
	LOS	n/a	Note 1	Note 1	B	Note 1	n/a	n/a	C	n/a	n/a	n/a	n/a
Broward Blvd at 16th Ave	V/C	n/a	0.27	0.02	n/a	0.14	n/a	n/a	0.13	n/a	n/a	0.07	n/a
	Delay [sec]	n/a	Note 1	Note 1	n/a	Note 1	n/a	n/a	11.2	n/a	n/a	9.8	n/a
	LOS	n/a	Note 1	Note 1	n/a	Note 1	n/a	n/a	B	n/a	n/a	A	n/a
Las Olas Blvd at 12th Ave	V/C	0.02	0.19	n/a	n/a	0.20	0.11	n/a	n/a	n/a	n/a	0.11	n/a
	Delay [sec]	1.2	Note 1	n/a	n/a	Note 1	Note 1	n/a	n/a	n/a	n/a	14.8	n/a
	LOS	A	Note 1	n/a	n/a	Note 1	Note 1	n/a	n/a	n/a	n/a	B	n/a
Las Olas Blvd at 13th Ave	V/C	0.06	0.23	n/a	n/a	0.19	0.11	n/a	n/a	n/a	n/a	0.05	n/a
	Delay [sec]	2.6	Note 1	n/a	n/a	Note 1	Note 1	n/a	n/a	n/a	n/a	12.5	n/a
	LOS	A	Note 1	n/a	n/a	Note 1	Note 1	n/a	n/a	n/a	n/a	B	n/a
Las Olas Blvd at 16th Ave	V/C	0.01	0.25	Note 1	0.00	0.29	n/a	n/a	0.04	n/a	n/a	0.11	n/a
	Delay [sec]	0.2	Note 1	Note 1	0.0	Note 1	n/a	n/a	16.9	n/a	n/a	20.7	n/a
	LOS	A	Note 1	Note 1	A	Note 1	n/a	n/a	C	n/a	n/a	C	n/a

Note 1: Uninterrupted movement

Assessment of Traffic Conditions and Design Issues

During field observations, over-saturated conditions were observed at the signalized intersection of Broward Boulevard at SE 15th Avenue intersection during the PM peak hour and at the signalized intersection of Las Olas Boulevard at SE 15th Avenue during AM and PM peak hours. Because intersections cannot process more vehicles than their capacity, the turning movement/traffic counts reflect capacity-constrained volumes and not the actual demand at these two intersections. As such, it is necessary to adjust the counts to reflect the actual peak-hour demand at these intersections by using the turning movement counts as ratios and increasing the approach volumes based on Average Annualized Daily Traffic (AADT) and by applying peak-to-daily ratios (K Factors) and directionality factors (D Factors) to the AADT. The specific steps followed in this estimate are documented in Appendix A.

The two signalized intersection analyses are summarized in Table 2, and worksheets documenting the analyses can be found in Appendix C. This analysis was performed using existing signal timings as provided by the City of Fort Lauderdale. These are included in Appendix D. The analysis shows that during the AM peak hour, both intersections operate acceptably; however, during our field observations, "cycle failures" were observed for the southbound-to-eastbound left turn movement at the intersection of Las Olas Boulevard and SE 15th Avenue. A "cycle failure" is defined as a condition in which some of the vehicles in the queue at the beginning of the green phase are unable to make it through the intersection and must wait until the next green phase.

Even with the application of the adjusted demand (discussed above), the "cycle failure" condition observed in the field is not reflected in the Synchro analysis. A potential explanation for this is that the software does not take into consideration the interaction among the southbound approach, the alley, and the parking lot located east of SE 15th Avenue.

The analysis indicates that during the PM peak hour conditions the northbound approach to the intersection of Broward Boulevard and SE 15th Avenue and southbound approach to the intersection of Las Olas Boulevard and SE 15th Avenue are deficient (LOS = F) and cycle failures are present (V/C > 1.00). These simulated conditions were observed and verified in the field; however, a similar discrepancy exists between the modeled performance of the southbound approach at the intersection of Las Olas Boulevard and SE 15th Avenue and the observed performance in the field. Specifically, the Synchro analyses seem to indicate that both of the intersection approaches operate at comparable levels of deficiency (V/C of 1.14 and 1.17, Delay = 104.7 sec/veh and 135.3 sec/veh), whereas field observations suggest that the intersection of Las Olas Boulevard and SE 15th Avenue experiences significantly longer queues and delay over a longer period of time in the afternoon.

Simply put, while both the northbound approach at Broward Boulevard and the Southbound approach at Las Olas Boulevard exhibit failing conditions on paper and in the field, operating conditions are significantly worse along southbound SE 15th Avenue at Las Olas Boulevard than along northbound SE 15th Avenue at Broward Boulevard. Again, it is likely that the discrepancy between the Synchro analysis and field observation is related to the additional "friction" created by traffic activities associated with business parking, alley traffic, and traffic along SE 2nd Court.

Table 2: Signalized Intersection LOS Analysis Summary—Existing Conditions

Intersection	Time Period	Measure	Movement												
			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Total
Broward Blvd at 15th Ave	AM Peak Hour	V/C	0.14	0.32	0.21	0.19	0.35	n/a	n/a	0.78	n/a	0.02	0.69	n/a	0.61
		Delay [sec]	16.6	17.5	16.9	16.8	17.5	n/a	n/a	24.6	n/a	17.3	24.6	n/a	20.4
		LOS	B	B	B	B	B	n/a	n/a	C	n/a	B	C	n/a	C
Las Olas Blvd at 15th Ave		V/C	0.12	0.21	n/a	0.02	0.49	n/a	n/a	0.47	n/a	n/a	0.85	n/a	0.62
		Delay [sec]	14.5	14.7	n/a	17.3	22.3	n/a	n/a	41.9	n/a	n/a	44.0	n/a	27.2
		LOS	B	B	n/a	B	C	n/a	n/a	D	n/a	n/a	D	n/a	C
Broward Blvd at 15th Ave	PM Peak Hour	V/C	0.37	0.76	0.23	0.54	0.24	n/a	n/a	**1.14**	n/a	0.05	0.68	n/a	0.90
		Delay [sec]	18.3	26.6	17.2	22.5	17.0	n/a	n/a	**104.7**	n/a	20.7	28.0	n/a	46.7
		LOS	B	C	B	C	B	n/a	n/a	**F**	n/a	C	C	n/a	D
Las Olas Blvd at 15th Ave		V/C	0.20	0.32	n/a	0.04	0.51	n/a	n/a	0.63	n/a	n/a	**1.17**	n/a	0.75
		Delay [sec]	16.6	17.7	n/a	20.9	26.5	n/a	n/a	46.0	n/a	n/a	**135.3**	n/a	55.5
		LOS	B	B	n/a	C	C	n/a	n/a	D	n/a	n/a	**F**	n/a	E

Assessment of Traffic Conditions and Design Issues

Multimodal Design/Operational Issues

Following is a summary of design and operational issues affecting the mobility of cyclists and pedestrians along Las Olas Boulevard.

Bicycle Facilities

Field observation indicates a significant degree of bicycle activity along Las Olas Boulevard with a wide range of cyclist behaviors. Some of these behaviors captured in the photos to the right show cyclists hugging the shoulder, a cyclist "taking the lane," and a cyclist riding on the sidewalk with and against traffic. The principal challenge for cyclists within the study segment is that from SE 17th Way west, adequate on-street bicycle facilities are not provided.

Because the Himmarshee Canal and the Sospiro Canal (between SE 17th Avenue and SE 17th Way) limit cyclists' ability to travel along low-speed, low-volume neighborhood streets and because the sidewalks along Las Olas Boulevard are too narrow and too busy with pedestrian traffic and street furniture to safely accommodate cyclists, it is essential that on-street bicycle facilities be provided along Las Olas Boulevard.

