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Auburn University

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[OPELIKA ROAD: GAY TO DEAN REDEVELOPMENT]

Assignment 2: Stage two review. Development proposals, design, and policy guidelines.

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1. EXISTING CONDITIONS

1.1. Overview of existing conditions

The considered segment of analysis in Opelika Road, at Auburn, Alabama, starts at North Gay Street and ends at Dean Road. This area is usually characterized by residential and commercial mix, with no bicycle lanes and few sidewalks and other pedestrian features. Also, several auto-repair or sales facilities can be observed there.

The existence of limited lot depths and the proximity of a railroad make the south side of the road sparsely occupied (see Figure 1). Pictures of this segment of Opelika Road will be presented along this section and the location for all of them can be identified in Figure 12.

Figure 1 – Aerial view of existing conditions

The segment can be divided in three sections according to the characteristics for bicycle and pedestrian facilities. The first section, here defined as 1A, is from North Gay Street to North Ross Street, with 25mph speed limit and 3 lanes (2 Lanes with two-way left turn lane); the second section, 1B, is from North Ross Street to Temple Street, with 35mph speed limit and 3 lanes (2 Lanes with TWLTL); the last section, 1C, is from Temple Street to North Dean Road, with 45mph speed limit and 5 lanes (4 Lanes with TWLTL). The three sections of the considered Opelika Road segment can be observed in Figure 13.

Section 1A starts at the intersection between Gay Street and Opelika Road. There are no crosswalks or pedestrian signals at the intersection. Along this segment there are sidewalks on both sides of Opelika Road, as it can be seen in Figure 2. Some parts have buffers, as it can be seen in Figure 3, but not all, as shows Figure 4; no buffers were wider than 5 feet. Posted speed limit is 25mph and some minor problems are observed in the crosswalk, as it shows Figure 5. No bicycle lanes in the section.

Figure 2 – Segment 1A: Gay/Opelika intersection and sidewalks

Figure 3 – Segment 1A: sidewalk with narrow buffer

Figure 4 – Segment 1A: sidewalk without buffer

Figure 5 – Segment 1A: minor problems at the sidewalk

Section 1B starts at the intersection of Opelika and North Ross Street, which contains no pedestrian signal heads or pushbuttons, but crosswalks exist across the north, south, and west approaches of the intersection, as it can be observed in Figure 6.

Figure 6 – Segment 1B: Ross/Opelika intersection

The south sidewalk ends shortly after the Ross Street intersection and does not begin again during section 1B; north sidewalk is not continuous, as it can be seen in Figures 7 and 8. Speed limit in this section is 35 mph.

Figure 7 – Segment 1B: end of the sidewalk

Figure 8 – Segment 1B: sidewalk goes nowhere

After the beginning of segment 1C, no sidewalks exist at all (see Figure 9 and Figure 10).

Figure 9 – Segment 1C: Temple/Opelika intersection

Figure 10 – Segment 1C: no sidewalks

At the intersection of Opelika Road and Dean Road, as in Figure 11, pedestrian signal heads and push buttons exist on the south and west legs of the intersection. A crosswalk exists only across the west leg. A sidewalk starts again from the east side of Dean Road.

Figure 11 – Segment 1C: Dean/Opelika intersection

Figure 12 – Location of photographs

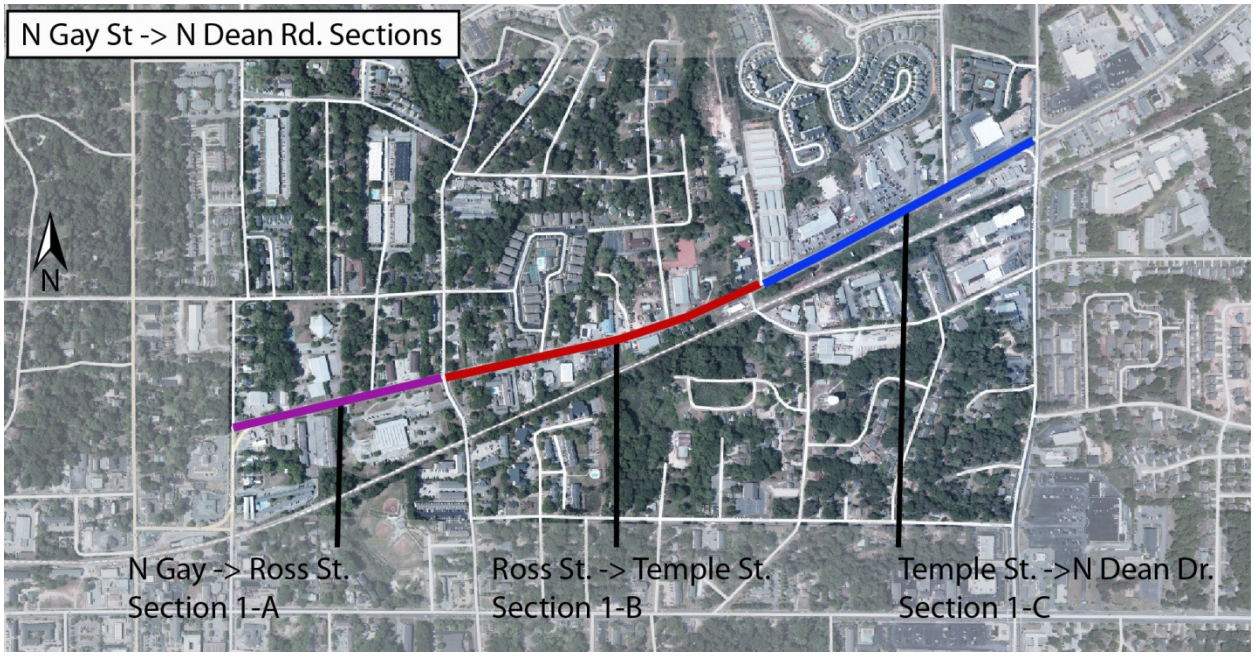

Figure 13 – Sections of the considered segment of Opelika Road

1.2. Level of Service Analysis

The analysis performed in this report is based on a method developed in the University of Florida (Dixon, 1996). This method was chosen because it is one of the most used in transportation research as it involves all important information when analyzing bicycles and pedestrian facilities and it is simple at the same time. It evaluates roadway corridors using a point system of 1 to 21 that results in LOS ratings from A to F. The level of service ratings describe the characteristics and attractiveness of facilities and also consider the level of interaction that a bicyclist or pedestrian can anticipate with motorists in a corridor and the level of support provided to attract non-motorized modes to that corridor. Table 1 shows how to classify a segment in the road according to these LOS ratings. Each element of this list is explained in topics 1.2.1. and 1.2.2.

Table 1 - Bicycle and Pedestrian Level-of-Service Performance-Measure Point System

BICYCLE			PEDESTRIAN		
CATEGORY	CRITERION	POINTS	CATEGORY	CRITERION	POINTS
BICYCLE FACILITY PROVIDED	Outside Lane 3.66m (12')	0	PEDESTRIAN FACILITY PROVIDED	Not Continuous or Non-existent	0
(Max Value = 10)	Outside Lane >3.66m-4.27m (>12'-14')	5	(Max Value = 10)	Continuous on One Side	4
	Outside Lane >4.27m (>14')	6		Continuous on Both Sides	6
	Off-Street / Parallel Alternative Facility	4		Min. 1.53m (5') Wide & Barrier Free	2
				Sidewalk Width >1.53m (5')	1
				Off-Street / Parallel Alternative Facility	1
CONFLICTS	Driveways & Sidestreets	1	CONFLICTS	Driveways & Sidestreets	1
(Max Value = 4)	Barrier Free	0.5	(Max Value = 4)	Ped Signal Delay 40 Sec. or Less	0.5
	No On-Street Parking	1		Reduced Turn Conflict Implementation	0.5
	Medians Present	0.5		Crossing Width 18.3m (60') or Less	0.5
	Unrestricted Sight Distance	0.5		Posted Speed	0.5
	Intersection Implementation	0.5		Medians Present	1
SPEED DIFFERENTIAL	>48 KPH (>30 MPH)	0	AMENITIES	Buffer Not Less Than 1m	1
(Max Value = 2)	40-48 KPH (25-30 MPH)	1	(Max Value = 2)	(3.5')	
				Benches or Pedestrian Scale Lighting	0.5
	24-32 KPH (15-20 MPH)	2		Shade Trees	0.5
MOTOR VEHICLE LOS	LOS = E, F, OR 6 or More Travel Lanes	0	MOTOR VEHICLE LOS	LOS = E, F, OR 6 or More Travel Lanes	0
(Max Value = 2)	LOS = D and < 6 Travel Lanes	1	(Max Value = 2)	LOS = D and < 6 Travel Lanes	1
	LOS = A, B, C, and < 6 Travel Lanes	2		LOS = A, B, C, and < 6 Travel Lanes	2
MAINTENANCE	Major or Frequent Problems	-1	MAINTENANCE	Major or Frequent Problems	-1
(Max Value = 2)	Minor or Infrequent Problems	0	(Max Value = 2)	Minor or Infrequent Problems	0
	No Problems	2		No Problems	2
TDM / MULTI-MODAL	No Support	0	TDM / MULTI-MODAL	No Support	0
(Max Value = 1)	Support Exists	1	(Max Value = 1)	Support Exists	1
CALCULATIONS	Segment Score [1]	21	CALCULATIONS	Segment Score [1]	21
	Segment Weight [2]	1		Segment Weight [2]	1
	Adjusted Segment Score [3]	21		Adjusted Segment Score [3]	21
	Corridor Score [4]	21 = LOS A		Corridor Score [4]	21 = LOS A

[1] Segment Score = sum of points in the six categories

[2] Segment Weight = segment length / corridor length

[3] Adjusted Segment Score = Segment Score x Segment Weight

[4] Corridor Score = sum of the Adjusted Segment Scores in the corridor

SOURCE: Dixon, 1996

1.2.1. Bicycle Level of Service

BICYCLE FACILITY PROVIDED

a) Width of Outside Lane: the measurement is taken from the inside stripe of the rightmost travel lane to the edge of pavement, excluding the gutter pan.

b) Off-Street and Parallel Alternative Facility: areas used by bicycles that are physically separated from motorized vehicular traffic by an open space or a barrier or possess their own right-of-way.

CONFLICTS

a) Driveways and Sidestreets: driveway and sidestreet access points create conflicts for bicyclists. If either side of the street exceeds the target of 22 per 1.61 km (1 mi), the entire segment will not score points.

b) Barrier Free: barriers or pinch points to bicycle travel. Barriers are physical encroachments that force a bicyclist to enter the motor vehicle travel lane at a specific point within the segment.

c) On-Street Parking: the presence of on-street parking should be noted even if it appears for only a short distance within the segment.

d) Medians Present: the medians must be restrictive, raised medians with or without turn bays.

e) Unrestricted Sight Distance: restricted sight distances are typically created by steep slopes and sharp curves, but they can also result from on-street parking and other physical obstructions.

f) Intersection Implementations: desirable intersection implementations are primarily bicycle pockets and bicycle-sensitive loop detectors. Bicycle pockets are lanes for through-bicycle movement at intersections where a right-turn lane is provided. Other intersection

implementations can include pavement markings or space provisions to accommodate left-turning bicyclists at intersections.

SPEED DIFFERENTIAL

Speed differential is calculated by comparing the average bicycle speed of 24 kph (15 mph) with the posted speed.