Cyclist hugging curb

Cyclist "taking" the lane

Cyclist on sidewalk with traffic

Cyclist on sidewalk against traffic

Assessment of Traffic Conditions and Design Issues

Pedestrian Facilities

Because of the high level of pedestrian activity along Las Olas Boulevard, best-practice design and operational treatments to promote pedestrian safety and mobility should be considered. Observed issues related to the ability of pedestrians to safely navigate across Las Olas Boulevard include the following:

- Worn crosswalk markings at the signalized intersection of Las Olas Boulevard and SE 15th Avenue as well as the mid-block crosswalk at SE 13th Avenue
- No pedestrian crossing across the east leg of the intersection of Las Olas Boulevard and SE 15th Avenue
- Conflict between heavy westbound to northbound right turn flow at Las Olas Boulevard and SE 15th Avenue, with pedestrians/cyclists crossing the north leg of the intersection
- Appropriate signing, pavement marking, and warning beacon devices not applied to marked mid-block crosswalks
- Opportunities to improve crosswalk area lighting

Worn crosswalk markings across 15th Ave.

Missing Crosswalk across Las Olas

Worn mid-block crosswalk markings – opportunity to provide enhanced crosswalk

Assessment of Traffic Conditions and Design Issues

In addition to issues related roadway crossings, the following observations were noted with respect to the ability of pedestrians to safely/comfortably walk along Las Olas Boulevard:

- The sidewalks along Las Olas Boulevard are relatively narrow and, in some cases, are obstructed by café tables and street furniture. While the minimum 3ft accessible path necessary for ADA compliance is generally maintained, features in the sidewalk area frequently constrain the walkable pathway to less than 5ft, the minimum width for two people to walk abreast or walk past one another comfortably. In an urban area such as the Las Olas corridor, a wider pedestrian pathway of 8–12ft is preferred; however, this cannot be accommodated within the current roadway cross section.
- The sidewalk across both canal bridges is relatively narrow and is not buffered from the outside travel lane, making for a less pleasant walking environment. Higher traffic volumes, narrower lanes, and higher motor vehicle volumes and travel speeds across the canal to the east of SE 17th Avenue.

Street furniture obstructing sidewalk area


Significant pedestrian activity



No buffer between traffic and pedestrians on canal bridges along the corridor

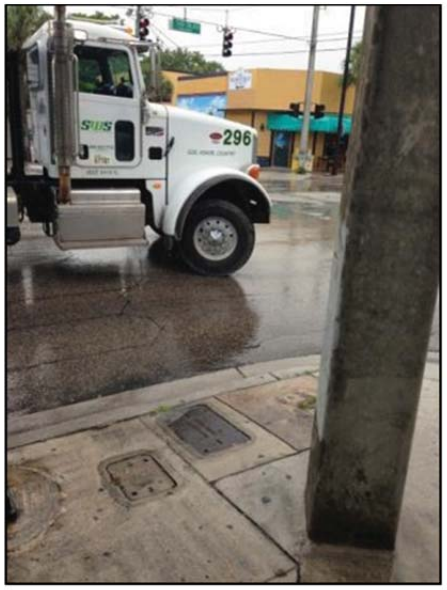
Other Design Issues

In addition to bicycle and pedestrian safety/mobility issues, the primary design/operational issue observed in the study corridor relates to the ability of trucks to navigate the intersections of SE 15th Avenue at Las Olas Boulevard and at Broward Boulevard. The predominant types of truck observed along SE 15th Avenue were medium and large single unit trucks, such as those pictured to the right.

Both the southbound approach at SE 15th Avenue and Las Olas Boulevard and the northbound approach at SE 15th Avenue and Broward Boulevard are approximately 30ft wide from curb to curb with the roadway centerline striped at the approximate center of the pavement. To complete right turns onto SE 15th Avenue, trucks must turn very slowly using every inch of the available roadway cross-section (top right and bottom left photos). When possible, trucks were observed crossing into the inside lane prior to initiating right turns in order to provide for a larger effective radius (top left photo).

Even with these measures, damage was observed on the drainage inlet on the northeast corner of SE 15th Avenue and Las Olas Boulevard and to the inlet, shoulder, curb, and sidewalk on the southwest corner of SE 15th Avenue and Broward Boulevard.

To address the objective of reducing truck volumes on Las Olas Boulevard west of the study area and address existing maintenance issues, it is necessary to address these geometric deficiencies.




Large single-unit truck turning wide at Las Olas Blvd. and 15th Avenue

Single-unit truck turning wide at Broward Blvd; damage to curb and sidewalk

Recommended Solutions

To address cut-through traffic issues, alleviate congestion, and improve multimodal mobility/safety, operational and design solutions have been developed. These have been categorized as short-term, mid-term, and longer-term based on the relative cost and complexity of the solutions. Table 3 summarizes the relative difference between short, mid, and longer-term recommendations based on eight considerations.

Table 3: Characterization of Short-, Mid-, and Longer-Term Recommendations and Cost Estimates

Criteria	Short-Term	Mid-Term	Longer-Term
Right of Way Impacts	None	Easement/Clip	Partial Take
Drainage/Utility Impacts	None	Modifications	Relocation
Sign/Pavement Markings	Enhance	Mill/Resurf.	Mill/Resurf.
Signal Work	None	Add Heads	Reconstruct
Pavement/Sidewalk/Ramps	Minor	Similar to 3R	Major
Intersection Geometrics	Minor	Minor	Add Lane
Modify Typical Section	None	Mill/Resurf.	Reconstruct
Cost Estimate	$50-100k	$1,350-2,700k	$185-370k

General cost estimate worksheets for each recommendation are provided in Appendix I.

Short-Term Recommendations

Consistent with Table 3, short-term solutions to address the objectives of the Las Olas Boulevard Corridor Study are low cost items that can be implemented quickly with little additional analysis. Based on this study's traffic data analysis, field review activities, and consultations with City staff, the following short-term solutions are recommended:

- Modify signal timings at the intersections of SE 15th Avenue and Broward Boulevard and SE 15th Avenue and Las Olas Boulevard.
- Enhance crosswalk markings and provide supplemental signs, pavement markings, and warning devices along Las Olas Boulevard.
- Provide shared lane arrow markings along Las Olas Boulevard.
- Provide enhanced crosswalk lighting at SE 15th Avenue and Las Olas Boulevard.
- Provide enhanced speed limit sign and/or speed feedback sign east of the Sospiro Canal Bridge (west of SE 17th Way) to reinforce the 30 mph speed limit to the west along Las Olas Boulevard.
- Provided that the signal timing modifications effectively eliminate standing queues through SE 2nd Street along SE 15th Avenue, construct curb bulb-outs to restrict on-street parking in the sight triangles and remove the north-south stop control at this intersection.
- Modify the centerline and stop bar placement at the south leg of SE 15th Avenue and Broward Boulevard to facilitate truck turning movements.
- Provide a special event scenario signal timing plan.

Further discussion related to each of these recommendations is provided below:

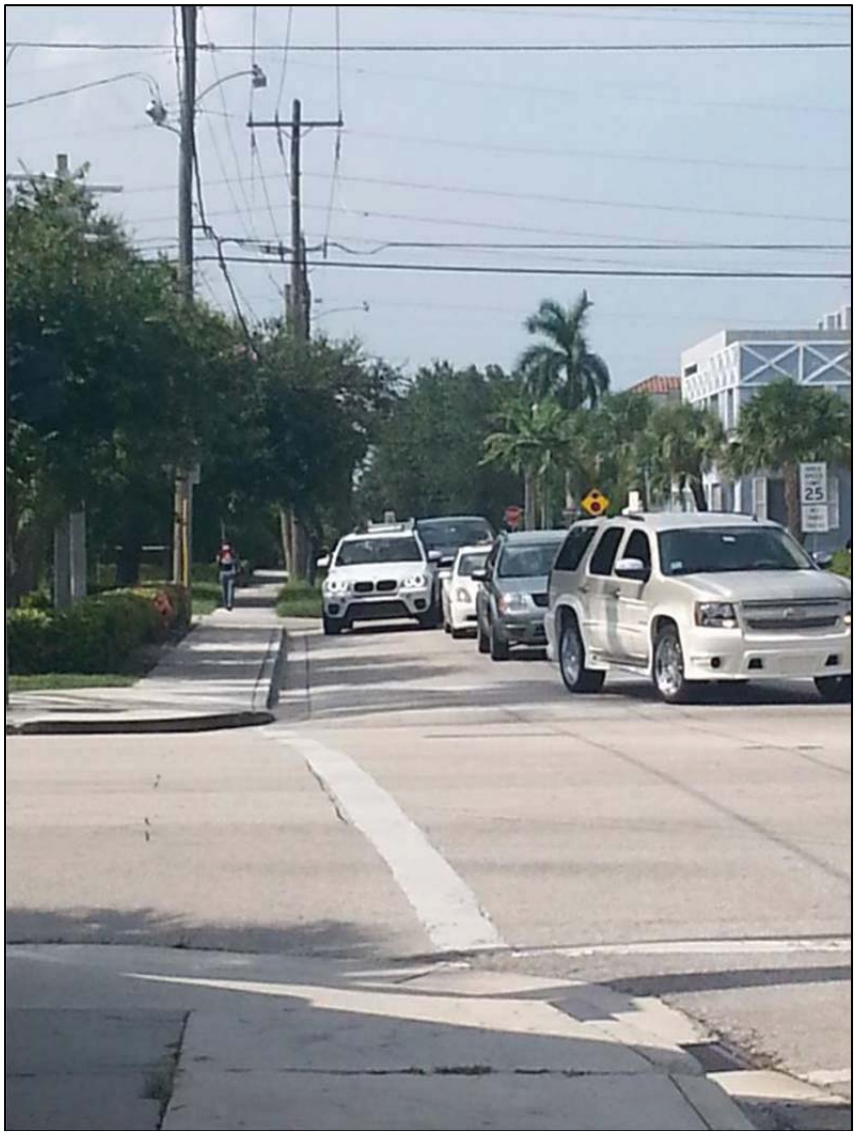
Recommended Solutions

Modify signal timings at the intersections of SE 15th Avenue and Broward Boulevard and SE 15th Avenue and Las Olas Boulevard.

When performing the analysis of the signalized intersections for the existing conditions, it was noted that the signal timings at the intersection of Broward Boulevard and SE 15th Avenue and Las Olas Boulevard and SE 15th Avenue could be optimized to obtain better overall operating conditions. Improving the efficiency of these signalized intersections will reduce overall congestion and may reduce cut-through traffic volumes on the parallel north-south streets through the Colee Hammock neighborhood.

Based on the relative demand along Las Olas Boulevard, Broward Boulevard, and SE 15th Avenue, a more efficient signal timing plan was developed for both intersections. Additionally, at Las Olas Boulevard and SE 15th Avenue the phase recall modes for the Las Olas Boulevard movements were changed to minimum rather than maximum. This means that instead of always providing the maximum green time allocated to Las Olas Boulevard (35 secs), the signal will show a green light for movements along Las Olas Boulevard for at least the minimum green time, and it will remain green for long as there is vehicular demand or until it reaches the maximum allowable green time.

These signal timing recommendations are detailed in Appendix E, and the resulting improvement in overall intersection performance is summarized in Table 4. As noted above, because the Synchro model of Las Olas Boulevard at SE 15th Avenue presented operating conditions that were more favorable than those observed in the field, it is reasonable to assume that the improvements in the operating conditions on the southbound approach due to signal timings optimization, even though significant, will not be as dramatic as suggested by the analysis results.



Recommended Solutions

Table 4: Signalized Intersection LOS Analysis Summary with Recommended Signal Timing Improvements

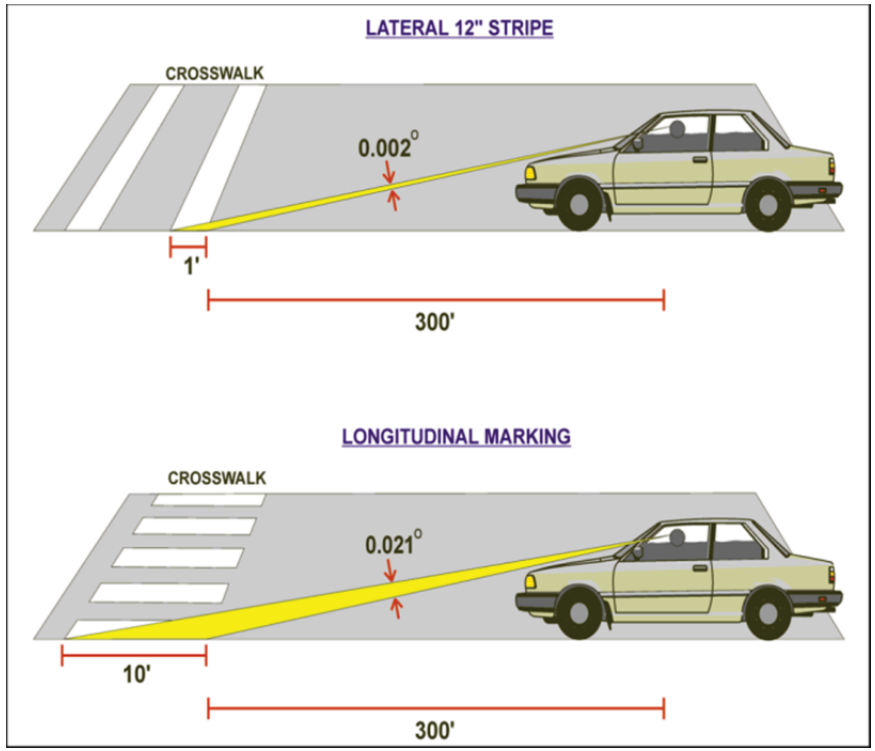
Intersection	Time Period	Measure	Movement												
			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Total
Broward Blvd at 15th Ave	AM Peak Hour	V/C	0.15	0.34	0.21	0.21	0.38	n/a	n/a	0.74	n/a	0.02	0.64	n/a	0.60
		Delay [sec]	18.9	20.0	19.2	19.2	19.9	n/a	n/a	23.7	n/a	17.5	22.9	n/a	21.2
		LOS	B	B	B	B	B	n/a	n/a	C	n/a	B	C	n/a	C
Las Olas Blvd at 15th Ave		V/C	0.20	0.30	n/a	0.04	0.76	n/a	n/a	0.39	n/a	n/a	0.72	n/a	0.70
		Delay [sec]	16.9	16.8	n/a	19.6	27.4	n/a	n/a	30.1	n/a	n/a	23.6	n/a	23.9
		LOS	B	B	n/a	B	C	n/a	n/a	C	n/a	n/a	C	n/a	C
Broward Blvd at 15th Ave	PM Peak Hour	V/C	0.37	0.77	0.23	0.64	0.24	n/a	n/a	**0.90**	n/a	0.60	0.78	n/a	0.83
		Delay [sec]	24.4	33.7	23.0	35.6	23.0	n/a	n/a	**37.3**	n/a	29.0	44.2	n/a	32.3
		LOS	C	C	C	D	C	n/a	n/a	**D**	n/a	C	D	n/a	C
Las Olas Blvd at 15th Ave		V/C	0.36	0.46	n/a	0.06	0.81	n/a	n/a	0.60	n/a	n/a	**0.83**	n/a	0.79
		Delay [sec]	22.5	23.2	n/a	25.9	37.2	n/a	n/a	37.7	n/a	n/a	**33.6**	n/a	32.0
		LOS	C	C	n/a	C	D	n/a	n/a	D	n/a	n/a	**C**	n/a	C