MOTOR VEHICLE LOS

The Highway Capacity Manual (TRB, 2010) and AASHTO Geometric Design of Highways and Streets ("Green Book") (AASHTO, 2011) list the following levels of service:

A= Free flow

B=Reasonably free flow

C=Stable flow

D=Approaching unstable flow

E=Unstable flow

F=Forced or breakdown flow

MAINTENANCE

Considers the existence of maintenance deficiencies, such as cracking, patching, weathering, potholes, rough road edge, rough railroad crossing, and standing water.

TDM AND MULTIMODAL SUPPORT

Considers the existence of support of transportation management organization (TMO) services or intermodal links to transit that assist in overcoming institutional, social, and logistical barriers and affect the decision to bicycle.

BICYCLE LOS RATINGS

The scores for the segments, regarding bicycle LOS analysis, can be observed in Table 2.

Table 2 – Scores for bicycle LOS analysis

Segment	Score
1A	6.0
1B	6.0
1C	4.0

All segments, 1A, 1B, and 1C, presented the LOS E. Scores 7 or below but above 3 equal an LOS E rating. These roadways require cautious use. There is high level of interaction with motor vehicles and no bicycle facilities. This is not the worst case scenario because the street has a low-speed limit, low-volume motor-vehicle traffic, limited conflicts, and reasonable surface conditions.

1.2.2. Pedestrian Level of Service

PEDESTRIAN FACILITY PROVIDED

a) Dominant Facility Type: the characteristics of the pedestrian facility provided in the corridor. The dominant facility can be either non-continuous or non-existent, continuous on one side, or continuous on both sides.

b) Minimum 1.53 m (5 ft) Wide and Barrier Free: the sidewalk must be at least 1.53 m (5 ft) wide for its entire length. The barrier-free measure also takes into account the presence of intersection curb ramps, which are required for a sidewalk to be completely barrier free.

c) Sidewalk Width Greater than 1.53 m: when the sidewalk provided is greater than 1.53 m wide the corridor segment will score points in this category.

d) Off-Street Parallel Alternative Facility: this facility must be located within 0.4 km of the roadway segment and provide access to the same primary destination points served by the roadway network. Examples of such facilities may include, greenways, rail-trails, and pedestrian plazas.

CONFLICTS

a) Less Than 22 Driveways and Sidestreets per 1.61 km: compliance with this criterion is measured the same as for pedestrian facilities as for bicycle facilities.

b) Pedestrian Signal Delay of 40 Sec or Less: the pedestrian signal delay is calculated for sidestreet crossings along the corridor segment, but not for movements across the major corridor being evaluated.

c) Reduced Turn Conflict Implementation: to receive points for this criterion all of the corridor segment's intersections must be free of obstructions to pedestrian sight distances and provide a crosswalk.

d) Crossing Widths 18.3 m (60 ft) or Less: the pedestrian crossing width is measured in the center of a crosswalk at a signalized intersection only.

e) Posted Speed 56 kph or Less: high-speed traffic greatly decreases the comfort of pedestrians and can be a major deterrent to pedestrian trips.

f) Medians Present: points will be received for this criterion when medians are a dominant characteristic within the corridor or when they are present at locations with frequent motor-vehicle turning movements or frequent pedestrian midblock crossing movements.

AMENITIES

a) Buffer not Less Than 1 m (3.3 ft): the buffer is the space between the existing sidewalk and the curb or roadway edge. To score points the 1-m buffer must be maintained throughout the segment, excluding intersections.

b) Benches or Pedestrian-Scale Lighting Benches: they must be a dominant feature of the segment or at least be provided in locations along the segment adjacent to high pedestrian-traffic generators, such as activity centers, office complexes, retirement communities, schools, and transit transfer stations.

c) Shade Trees: shade trees must be a dominant feature of the segment or at least be provided in locations along the segment adjacent to high-pedestrian-traffic generators.

MOTOR VEHICLE LOS

Same classification already mentioned for the bicycle LOS analysis.

MAINTENANCE

Same considerations for the bicycle LOS analysis.

TDM AND MULTIMODAL SUPPORT

Considers if the corridor has the available support of TMO services or intermodal links to transit that assist in overcoming non-roadway barriers and affect the decision to walk.

PEDESTRIAN LOS RATINGS

The scores for the segments, regarding pedestrian LOS analysis, can be seen in Table 3.

Table 3 – Scores for pedestrian LOS analysis

Segment	Score
1A	9.5
1B	3.5
1C	2.5

Segment 1A

LOS D: Scores 11 and below but greater than 7 equal an LOS D rating. These roadways are adequate for pedestrian use, but will not attract pedestrian trips. These roadways will have more frequent deficiencies in pedestrian safety and comfort features and are more likely to violate ADA requirements for width and clearance. Gaps in the sidewalk system may occur within this roadway corridor. Intersection crossings are likely to be more frequent and more difficult. Pedestrians can anticipate moderate to high levels of interaction with motor vehicles.

Segment 1B

LOS E: Scores 7 and below but greater than 3 equal an LOS E rating. These roadways are inadequate for pedestrian use. Even where a sidewalk is provided these roadways will not meet ADA requirements and will have frequent deficiencies in sidewalk width, clearance, continuity,

and intersection design. Pedestrians can anticipate a high level of interaction with motor vehicles.

Segment 1C

LOS F: Scores of 3 and below equal an LOS F rating. These roadways are inadequate for pedestrian use. These roadways do not provide any continuous pedestrian facilities and are characterized by high levels of motor-vehicle use and automobile-oriented development. These roadways are designed primarily for high-volume motor-vehicle traffic with frequent turning conflicts and high speeds.

1.2.3. Summary of Level of Service

For the bicycle LOS, all segments presented LOS E. All sections had an outside lane less than 12 feet, they were barrier free and with no on-street parking. Speed differential for sections 1A and 1B were between 15 and 20mph, but segment 1C had a speed differential greater than 30mph. Motor vehicle LOS is not a problem at this area, and it was considered more than C for all sections. No support exists for transit facilities.

For the pedestrian LOS, segment 1A had a LOS D. It had continuous sidewalks on both sides, a crossing width less than 60 feet, posted speed, and shade trees. Motor vehicle LOS was at least C and no support existed for transit. Section 1B had a LOS E for pedestrians; sidewalks were not continuous, crossing width was less than 60 feet, there was a posted speed sign, and shade trees. Motor vehicle LOS was at least C and no support for transit existed. Segment 1C had LOS F for pedestrians, with no sidewalks, posted speed, motor vehicle LOS at least C, and no support for Transit. Figure 14 shows LOS for bicycles and pedestrians in the map.

Figure 14 – LOS for bicycles and pedestrians

1.3. Land Use

Figure 15 shows the land use map for the considered region.

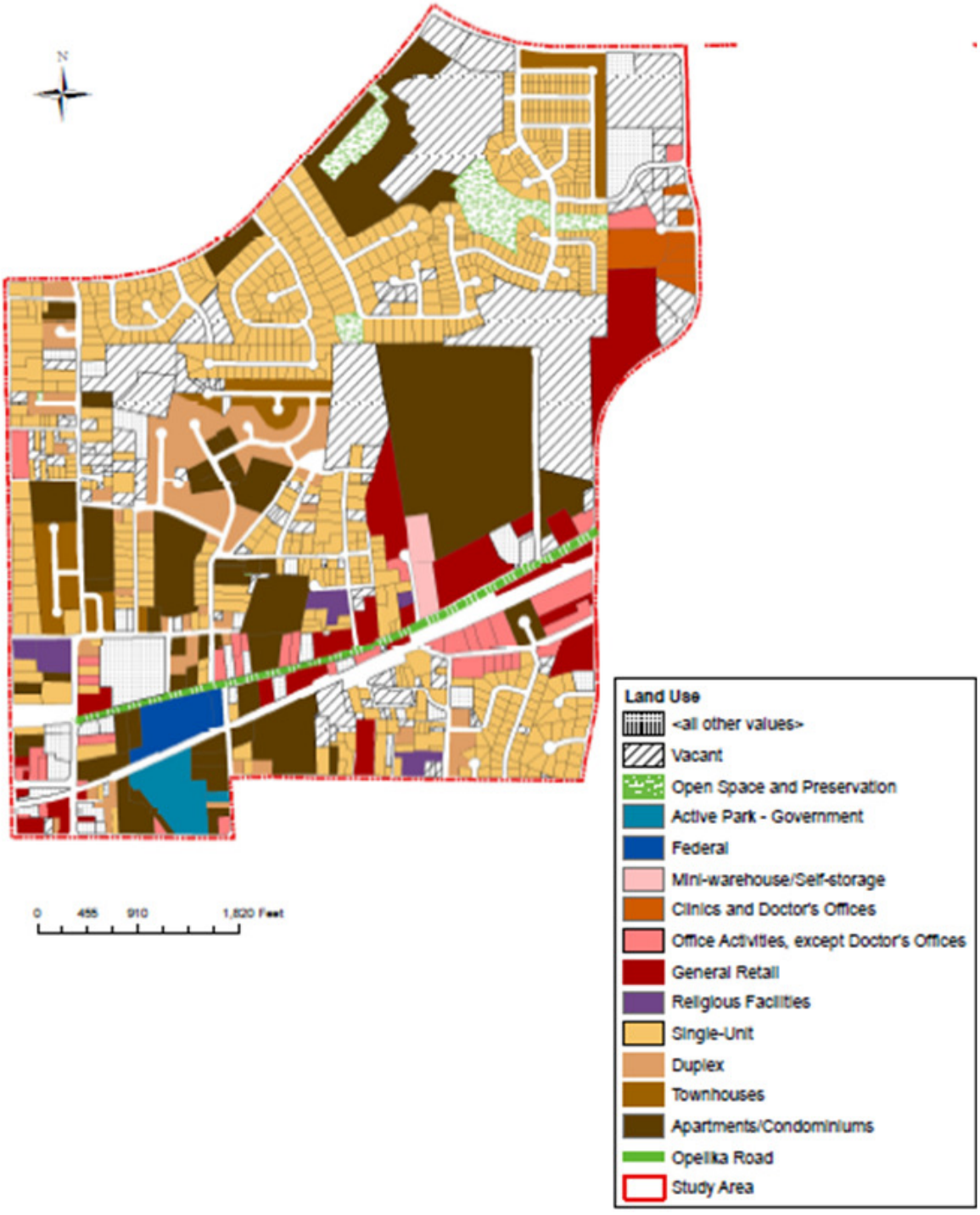

Figure 15 – Land use on Opelika Corridor from Gay Street to Dean Road

1.4. Household Characteristics

Figure 16 shows the number of households and the percentage of vacant households.