Recommended Solutions

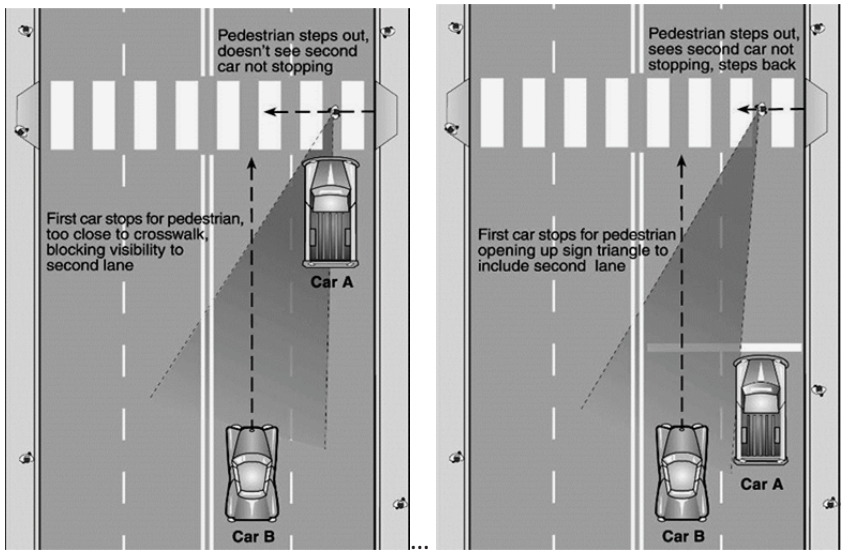
Enhance crosswalk markings and provide supplemental signs, pavement markings, and warning devices along Las Olas Boulevard.

To encourage pedestrians to cross at controlled locations and ensure that unsignalized (mid-block) crosswalks are as safe as possible, the following design strategies are recommended:

- Re-stripe lateral crosswalk markings and increase the "target value" by adding supplemental longitudinal bars to the existing crosswalks in the corridor including the three marked crosswalks at the intersection of SE 15th Avenue and Las Olas Boulevard and the unsignalized crosswalk at SE 13th Avenue.



- At the unsignalized crosswalk at SE 13th Avenue provide advance stop bar markings and corresponding R1-5 signs to reduce the risk of "multiple threat" crashes, as shown below:



- Install Rectangular Rapid Flashing Beacons (RRFB) or other high-emphasis, pedestrian-actuated warning device to supplement the marked crosswalk at SE 13th Avenue.

Recommended Solutions

- Provide an R10-15 Right-Turn Yield to Pedestrian sign for the westbound approach of Las Olas Boulevard at SE 15th Avenue to help pedestrians secure their right of way over the high-volume westbound to northbound right-turn movement at this intersection.

Provide shared lane arrow markings along Las Olas Boulevard.

While on-street, marked bike lanes remain the preferred solution for bicycle facilities along collector and arterial streets, shared-lane arrows (also known as sharrows) are an acceptable alternative design solution to provide for bicycle mobility along roadways with a posted speed of 35 mph or less. Generally, shared-lane arrows:

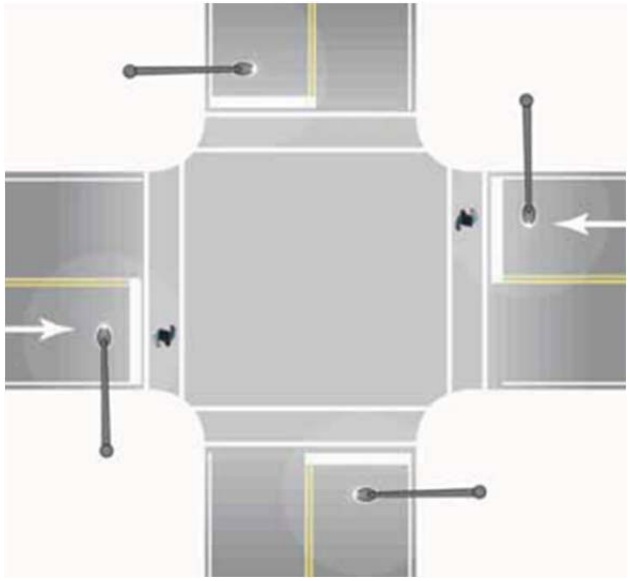
- Assist bicyclists with lateral positioning in a shared lane with on-street parallel parking to reduce the chance of a bicyclist's impacting the open door of a parked vehicle
- Assist bicyclists with lateral positioning in lanes that are too narrow for a motor vehicle and a bicycle to travel side-by-side within the same traffic lane
- Alert road users of the lateral location bicyclists are likely to occupy within the traveled way
- Encourage safe passing of bicyclists by motorists
- Reduce the incidence of wrong-way bicycling

Concurrent with the installation of shared-lane arrows, the substandard bike lane between SE 16th Avenue and SE 17th Avenue should be removed using water blasting or other treatment suitable to the City.

Provide enhanced crosswalk lighting at SE 15th Avenue and Las Olas Boulevard.

Often, roadway lighting is not designed to specifically illuminate crosswalk areas. The intersection at SE 15th Avenue and Las Olas Boulevard incorporates luminaires on the northeast and southwest corners, but no lighting appliances are provided on the opposite corners. The best practice for pedestrian lighting design is to provide 20 lux at 5ft above pavement using a lighting configuration that places the light source in advance of the crosswalk.

This study recommends verifying the existing lighting levels for the signalized and unsignalized crosswalks in the study area and consider providing additional luminaires, if needed. In the case of the intersection of SE 15th Avenue and Las Olas Boulevard, it may be possible to mount these on the existing signal strain poles.



Recommended Solutions

Provide enhanced speed limit signs and/or speed feedback signs east of the Sospiro Canal Bridge (SE 17th Way) to reinforce the 30 mph speed limit to the west along Las Olas Boulevard.

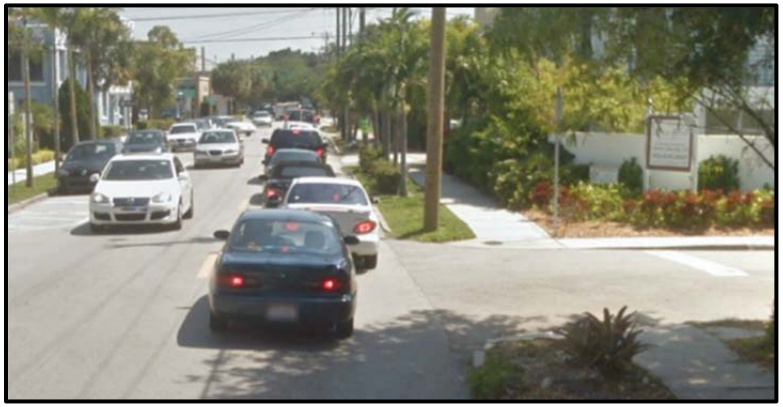
To help facilitate the transition from marked bike lanes to shared lane arrows and generally improve pedestrian mobility and safety in the corridor, it is essential that drivers observe the posted 30 mph speed limit west of the Sospiro Canal/SE 17th Way. In addition to coordination with the City's police department, use of high emphasis speed limit and speed feedback signs can help remind drivers of their responsibility to drive safely.

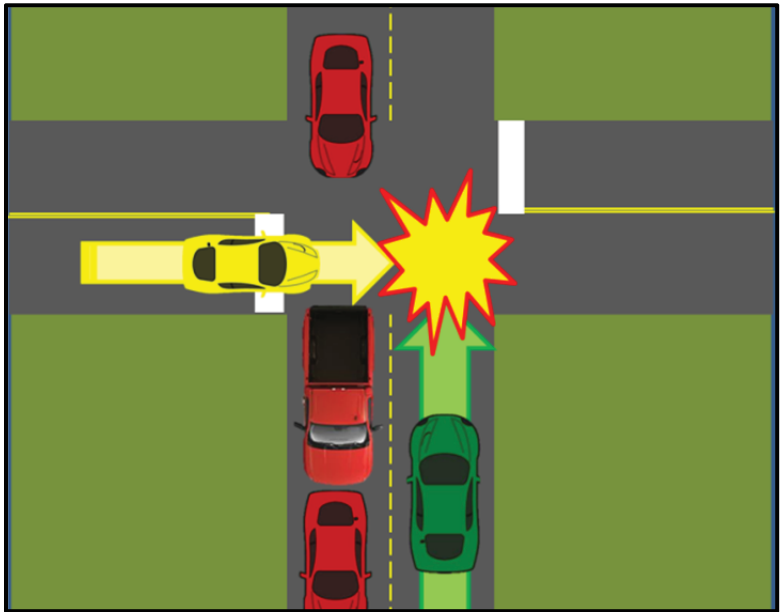
Remove the north-south stop control at SE 15th Avenue and SE 2nd Street and enhance intersection safety features pending outcome of signal timing modifications.

Because southbound traffic on SE 15th Avenue routinely queues through the intersection at SE 2nd Street, the recently-installed four-way stop sign at this intersection is necessary to avoid gridlock and mitigate the risk of "thru-the-queue" automobile crashes. Thru-the-queue crashes, also referred to as "good Samaritan" crashes, occur when a vehicle is waved through a standing queue and is struck by a free-flowing vehicle (as shown to the right)

It may be possible to remove the north-south stop control if the queue spill-back issue is sufficiently mitigated by the signal timing revisions recommended above. In this event, a marked crosswalk (with supplemental sign, pavement marking, warning device, enhanced speed limit or speed feedback signs, and lighting treatments similar to those described above) should be provided and curb bulb outs should be constructed to prohibit on-street parking to the alley way north and south of the intersection.

In the long-term, if the box-span signal at SE 15th Avenue and Las Olas Boulevard is replaced with mast-arms, visibility-limited signals may be considered to reduce drivers' incentive to speed to "make the light."





Recommended Solutions

Modify the centerline and stop bar placement at the south leg of SE 15th Avenue and Broward Boulevard to facilitate truck turning movements.

Observations of damage to the curb, pedestrian ramp, and storm-water inlet on the southwest corner of the intersection of SE 15th Avenue and Broward Boulevard and field observations of single-unit trucks navigating the intersection indicates the need to modify the intersection to better enable trucks to navigate the eastbound to southbound right turn. A short term option to address this issue (pictured to the right) is to remove the existing stop bar and centerline markings on the south leg of the intersection and reposition as follows:

- Shift the stop bar 5–10 feet further to south such that it is positioned 20–25 feet south of the eastbound curb line of Broward Boulevard.
- Shift the roadway centerline approximately 3–4 ft to the east providing for a wide southbound lane and an 11–12 ft wide northbound lane.

This will increase the effective curb radius and reduce the tendency for trucks to drag their rear tires over the curb, sidewalk, and drainage inlet.

Provide a special event scenario signal timing plan.

In the event of a special event in which Las Olas Boulevard is closed to vehicular traffic between US-1 and the Himmarshee Canal, traffic must travel through the Colee Hammock neighborhood to reach downtown or points west. Appendix H shows the approximate reassignment of this traffic to SE 15th Avenue and other streets through the neighborhood and presents a signal timing plan to be used as a starting point for event traffic management.

Recommended Solutions

Mid-Term Recommendations

If the recommended short-term solutions do not adequately address the City's congestion management, cut-through traffic, and multimodal mobility objectives, the following additional "mid-term" solutions are recommended for consideration:

- Modify the westbound approach at the intersection of Las Olas Boulevard and SE 15th Avenue to eliminate the westbound left-turn movement and convert the inside lane to a right-turn-only lane.
- Implement a "road diet" along Las Olas Boulevard west of SE 15th Avenue.
- Install parking bays/curb bulb-outs and raised intersections in the Colee Hammock neighborhood.

Modify the westbound approach at the intersection of Las Olas Boulevard and SE 15th Avenue to eliminate the westbound left-turn movement and convert the inside lane to a right-turn-only lane.

A significant number of vehicles approaching SE 15th Avenue from westbound Las Olas Boulevard turn right at SE 15th Avenue (approximately 36% during the AM peak hour and 37% during the PM peak hour). Due to this heavy right turn movement, the westbound outside lane operates as a *de facto* right-turn lane, with approximately 72 percent of vehicles turning right during the AM peak hour and 74 percent during the PM peak hour. Turning movement counts collected at this intersection also reveal that very few (only 9 vehicles in the AM and 11 vehicles in the PM peak hours) make a westbound to southbound left turn. Because a protected left-turn phase is not provided for this movement and there are other opportunities along Las Olas Boulevard to make a westbound to southbound left turn, prohibiting this movement at the signal is feasible.

Based on these observations, a scenario was developed where the outside westbound lane at Las Olas Boulevard and SE 15th Avenue is converted to a "drop" lane (right-turn-only), and the westbound left turn lane is eliminated. This configuration, shown in Figure 9, allows the inside (thru) lane to shift approximately 10 ft to the south, providing for a bike lane "key hole" between the thru and right-turn lane and allowing for a 15-ft-wide right-turn lane to help accommodate the turning radius of larger vehicles.

Figure 9: Proposed Mid-Term Improvements to Westbound Approach of Las Olas Boulevard and SE 15th Avenue

Recommended Solutions

The summary of the LOS analysis for this scenario, shown in Table 5, indicates that all movements operate satisfactorily.

Detailed LOS analysis worksheet documenting this analysis is shown in Appendix F.

If this recommendation is implemented, consideration should be given to also providing a leading pedestrian interval to supplement the R10-15 turning vehicles Yield to Pedestrians sign recommended as a short-term solution.

Table 5: Signalized Intersection LOS Analysis Summary with Improvements, Mid-Term Scenario

Intersection	Time Period	Measure	Movement												
			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Total
Las Olas Blvd at 15th Ave	AM Peak Hour	V/C	0.18	0.26	n/a	n/a	0.80	0.16	n/a	0.46	n/a	n/a	0.75	n/a	0.75
		Delay [sec]	16.6	15.6	n/a	n/a	31.5	19.0	n/a	33.2	n/a	n/a	22.9	n/a	24.9
		LOS	B	B	n/a	n/a	C	B	n/a	C	n/a	n/a	C	n/a	C
	PM Peak Hour	V/C	0.36	0.41	n/a	n/a	0.87	0.16	n/a	0.69	n/a	n/a	0.87	n/a	0.84
		Delay [sec]	22.3	21.9	n/a	n/a	45.9	25.2	n/a	46.4	n/a	n/a	39.5	n/a	34.4
		LOS	C	C	n/a	n/a	D	C	n/a	D	n/a	n/a	D	n/a	C

Recommended Solutions

Implement a road diet along Las Olas Boulevard west of SE 15th Avenue.