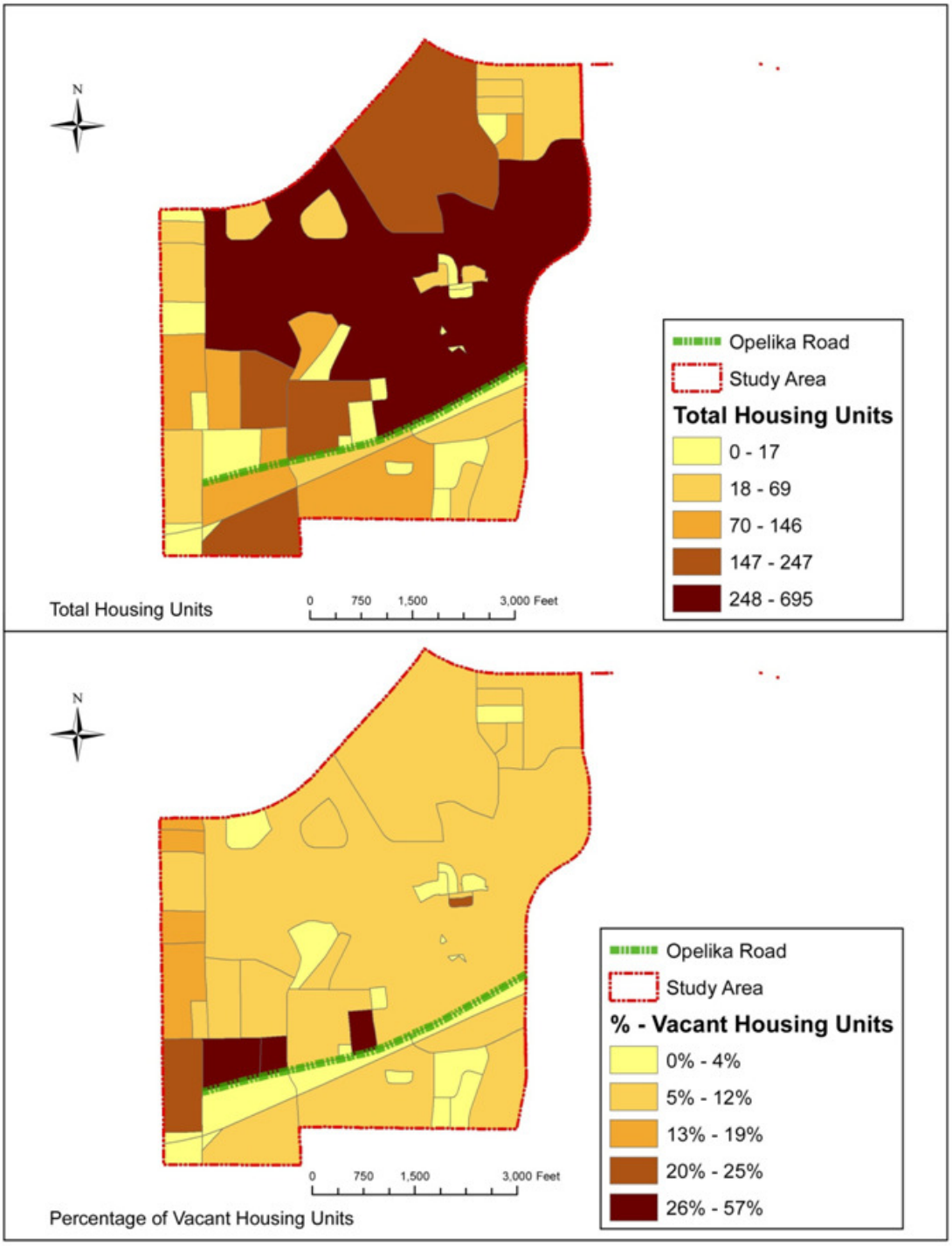

Figure 16 – Household characteristics on Opelika Corridor from Gay Street to Dean Road

1.5. Age of Residents

Figure 17 shows an overview of the age of residents of the study area.

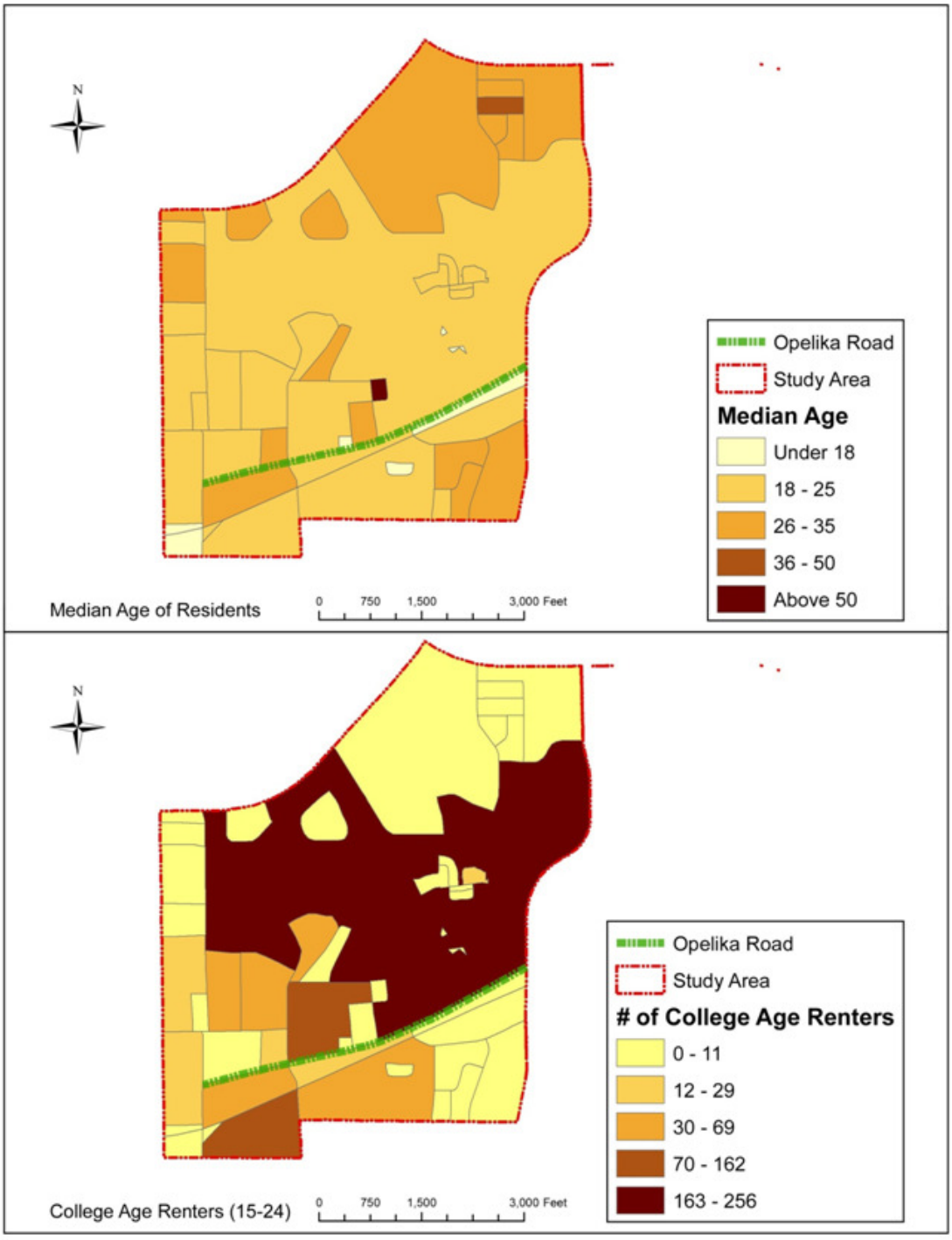

Figure 17 – Age of the residents of study area

1.6. Bike paths and Sidewalks

Figure 18 shows the bike paths, sidewalks and greenways in the study area.

Figure 18 – Bike paths, sidewalks, and greenways in the study area

1.7. Traffic Signals, Crosswalks, Street Lights, and Railroad

Figure 19 shows the location of traffic lights, crosswalks, street lights, and the railroad.

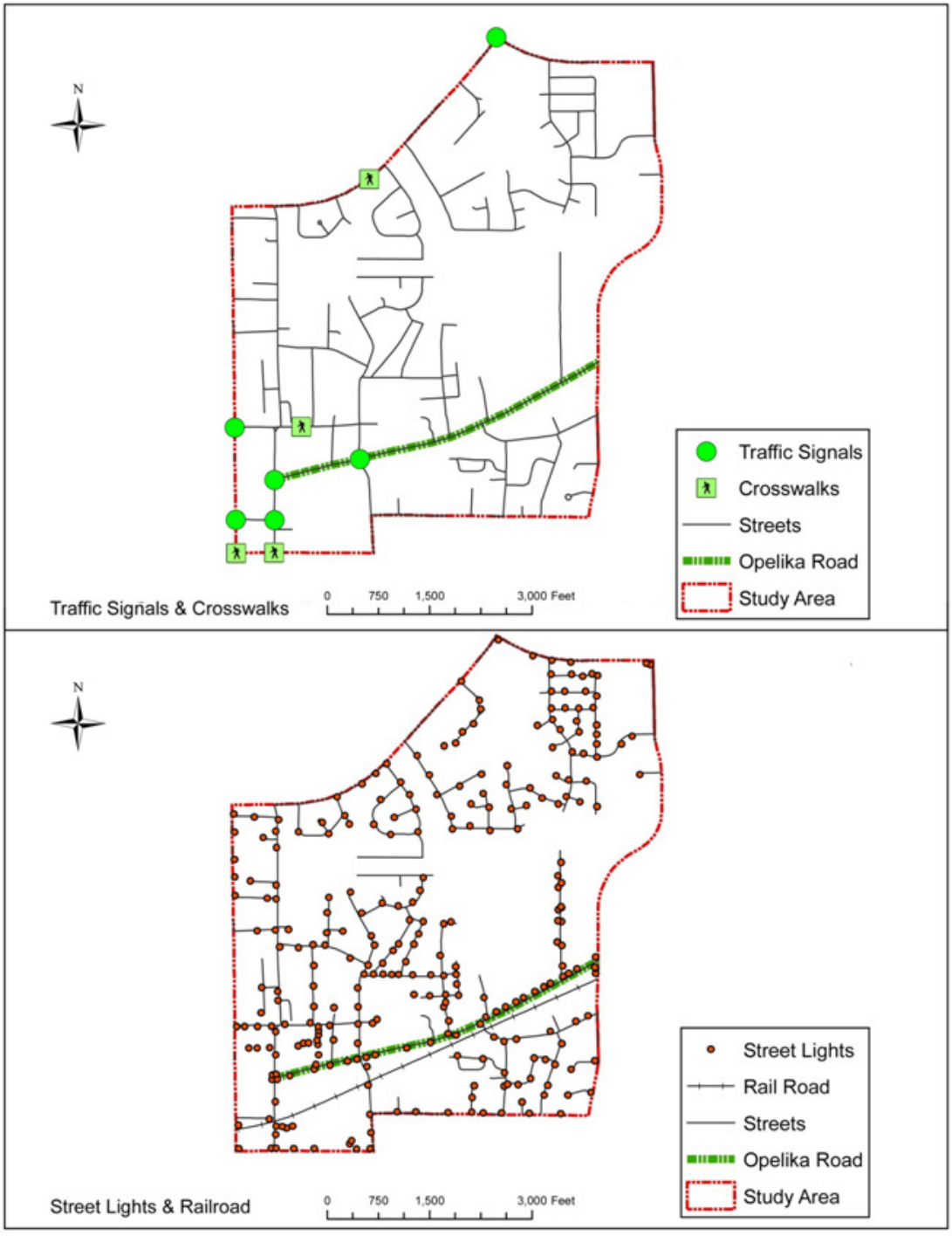

Figure 19 – Traffic signals, crosswalks, street lights, and railroad in the study area

1.8. Structures, Parcels, and Parking Lots

Figure 20 shows the location of structures, parcels, and parking lots at the study area.