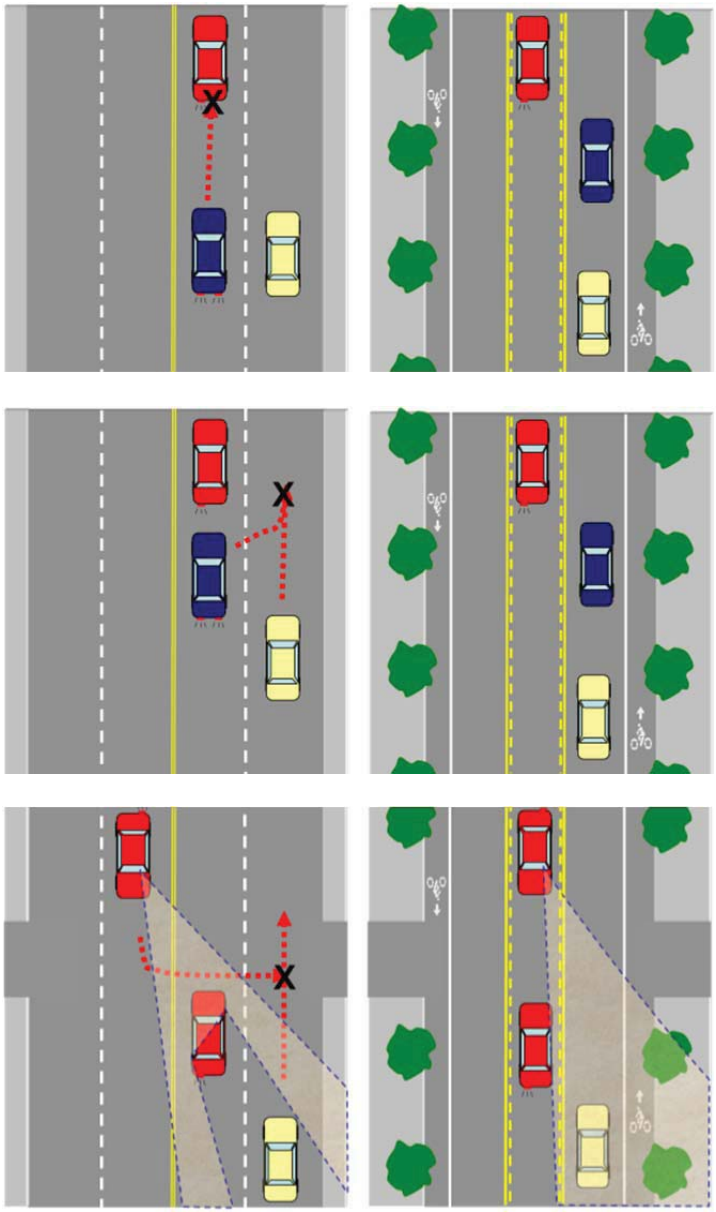
A "road diet" is a traffic engineering strategy that reduces the number of general purpose/thru lanes to satisfy other transportation/planning objectives. The most common form of a road diet is the conversion of a four-lane undivided roadway to a two-lane divided roadway. Because this conversion generally yields an extra lane's worth of cross-section, it is often possible to provide bicycle lanes, a parking lane, wider sidewalks, or other amenities as part of a road diet project.

In addition to providing an opportunity to improve bicycle and pedestrian facilities or provide more opportunities for parking and/or landscaping, conversion of a four-lane undivided roadway to a two-lane divided roadway can reduce the risk of motor vehicle crashes. As shown on the right, rear-end, sideswipe, and left-turn crashes resulting from stopped/turning traffic in the inside lane can be mitigated by the provision of a center turn lane or left turn lanes at intersections.

Implicit in the concept of a road diet is the trade-off between thru-lane capacity/roadway LOS and other priorities. According to the FDOT 2012 "Generalized" LOS tables, the capacity of the existing and proposed typical sections is 21,060 and 14,060 daily vehicles and 1,898 and 1,264 hourly vehicles respectively (Table 6).

Table 6: Generalized LOS for Existing and Proposed Typical Sections

	Existing 4-Lane Undivided		Proposed 2-Lane Divided	
	Daily	Peak Hr.	Daily	Peak Hr.
Base Class II LOS "D" Daily Capacity:	32,400	2,920	14,800	1,330
Non-State Signalized Roadway Adjustment	-10%		-10%	
Median and Turn Lane Adjustment	-25%		5%	
"Generalized" Service Capacity	**21,000**	**1,900**	**14,000**	**1,300**



Recommended Solutions

Referring to Figure 1, the peak hourly demand along Las Olas Boulevard west of SE 15th Avenue is between 800 and 1,000 vehicles per hour, whereas the peak demand east of SE 15th Avenue is between 1,200 and 1,400 vehicles per hour. Based on this summary-level data, the Generalized LOS resulting from a road diet west of SE 15th Avenue is LOS "D"; east of SE 15th Avenue it is LOS "E." In urban areas such as the Las Olas Boulevard corridor, roadway LOS "D" is generally considered acceptable.

Other conditions that support a road diet include the use of the outside westbound lane at SE 15th Avenue as a *de facto* right-turn lane and the use of the outside lanes between US-1 and the Himmarshee Canal for on-street parking during the busier mid-day and PM peak periods. These existing conditions limit the effective throughput of Las Olas Boulevard to that of a two-lane roadway. Combined with the recommendation to preserve both eastbound lanes at the approach to SE 15th Avenue (so that the signal can process the thru-traffic demand efficiently), the reduction of roadway capacity from implementation of a road diet west of SE 15th Avenue is negligible.

Conversely, the potential benefits of a road diet include:

- Providing space for on-street bike lanes or wide outside lanes with shared lane arrows
- Provide additional lateral distance between thru traffic and the sidewalk—especially across the Himmarshee Canal bridge
- Provide for dedicated left turn lanes to improve the convenience and safety of turning onto side-streets and mitigating impacts to traffic circulation related to the prior recommendation to prohibit westbound to southbound left turns at SE 15th Avenue
- Provide for median refuge for pedestrians crossing at marked unsignalized crosswalks and and un-marked locations.
- Reduce off-peak traffic speeds by prohibiting speeding drivers from passing drivers who travel at the posted speed limit.
- Potential to make on-street parking west of the study area permanent through the construction of curb-bulb-outs and or wider sidewalk/café areas.

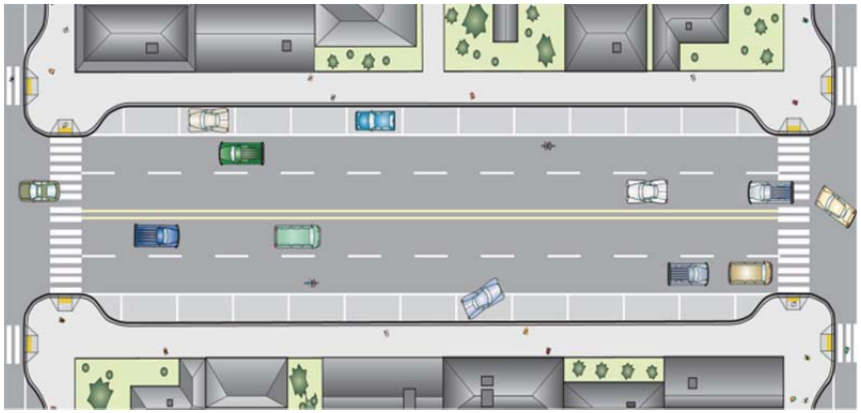
Figure 10: Proposed Road Diet Typical Sections in Vicinity of Tarpon Drive and at West Leg of SE 15th Avenue

Recommended Solutions

Install parking bays/curb bulb-outs and raised intersections in the Colee Hammock neighborhood.