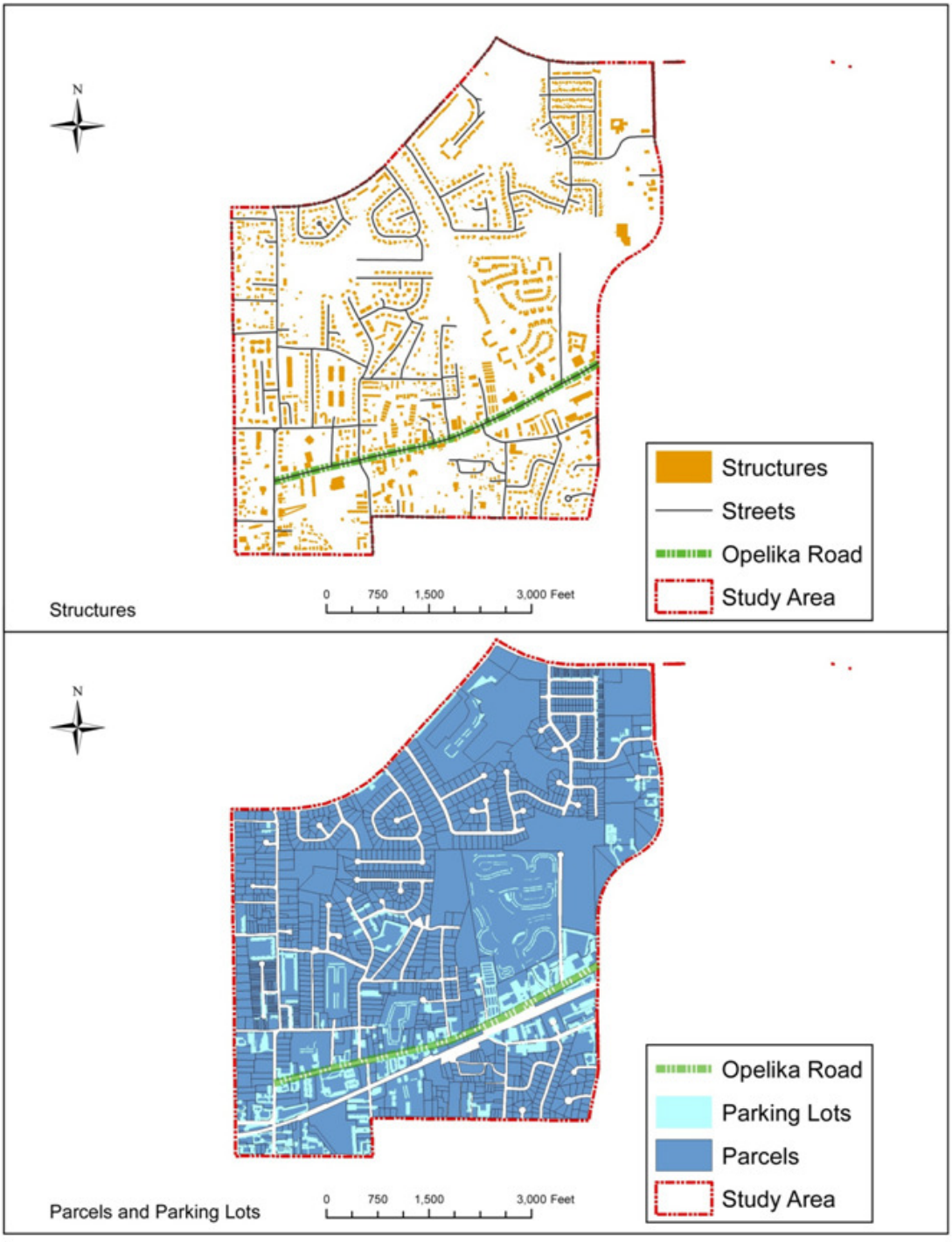

Figure 20 – Structures, parcels, and parking lots

2. DEVELOPMENT PROPOSALS

2.1. Sidewalks

2.1.1. Width

The Americans with Disabilities Act of 1990 mandates the establishment of minimum walkway clearance widths for sidewalks. The Americans with Disabilities Act (ADA) and the Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities state that walking surfaces should have a clear width minimum of 3 feet. The ADA and ABA guidelines also state that where sidewalks are less than five feet in width, passing spaces sufficiently wide enough for wheelchair users to pass one another or to turn around shall be provided at intervals of 200 feet (ADA and ABA, 2012).

Other sources also give minimum requirements for sidewalk width. The Guide for the Planning Design and Operation of Pedestrian Facilities from the American Association of State Highway and Transportation Officials (AASHTO) recommends a minimum of four feet, and for sidewalks that are less than five feet in width passing space at least five feet in width should be provided at reasonable intervals (AASHTO, 2004). The Design and Safety of Pedestrian Facilities from the Institute of Transportation Engineers (ITE) recommends sidewalks widths ranging from four feet to five feet for residential areas and of five feet for commercial areas (ITE, 1998). The Designing Sidewalks and Trails for Access: Best Practices and Design Guide from the Federal Highway Administration (FHWA) recommends a minimum width of five feet of sidewalk that is free of obstacles (FHWA, 2012).

Based on these minimum requirements, this project for Opelika Road will have sidewalks 5 feet wide. For arterial roads, like Opelika Road, sidewalks are required on both sides of the road (FHWA 2012), so this will also be implemented in this project.

2.1.2. Buffer

Between the road and the pedestrian path, there may be a space called buffer in the sidewalk. The one with grass and trees is the preferred buffer as it provides a more pleasant, shaded environment to walk. The FHWA (2012) recommends a minimum buffer width of 2 ft, but a 3 ft is preferable. According to Dixon (1996), a buffer of 3.5 feet is more comfortable for pedestrians. Therefore, the 3.5 feet will be adopted as the buffer for the Opelika Road project.

Another important proposal for Opelika Road is planting trees at the sidewalk buffers. Trees make cars drive more slowly, they can cut traffic noise, motivate residents walk to more, improve air quality, and increase property value. Small trees will be added to the buffers, because Opelika Road has significant traffic volume and medium or large trees could make it slow down more than it should and also cause problems with visibility. According to the Urban Tree Foundation, small trees should be spaced 20 to 30 feet from each other in a buffer with 2 to 4 feet. The buffer considered to this project, as mentioned before, will be 3.5 feet; the spacing between trees will be 25 feet. Figure 21 shows an example of the proposed buffer.

Figure 21 – Example of shading trees for Opelika Road

Lighting will also be considered for Opelika Road. Generally, all streetlights should be located in the curb zone of the sidewalks. Vehicular lights are generally spaced at 100 to 120 feet on center in a staggered pattern. The vehicular streetlights could be located at the intersections to provide safe levels of light in the roadway, while the pedestrian lights could be located in the mid-block areas. The typical spacing of pedestrian streetlights is 40 to 60 feet on center and they should be centered on a line 20 inches from the face of curb (City of Baltimore, 2012).

For this project, streetlights will be placed every 40 feet at the sidewalk. An example of the pedestrian streetlights for Opelika Road can be observed in Figure 22.

Figure 22 – Pedestrian streetlights

2.2. Crosswalks

Crosswalks will be required at all intersection approaches and they will be protected by a pedestrian signal. Also, at some points where there is a need for pedestrians to cross the street safely, crosswalks will be implemented. Crosswalks at the intersections will be standard, with the painting on the pavement, as they are protected by the traffic signal. The others will be raised and will include a median so that pedestrians do not have to cross all lanes at once, they can stop half way and wait until it is safe to go. Figure 23 shows an example of a raised crosswalk with median.

Figure 23 – Raised crosswalk with median

2.3. Bicycle Facilities

For this project, two different types of bicycle facilities will be considered, according to the characteristics of sections 1A, 1B, and 1C. The first one will be a shared lane. Bicycles can be operated on all roadways except where prohibited by statute or regulation. In most cases, bicyclists and motor vehicles share the same travel lanes. Shared lanes can be implemented everywhere: on local streets, on city streets, on urban, suburban, and rural highways. There are no specific designs or dimensions for a shared lane, but signs and marks on the pavement should be applied (AASHTO, 2012)

Figure 24 shows the "Share the Road" sign used to designate shared lanes. Figure 25 shows the mark on the pavement for a shared lane.

Figure 24 – "Share the road" sign

Figure 25 – Pavement marking for a shared lane

Where there is more space, in this project section 1C, bicycle lanes can be implemented. The minimum width for a bicycle lane is 4 feet, and in some cases it can be as wide as 7 feet (AASHTO, 2012). In this project, the minimum required width will be applied, as the bicycle lane will be protected by a buffer. Figures 26 and 27 show examples.

Figure 26 – Bicycle lane protected by a buffer

Figure 27 – Bicycle lane separated from vehicle lanes

2.4. Lane Width

According to the Green Book, an arterial road is the roadway that provides relatively high speeds and least interference to through traffic flow with little or no access control. It provides direct access to abutting properties, have frequent at-grade intersections, have pedestrian movements along and across the roadway, accommodate bicyclist unless specifically limited, and support public transportation. The width for arterial roads in urban areas varies from 10 to 12 ft (AASHTO, 2011). Opelika Road is an arterial in an urban area, so a lane width of 11 ft will be adopted for all lanes. There is enough room for that, it was checked on Auburn GIS maps, and there is no need for 12 ft lanes, leaving more space for the bicycle and pedestrian facilities.

2.5. Other Recommendations

2.5.1. Sidestreets

There are many sidestreets around Opelika Road. Some of them have significant potential pedestrian and bicyclist traffic, most of them because they connect students' residences to Opelika Road. It is not enough to renew only Opelika Road and not the roads that provide access to it; conditions of the main sidestreets should be improved so people can reach their destinations comfortably.

Analyzing the map of sidestreets, some of them do not represent potential demand for pedestrian and bicycle facilities, so no changes will be needed on them. Some sidestreets may have pedestrian and bicycle demand, but the vehicular traffic is so low that people can already walk or bike comfortably with the existing conditions.

Some other sidestreets have significant vehicular traffic and also a potential demand for pedestrians and bicyclists trips; these sidestreets will be improved. Figure 28 shows the sidestreets that will be considered for improvement of pedestrian and bicycle facilities.

At the sidestreets considered for improvement, at least one side of the road will have a sidewalk. The specifications for the sidewalks follow the same characteristics that the sidewalks for Opelika Road had. The sidewalk width will be 5 ft and there will be a 3.5 ft buffer. Pedestrian lighting will be placed every 40 ft and trees will be planted every 25 ft at the sidewalk buffers.

There will also be shared lanes for bicyclists because there is not enough space to build bicycle lanes at most sidestreets. Again, the "share the road" sign and the pavement markings should be applied to designate the lanes should be shared by both vehicular and bicycle traffic.

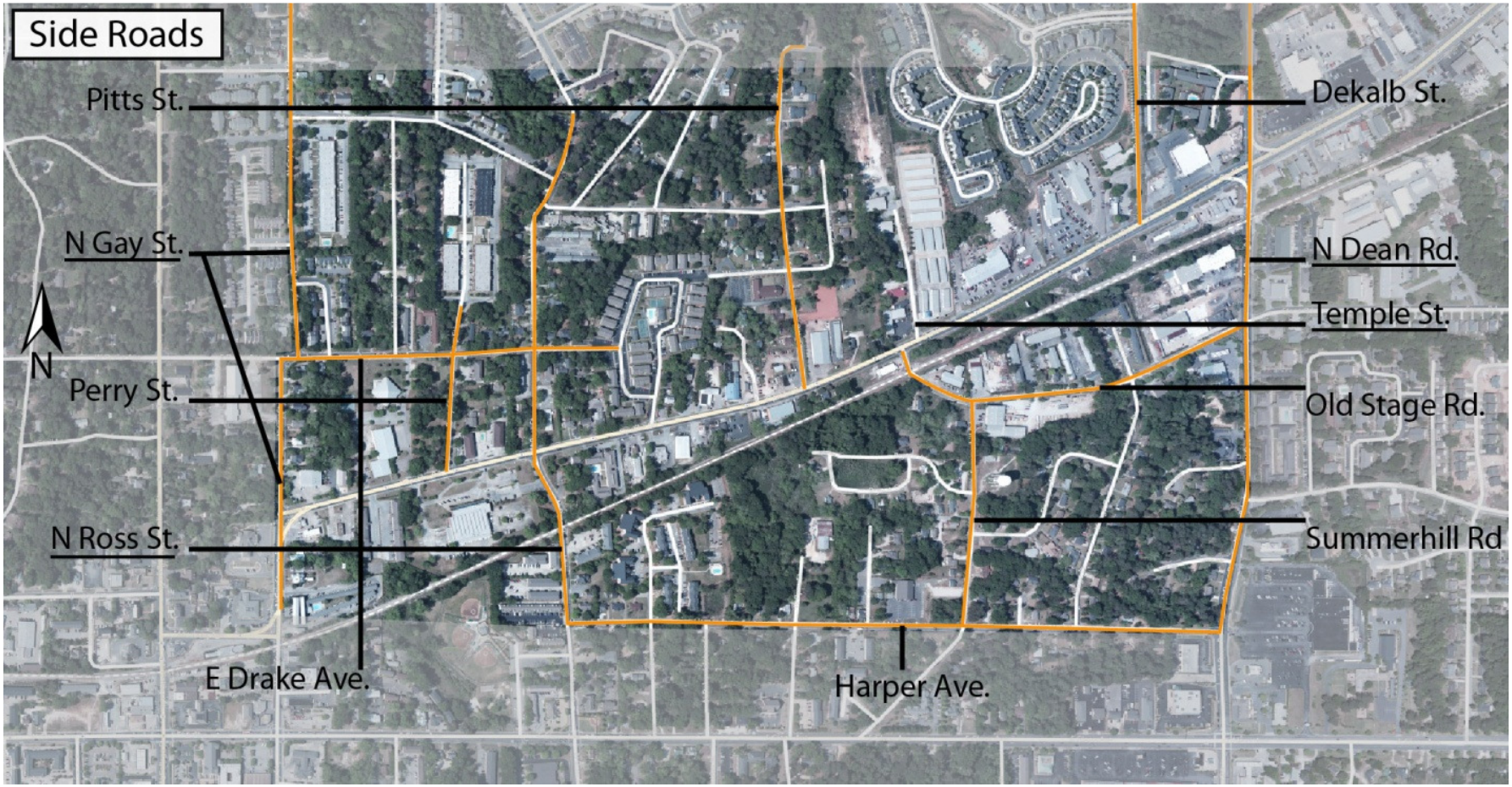

Figure 28 – Sidestreets considered for improvement

2.5.2. Transit facilities

At some locations of the considered segment in Opelika Road, there may be the need for new transit stops. In Auburn, the main transit system is Tiger Transit. There is also the Lee-Russell transit, but it is a "dial-a-ride" type, it does not have specific stops, so it will not be considered.

The Tiger Transit lines that pass through the considered segment of Opelika Road or though the main sidestreets are: Ross Harper line (see Figure 28), Opelika Road line (see Figure 30), and North Ross line (see Figure 31). Circles in the figures indicate the existing bus stops.

Based on that, new bus stops will be proposed in this project. The new stops will be added to Opelika Road line at places where there is a need for a stop and none of the other lines (Ross Harper or North Ross) have a stop nearby. Location of the proposed bus stops will be detailed later.

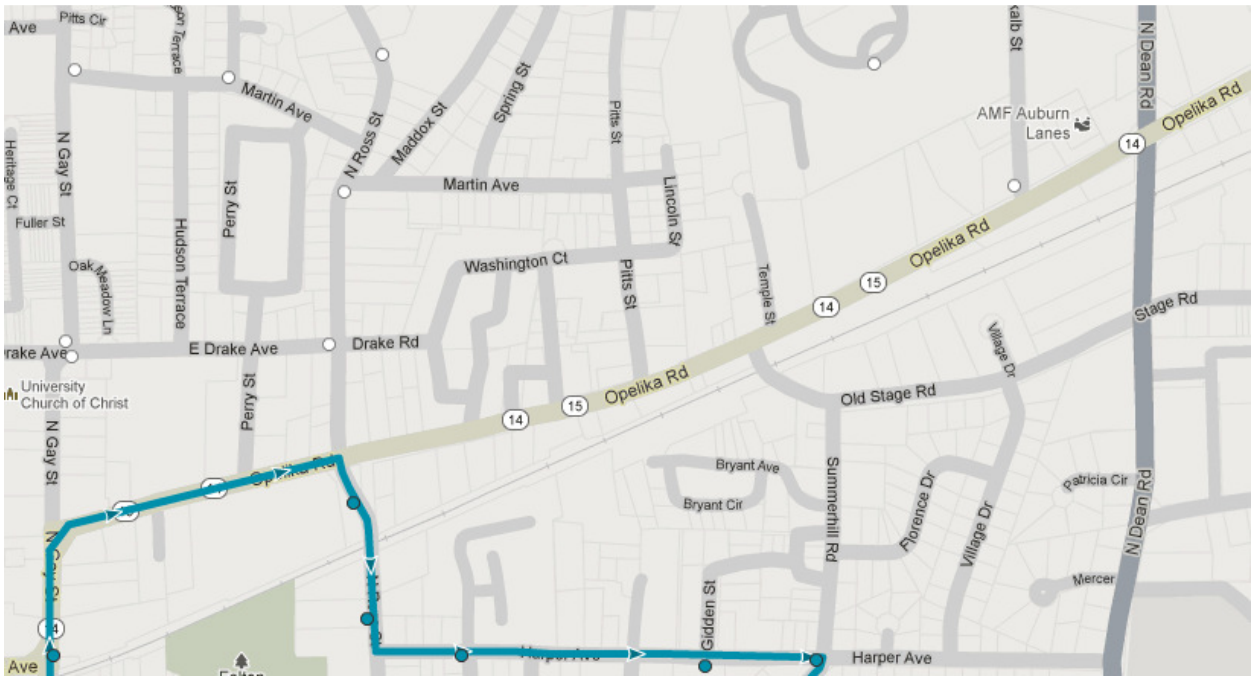

Figure 29 – Ross Harper line

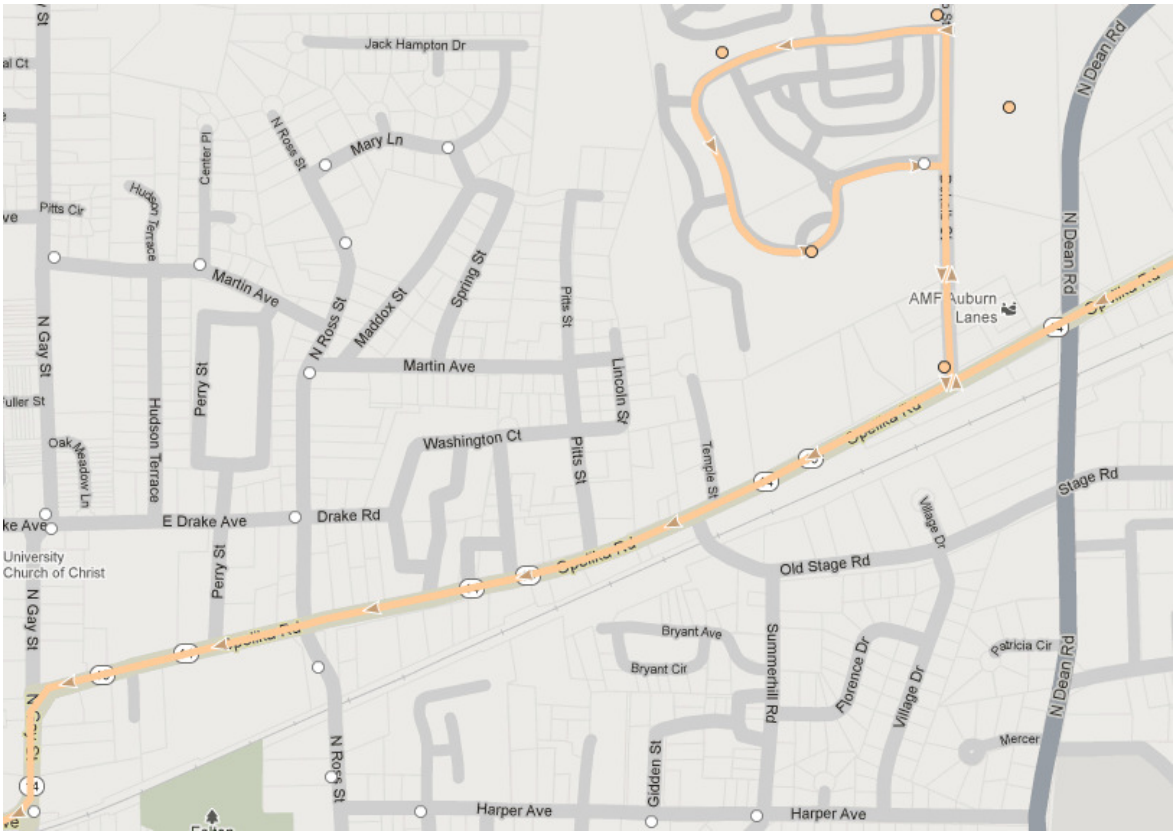

Figure 30 – Opelika Road line

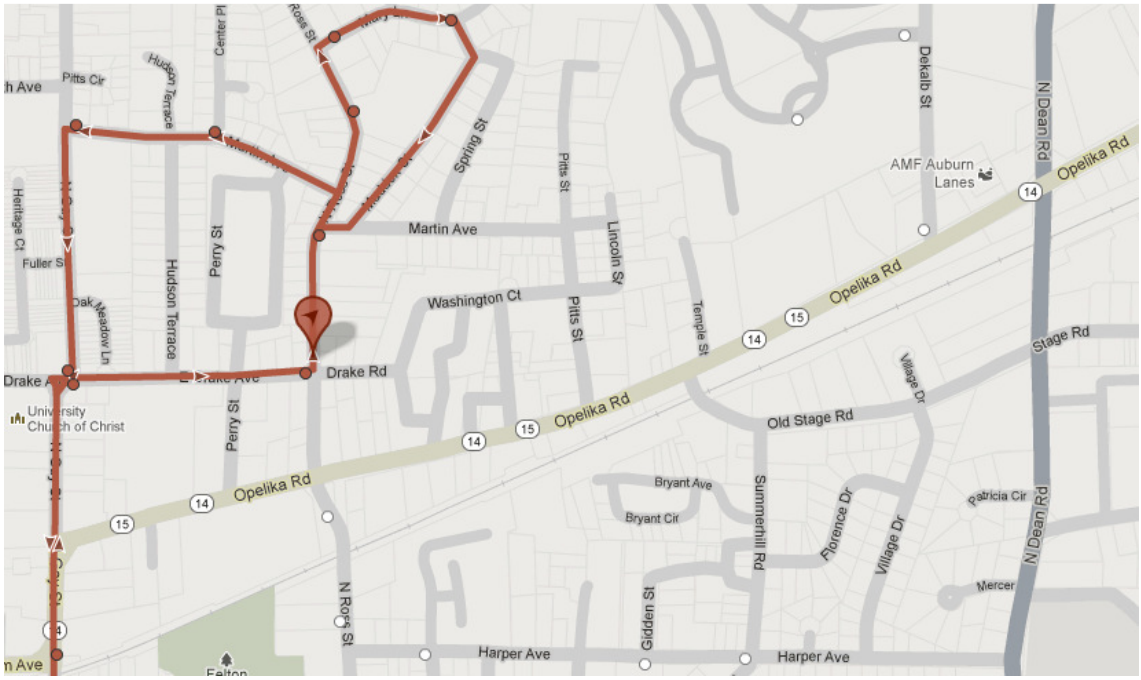

Figure 31 – North Ross line

2.6. Development proposals by section

This section is a summary of the development proposals by sections of the considered segment in Opelika Road. The detailed specifications for these proposals were seen before in this report, from sections 2.1 to 2.5.