While use of SE 15th Avenue for a mix of local and thru traffic is consistent with the roadway's designation as a "collector" street, high-speed traffic through the Colee Hammock neighborhood along SE 15th Avenue or along the parallel north-south streets is unacceptable and creates risks for pedestrians, cyclists, and motorists alike. Four-way stop signs deployed throughout the Colee Hammock neighborhood can help discourage speeding, but other design features can more effectively manage traffic speeds and reduce the noise associated with cars, and especially, trucks accelerating from stops.

Specifically, use of parking bays/curb bulb-outs (pictured below) and raised intersections are recommended to help encourage responsible driver behavior along north-south streets in the Colee Hammock neighborhood. Parking bays/curb bulb-outs reduce the crossing distance for pedestrians and use texture to visually integrate the parking lane into the sidewalk area, thereby narrowing the roadway surface and reducing drivers' tendency to speed when parked cars are not present.



Raised intersections function in a similar way to speed tables and require drivers to slow to 15 to 20 mph to cross comfortably and without risk of damaging their vehicles' undercarriage. Textural queues also enhance drivers' perception of the intersection as a potential conflict area and accentuate intersection crosswalks.

Figure 11 shows the application of these treatments to the intersection of SE 15th Avenue and SE 2nd Street. Figure 12 on the following page shows how these features can be deployed throughout the Colee Hammock neighborhood to reduce traffic speeds without further impacting the ability of local traffic to circulate.

Figure 11: Illustration of Intersection Speed Table and Curb Bulb-Outs at SE 15th Avenue and SE 2nd Street

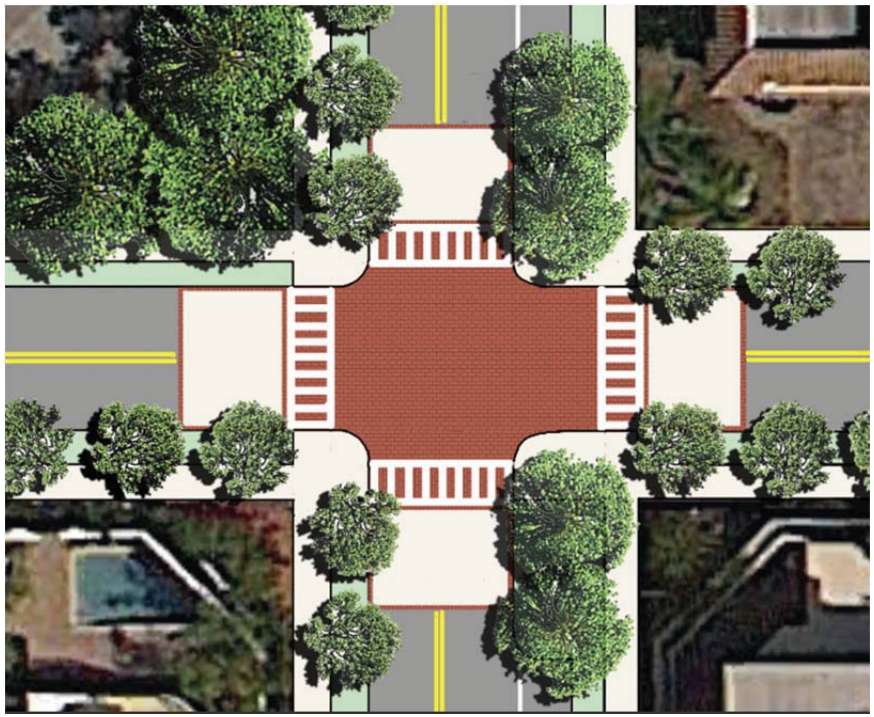


Figure 12: Suggested Use of Intersection Tables and Parking Bays/Curb Bulb-Outs in Colee Hammock Neighborhood

Recommended Solutions

Longer-Term Recommendations

As illustrated in Table 3, "Longer-Term Recommendations" include improvements that require reconstruction/relocation of sub-surface and/or overhead utilities, potential reconstruction of traffic signals, and/or acquisition of right-of-way. The short-term and mid-term recommendations discussed above will reduce congestion along SE 15th Avenue and enhance multimodal mobility and safety along Las Olas Boulevard. If additional through-put is desired along SE 15th Avenue, the following longer-term design concepts can be considered:

- Reconstruct the north leg of SE 15th Avenue at Las Olas Boulevard to provide for a 2nd southbound lane.
- Modify the curb radius of the southwest corner of Broward Boulevard and SE 15th Avenue and consider removing the thru-truck prohibition on SE 15th Avenue.

Reconstruct the north leg of SE 15th Avenue at Las Olas Boulevard to provide for a second southbound lane.

As noted previously, the most significant congestion drivers encounter when completing the "Z" movement between Broward Boulevard and Las Olas Boulevard along SE 15th Avenue is at the southbound approach at Las Olas Boulevard. While signal timing modifications recommended above will reduce congestion for this approach, additional capacity may be provided by constructing a second southbound lane.

Given this existing typical section, illustrated in Figure 13, options to provide a second southbound lane include widening to the east or widening to the west. In either case, the resulting intersection capacity summary is quite good as shown in Table 7.

Figure 13: Las Olas Boulevard at SE 15th Avenue Existing Cross-Section

Recommended Solutions

Table 7" Las Olas Boulevard at SE 15th Avenue Intersection LOS Analysis Summary with Additional Southbound Lane

Time Period	Measure	Movement												
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Total
AM Peak Hour	V/C	0.15	0.24	n/a	n/a	0.78	0.16	n/a	0.30	n/a	0.55	0.53	n/a	0.62
	Delay [sec]	14.0	13.1	n/a	n/a	27.2	16.7	n/a	27.9	n/a	23.7	23.4	n/a	19.5
	LOS	B	B	n/a	n/a	C	B	n/a	C	n/a	C	C	n/a	B
PM Peak Hour	V/C	0.29	0.37	n/a	n/a	0.80	0.16	n/a	0.48	n/a	0.67	0.66	n/a	0.69
	Delay [sec]	17.4	17.1	n/a	n/a	32.9	20.5	n/a	30.6	n/a	30.6	30.0	n/a	25.8
	LOS	B	B	n/a	n/a	C	C	n/a	C	n/a	C	C	n/a	C

East-Side Widening: The existing 30 ft of pavement could be widened to ~34 ft by sacrificing part of the landscaped buffer along the east side of the road and reconstructing the existing curb to provide for two 11-ft-wide southbound lanes and one 12-ft-wide northbound lane. This approach is attractive because it minimizes the right-of-way impacts of adding a second southbound lane.

The principal concern with this approach is that observations and design turning profiles for large single-unit trucks indicate that narrowing the northbound lane and/or shifting this lane to the east would require the radius of the northeast corner to be significantly larger. This would require reconstruction of the drainage inlet and signal strain pole/signal infrastructure and would result in a curb profile that encroaches on the sidewalk/frontage are of the building on the northeast quadrant of the intersection. Eliminating the westbound left-turn lane and providing for a ~15-ft-wide outside right-turn-only lane, as recommended in the Mid-Term Recommendations section of this report, would mitigate this issue somewhat; however, reconstruction of the curb radius would nonetheless be necessary.