2.6.1. Section 1A: Gay Street to Ross Street

a. Sidewalks:
    i. Improve sidewalk on both sides of the road:
        1. Width: 5ft
        2. Buffer: 3.5ft
        3. Shade trees (every 25 ft)
        4. Lighting (every 40 ft)

b. Bicycles:
    i. Put “share the road” sign and pavement marking to show there are shared lanes. No bike lanes, bikes and vehicles share same space

c. Crosswalks:
    i. At all Opelika Road/Ross Street intersection approaches, protected by a pedestrian signal
    ii. Crosswalk with median (see location at Figure 32)

d. Transit Stops:
    i. At the location shown in Figure 32

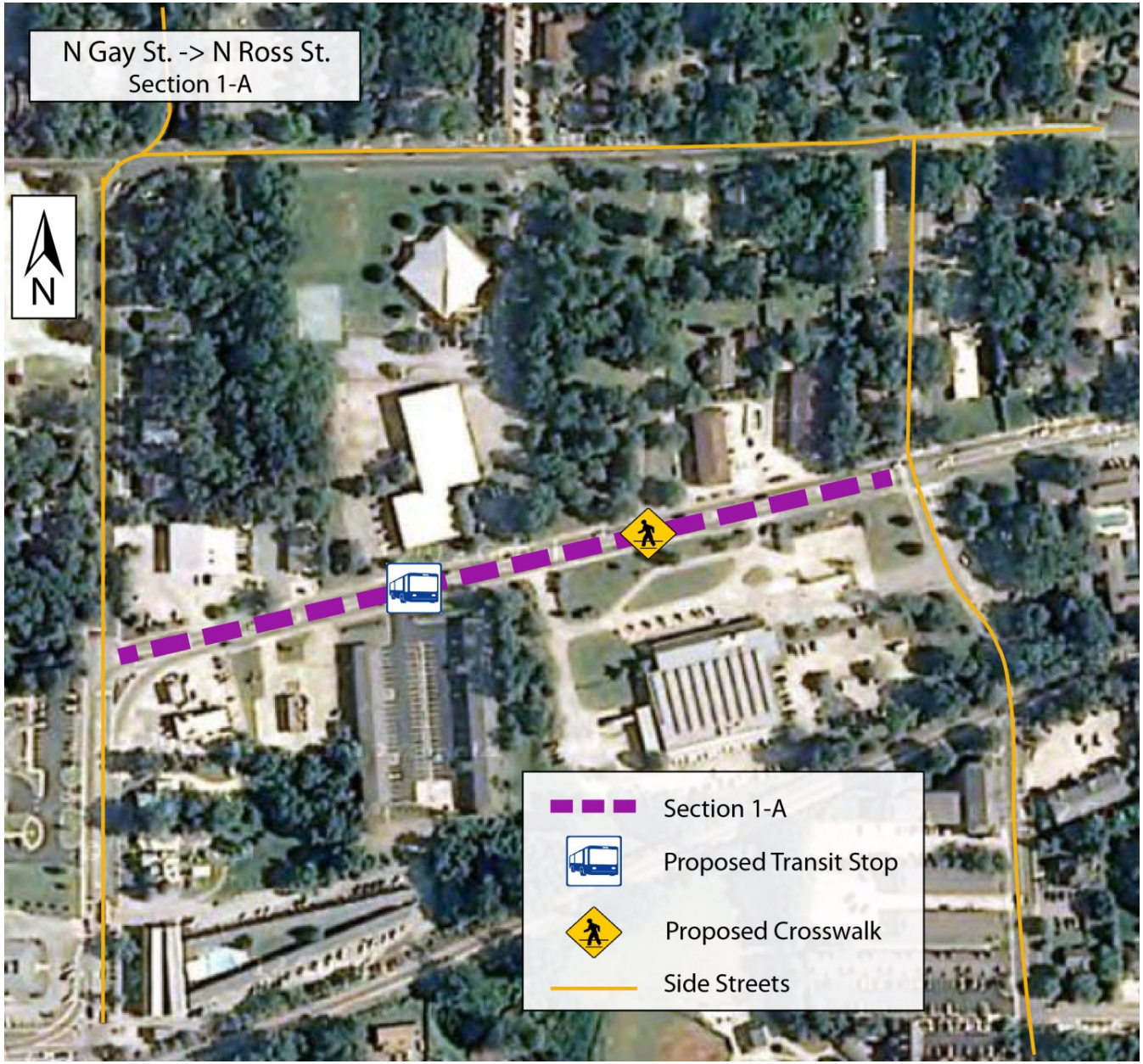

Figure 32 – Proposals for Section 1A

2.6.2. Section 1B: Ross Street to Temple Street

a. Sidewalks:
    i. On one side of the road, improve sidewalk:
        1. Width: 5ft
        2. Buffer: 3.5ft
        3. Shade trees (every 25 ft)
        4. Lighting (every 40 ft)

    ii. On the other side of the road, add a sidewalk with:
        5. Width: 5ft
        6. Buffer: 3.5ft
        7. Shade trees (every 25 ft)
        8. Lighting (every 40 ft)

b. Bicycles:
    i. Put “share the road” sign and pavement marking to show there are shared lanes. No bike lanes, bikes and vehicles share same space

c. Crosswalks:
    i. Crosswalks with median (see location at Figure 33)

d. Transit Stops:
    i. At the location shown in Figure 33

Figure 33 – Proposals for Section 1B

2.6.3. Section 1C: Temple Street to Dean Road

a. Sidewalks:
    i. On both sides of the road, add a sidewalk with:
        1. Width: 5ft
        2. Buffer: 3.5ft
        3. Shade trees (every 25 ft)
        4. Lighting (every 40 ft)

b. Bicycles:
    i. Add bike lanes on both sides of the road
    ii. Bike lane width: 4 ft
    iii. Put traffic signs according to that

c. Crosswalks:
    i. At all Opelika Road/Dean Road intersection approaches, protected by a pedestrian signal
    ii. Crosswalk with median (see location in Figure 34)

The detailed design of the development proposals will be showed in the next chapter of this report, Chapter 3. Cross sections and plans will give a better idea of how Opelika Road will be after the renew project. Cross sections and plans will show the existing conditions (before project implementation) and development proposals (after project implementation) for each section (1A, 1B, and 1C), and also for the Dean Road/Opelika Road intersection. This intersection will be analyzed separately because its geometry is different from the rest of the sections.

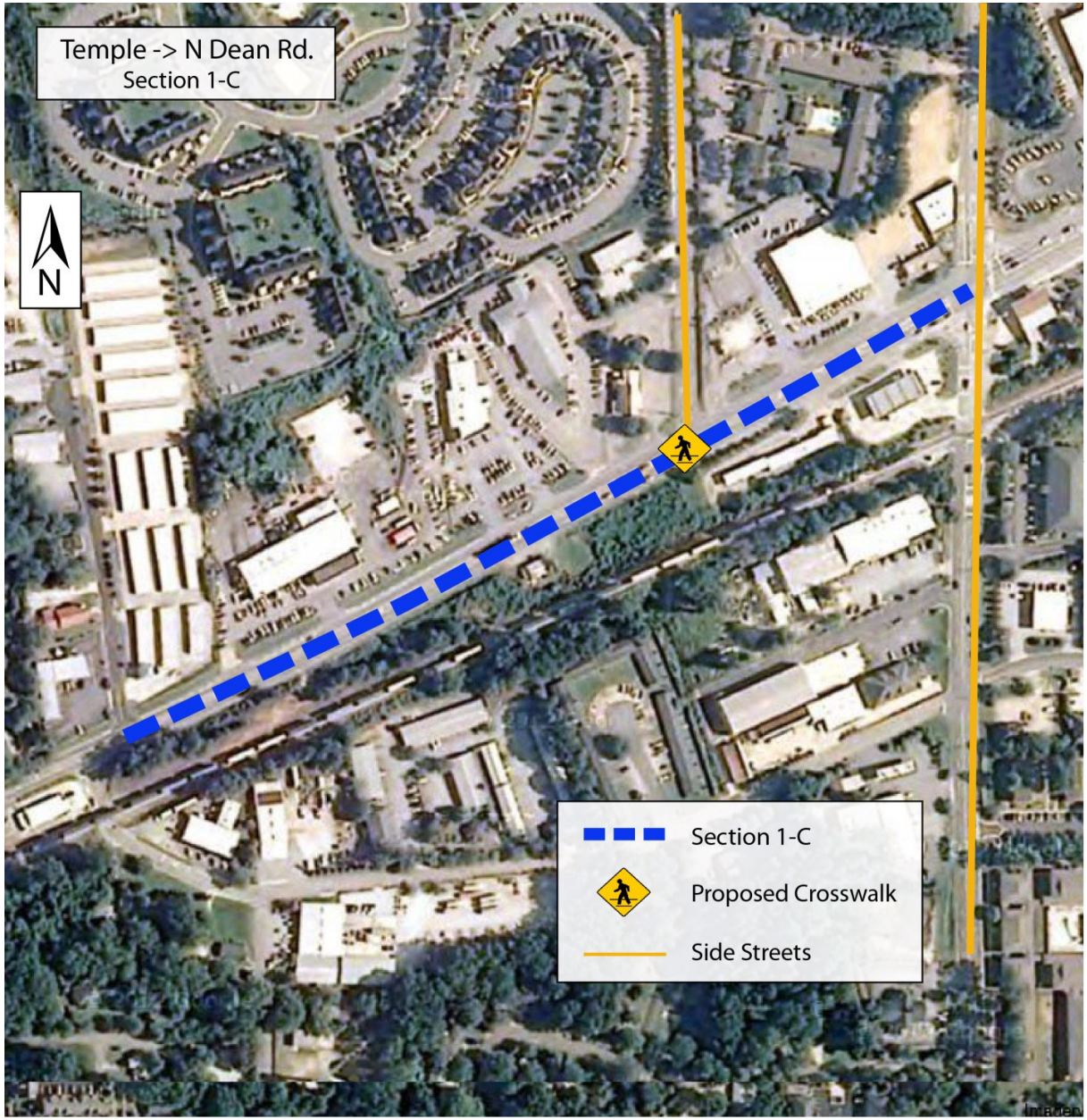

Figure 34 – Proposals for Section 1C

3. DESIGN

3.1. Traffic Engineering Analysis

This project proposes some geometric changes for the roadway lanes. The study of highway capacity is usually based on the Highway Capacity Manual (HCM), which is developed by the Transportation Research Board (TRB). The HCM presents the guidelines for an integrated multimodal approach to the analysis and evaluation of urban streets from the points of view of automobile drivers, transit passengers, bicyclists, and pedestrians; provides guidance on the proper application of microsimulation analysis and the evaluation of those results; presents active traffic management in relation to demand and capacity; and shows generalized service volume tables to assist planners in sizing roadway facilities (TRB, 2012).

To automate the process of using the equations and tables in the Highway Capacity Manual, McTrans has developed HCS (Highway Capacity Software), which allows a user to input the necessary parameters and have an auto-generated report on the conditions (McTrans, 2012). In order to verify the impact on capacity of the geometric changes in Opelika Road, an analysis will be performed with the software HCS+, developed in 2000. Geometric data (collected in the field), signal timing data, and traffic counts are required for the analysis in HCS+. The signal timing scheme can be observed in Figure 35.

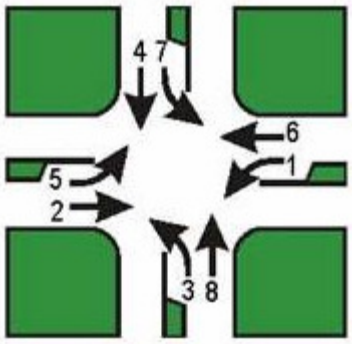

Figure 35 – Signal timing phases

The busiest part of the study area of Opelika Road is the intersection with Dean Road. Therefore, the intersection analysis will be performed and, if conditions are good for that location, they will also be satisfied for the remaining sections. The Foresite Group is one of the companies involved in the "Renew Opelika Road" project and they provided signal timing data and traffic counts for the Dean Road/Opelika Road (Foresite, 2012). Figure 36 shows the traffic counts for three peak periods of a weekday: morning, noon, and afternoon, and it can be observed in Table 4 the signal timing for the intersection.

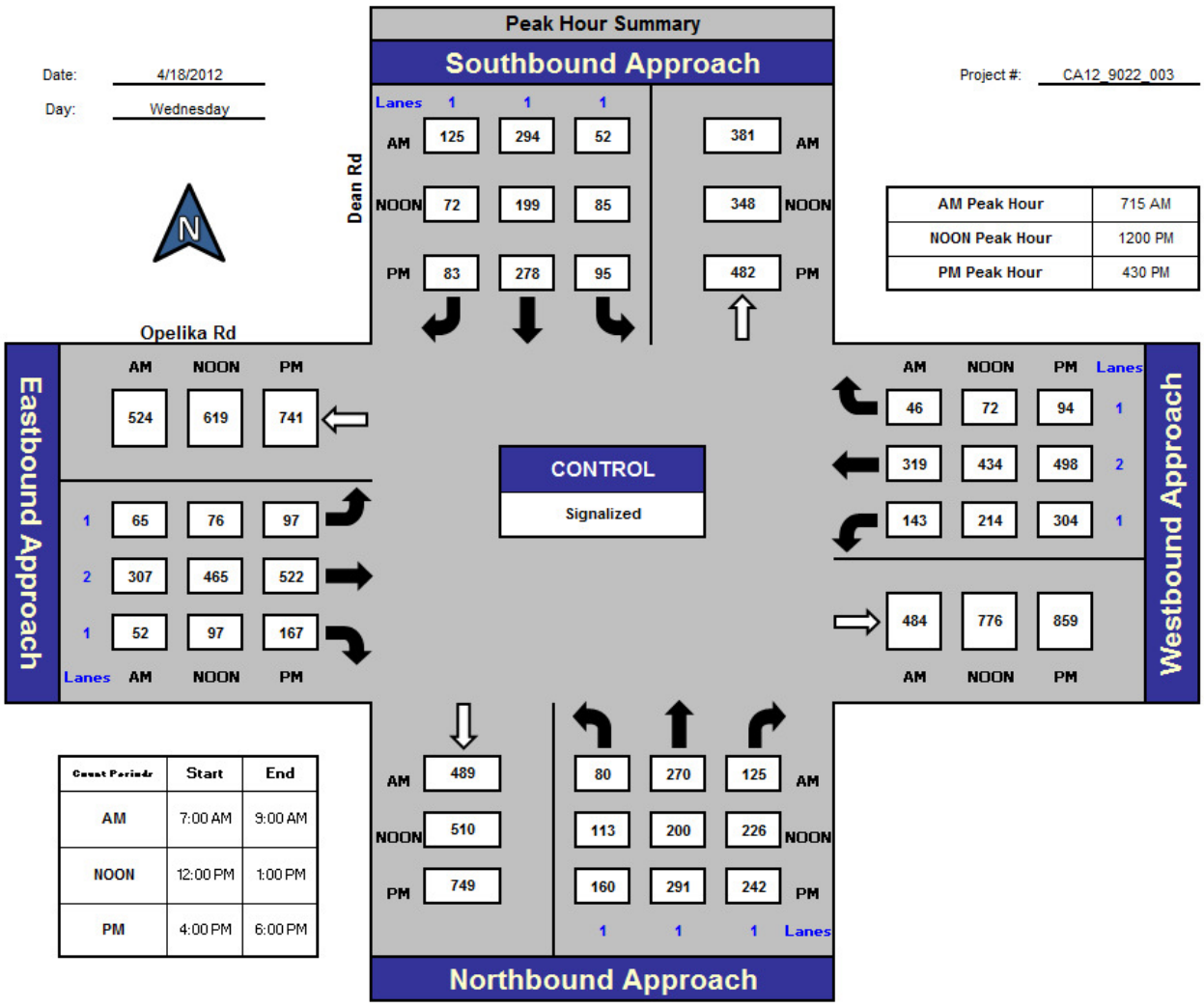

Figure 36 – Traffic counts for all Dean Road/Opelika Road intersection
SOURCE: Foresite, 2012

Table 4 – Signal timing for Dean Road/Opelika Road intersection

Phase	1	2	3	4	5	6	7	8
Min green	10	30	10	15	10	30	10	15
Pass	4	4	4	4	4	4	4	4
Yellow	4	4	4	4	4	4	4	4
All red	1	1	1	1	1	1	1	1
Max Green	20	35	15	45	20	35	15	45

SOURCE: Foresite, 2012

The analysis of the existing conditions can be observed in Figures 37 to 39, for AM, noon, and PM peak periods respectively.

RESULTS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Lane Group Adjusted Volume, (vph)	58	341	72	159	354	51	89	300	139	58	327	139
Lane Group Capacity, (vph)	254	891	426	254	891	426	201	633	538	201	633	538
Lane Group v/c Ratio	0.23	0.38	0.17	0.63	0.40	0.12	0.44	0.47	0.26	0.29	0.52	0.26
Critical Lane Group				#	#		#				#	
Lane Group Delay, (sec/veh)	51.2	41.4	38.9	58.8	41.6	38.3	57.6	36.2	33.1	55.9	37.0	33.1
Lane Group Level of Service	D	D	D	E	D	D	E	D	C	E	D	C
Final Unmet Demand, (v)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Approach Delay, (sec/veh)	42.2			46.1			39.0			38.0		
Approach Level of Service	D			D			D			D		

Cycle Length 135.0 sec Intersection Delay 41.4 sec/veh Intersection LOS D

Figure 37 – Existing conditions: AM period

RESULTS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Lane Group Adjusted Volume, (vph)	84	517	108	238	482	80	126	222	251	94	221	80
Lane Group Capacity, (vph)	254	891	426	254	891	426	201	633	538	201	633	538
Lane Group v/c Ratio	0.33	0.58	0.25	0.94	0.54	0.19	0.63	0.35	0.47	0.47	0.35	0.15
Critical Lane Group		#		#			#		#			
Lane Group Delay, (sec/veh)	52.3	44.6	40.0	96.5	43.8	39.1	63.4	34.3	36.2	58.0	34.3	31.7
Lane Group Level of Service	D	D	D	F	D	D	E	C	D	E	C	C
Final Unmet Demand, (v)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Approach Delay, (sec/veh)		44.8			59.0			41.2			39.4	
Approach Level of Service		D			E			D			D	

Cycle Length 135.0 sec Intersection Delay 47.6 sec/veh Intersection LOS D

Figure 38 – Existing conditions: noon period

RESULTS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Lane Group Adjusted Volume, (vph)	108	580	186	338	553	104	178	323	269	106	309	92
Lane Group Capacity, (vph)	254	891	426	254	891	426	201	633	538	201	633	538
Lane Group v/c Ratio	0.43	0.65	0.44	1.33	0.62	0.24	0.89	0.51	0.50	0.53	0.49	0.17
Critical Lane Group		#		#			#	#				
Lane Group Delay, (sec/veh)	53.4	46.3	42.5	230.8	45.5	39.8	93.4	36.8	36.7	59.2	36.4	32.0
Lane Group Level of Service	D	D	D	F	D	D	F	D	D	E	D	C
Final Unmet Demand, (v)	0.0	0.0	0.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Approach Delay, (sec/veh)		46.3			107.8			49.9			40.4	
Approach Level of Service		D			F			D			D	

Cycle Length 135.0 sec Intersection Delay 65.7 sec/veh Intersection LOS E

Figure 39 – Existing conditions: PM period

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In order to improve the conditions, three different solutions are proposed. The first one considers only the geometric changes in the intersection, changing all lane widths to 11 ft. The second proposal also includes a signal timing optimization; HCS+ changes the existing signal timing so the capacity can be improved. The last analysis considers a reduction in the number of lanes, because if possible more room can be left for pedestrians and bicyclists. Table 5 shows a summary of the intersection delay and Table 6 shows the LOS for each situation.

Table 5 – Intersection delay for each situation

Intersection delay (sec/veh)			
CONDITION	PEAK PERIOD		
	AM	Noon	PM
Existing	41.4	47.6	65.7
Case 1 (lane width changes to 11 ft)	41.3	47.1	64.4
Case 2 (lane width changes and there is signal optimization)	23.3	31.7	41.3
Case 3 (1 lane reduction)	45.0	63.9	108.1

Table 6 – Level of Service (LOS) for each situation

Level of Service (LOS)			
CONDITION	PEAK PERIOD		
	AM	Noon	PM
Existing	D	D	E
Case 1 (lane width changes to 11 ft)	D	D	E
Case 2 (lane width changes and there is signal optimization)	C	C	D
Case 3 (1 lane reduction)	D	E	F

It could be observed from Tables 5 and 6 that the best condition related to capacity is Case 2, changing lane widths to 11 ft and optimizing signal timing. Also, it can be seen that it is not possible to reduce lanes, as it would cause a significant increase in intersection and LOS would be as bad as F, the worst case scenario.