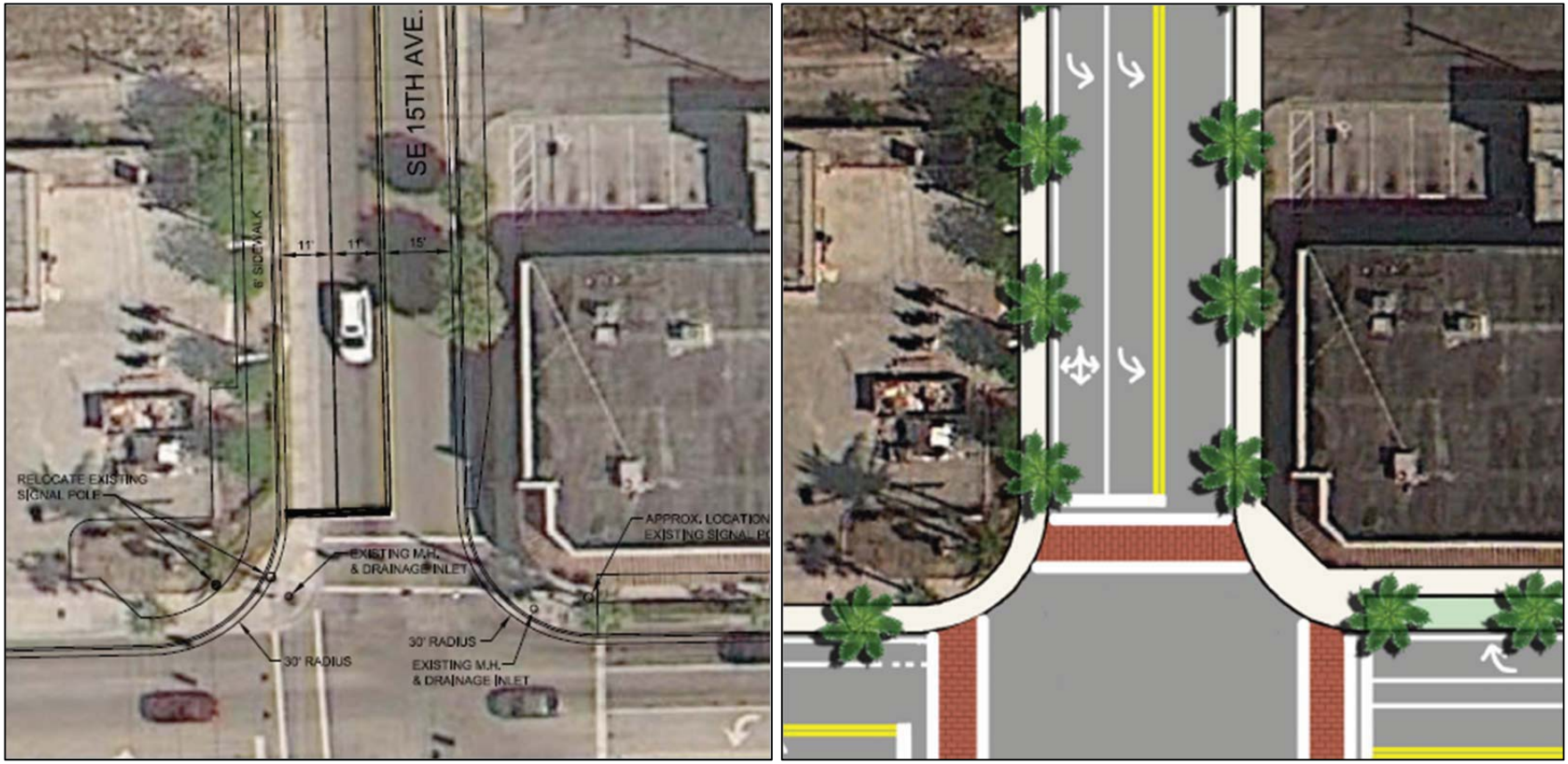
West-Side Widening: Although there is no landscaped buffer between the travel lanes and sidewalk on the west side of the road, the property on the northwest quadrant of the intersection is set back from the roadway such that widening to the west will not encroach on the building frontage area or require the taking of parking spaces. Widening to the west would require relocation/reconstruction of the corner drainage inlet, signal strain pole, sidewalk and curb line along the west side of the road, and possible relocation of a utility pole just south of the alleyway.

Right-of-way impacts would include taking 6–8 ft of property (depending on the actual right-of-way line) along SE 15th Avenue from the property on the northwest corner of the intersection and relocation/replacement of parking lot lighting poles/fixtures. Again, depending on the actual right-of-way line, several feet of right-of-way along the west side of SE 15th Avenue between the alley and SE 2nd Court may also be necessary to complete the transition; however, it may also be possible to shift the roadway centerline to the east from the alley to SE 2nd Court to reduce or negate this right-of-way impact.

Recommended Solutions

A schematic and rendering of the proposed widening to the west is shown in Figure 14. Note that this design concept assumes implementation of the prior recommendation to eliminate the westbound left-turn lane, shift the inside thru lane to the south, and implement a road diet along Las Olas Boulevard from SE 15th Avenue to the west. As such, the curb returns along Las Olas Boulevard are approximately 5ft further south than in the existing condition. This allows for curb profiles that provide for improved accommodation of southbound and westbound right turns for large single unit trucks. Shifting the curb line to the south also facilitates the provision of a marked crosswalk across the east leg of the intersection since the necessary ADA ramp can be accommodated within the build-out of the curb avoiding the obstructions caused by the drainage inlet and signal strain pole/infrastructure.

Figure 14: Proposed Long-Term Improvement at the Las Olas at SE 15th Avenue Intersection



Recommended Solutions

Modify the curb radius of the southwest corner of Broward Boulevard and SE 15th Avenue and consider removing the thru-truck prohibition on SE 15th Avenue.

As noted previously, rutting and damage from trucks making eastbound to southbound right turns is evident at the southwest corner of Broward Boulevard and SE 15th Avenue. In addition to shifting the centerline and northbound stop-bar to provide for a wider effective turn radius, as discussed previously in the Short-Term Recommendations section of this report, consideration should be given to reconstructing the southwest curb line to enlarge the existing ~15ft radius to 25–30ft. This will require reconstruction/relocation of the existing drainage inlet and may require a "corner clip" from the property on the southwest quadrant of the intersection.

If the curb radius is enlarged here to provide an effective radius between 30–40ft, and capacity and geometric improvements are made to the intersection of SE 15th Avenue and Las Olas Boulevard, the ability of delivery trucks to use SE 15th Avenue to complete the Broward Boulevard/Las Olas Boulevard "Z" movement will be improved. In this event, the City may elect to remove or modify the current "No Thru Trucks" designation along SE 15th Avenue; however, consideration should be given to prohibiting thru trucks during night-time hours due to the largely residential character of the land uses along the roadway.

Other considerations for the intersection of Broward Boulevard and SE 15th Avenue include widening the northbound approach to accommodate a second northbound lane or replacing the traffic signal with a one-lane roundabout.

Because there is a ~5ft grass buffer between the travel lanes and sidewalk along this section of SE 15th Avenue, widening could be accomplished without right-of-way impacts. However, it would be necessary to reconstruct/relocate at least one drainage inlet along the east side of SE 15th Avenue and reconstruct several driveways aprons. Impacts to underground utilities are unknown.

Constructing a single-lane roundabout would require reconstruction of the intersection and would most likely require corner-clips from the four properties around the intersection. Generally, roundabouts reduce crash severity and reduce congestion off-peak; however, a preliminary analysis shows that no significant peak-hour capacity improvement is likely for the critical northbound movement. Worksheets documenting this analysis are included in Appendix G.