3.2. Cross Sections

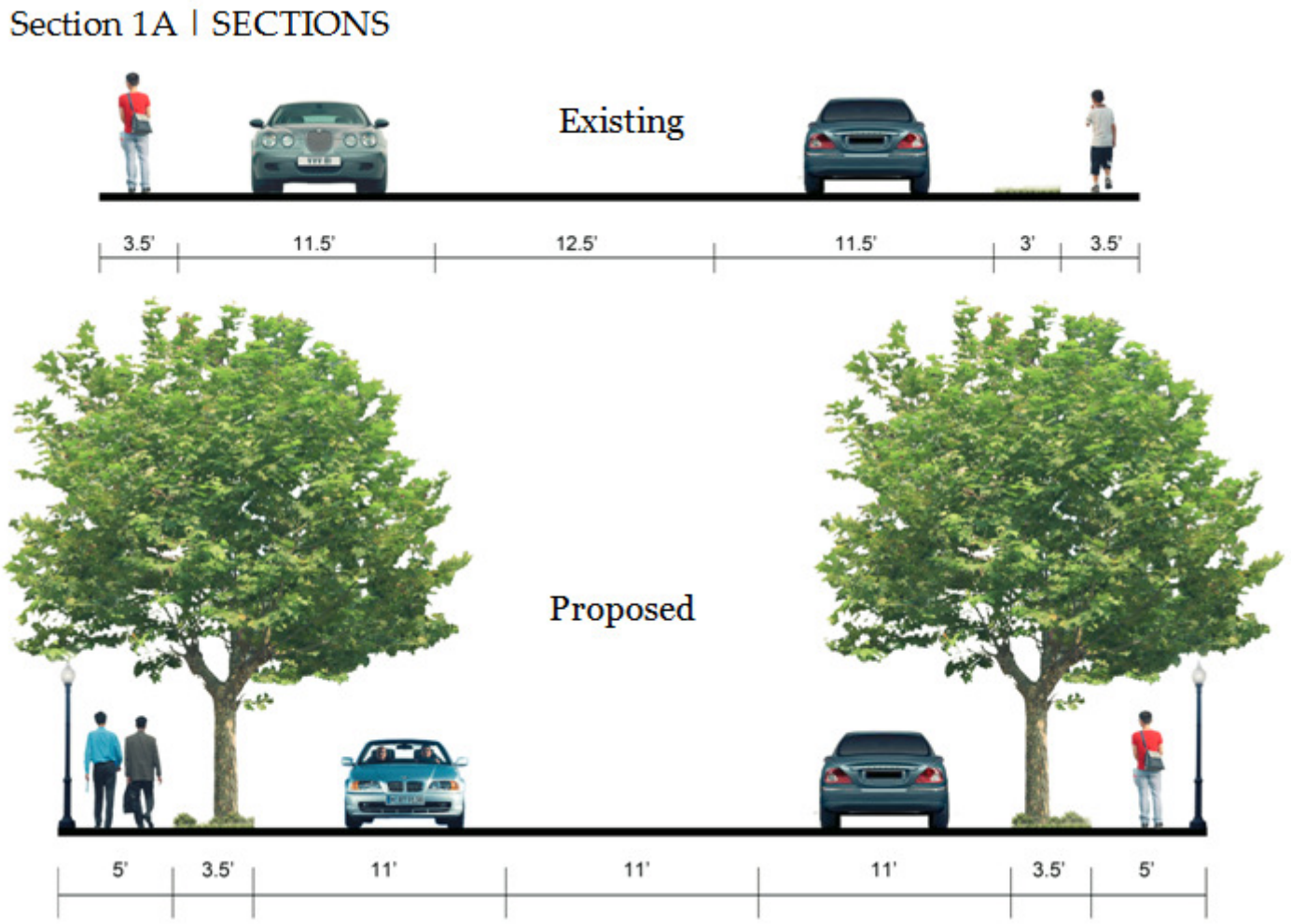

Figure 40 – Existing condition and proposed conditions - section: Section 1A

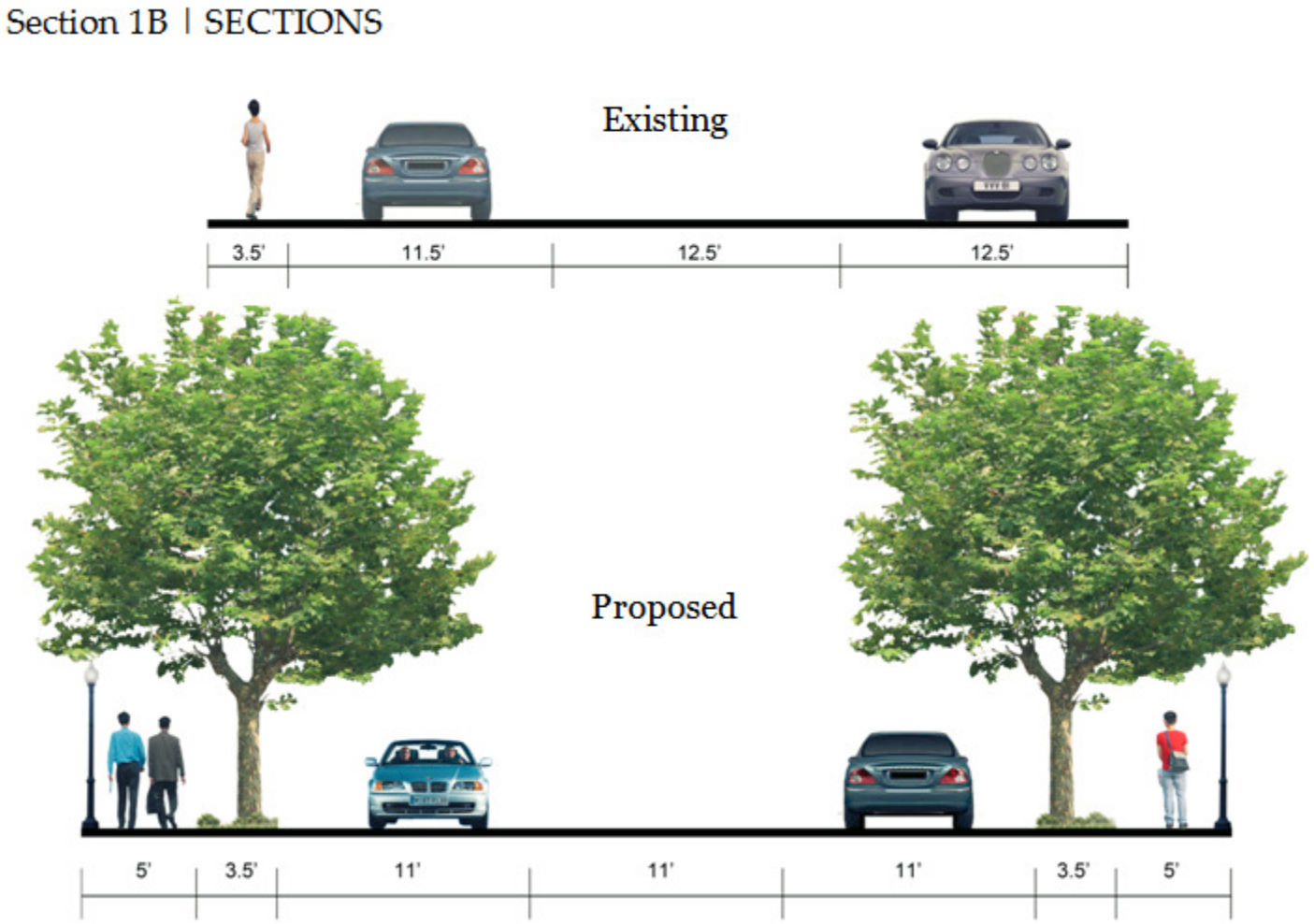

Figure 41 – Existing and proposed conditions - sections: Section 1B

Section 1C | SECTIONS

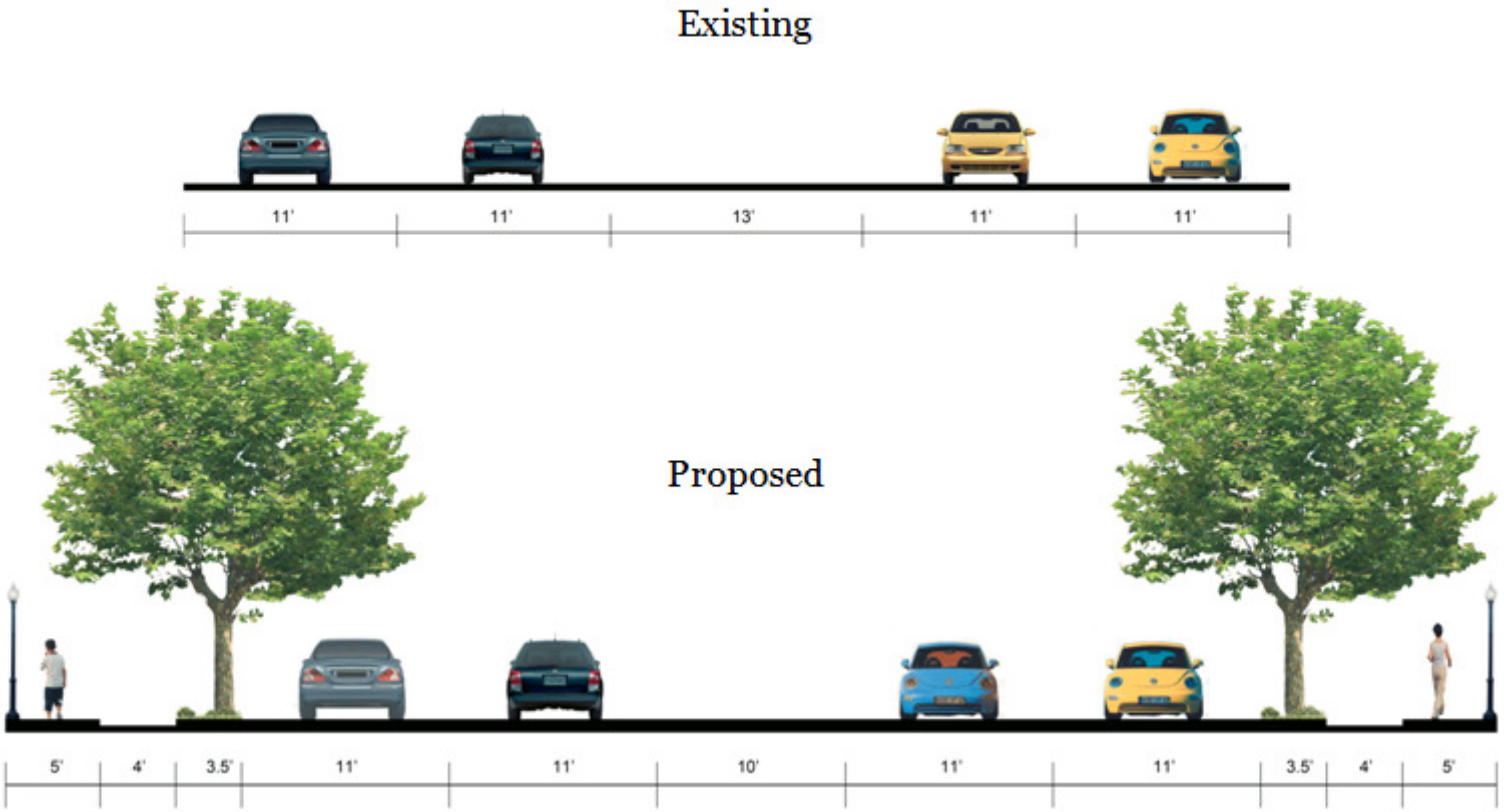

Figure 42 – Existing and proposed conditions - sections: Section 1C

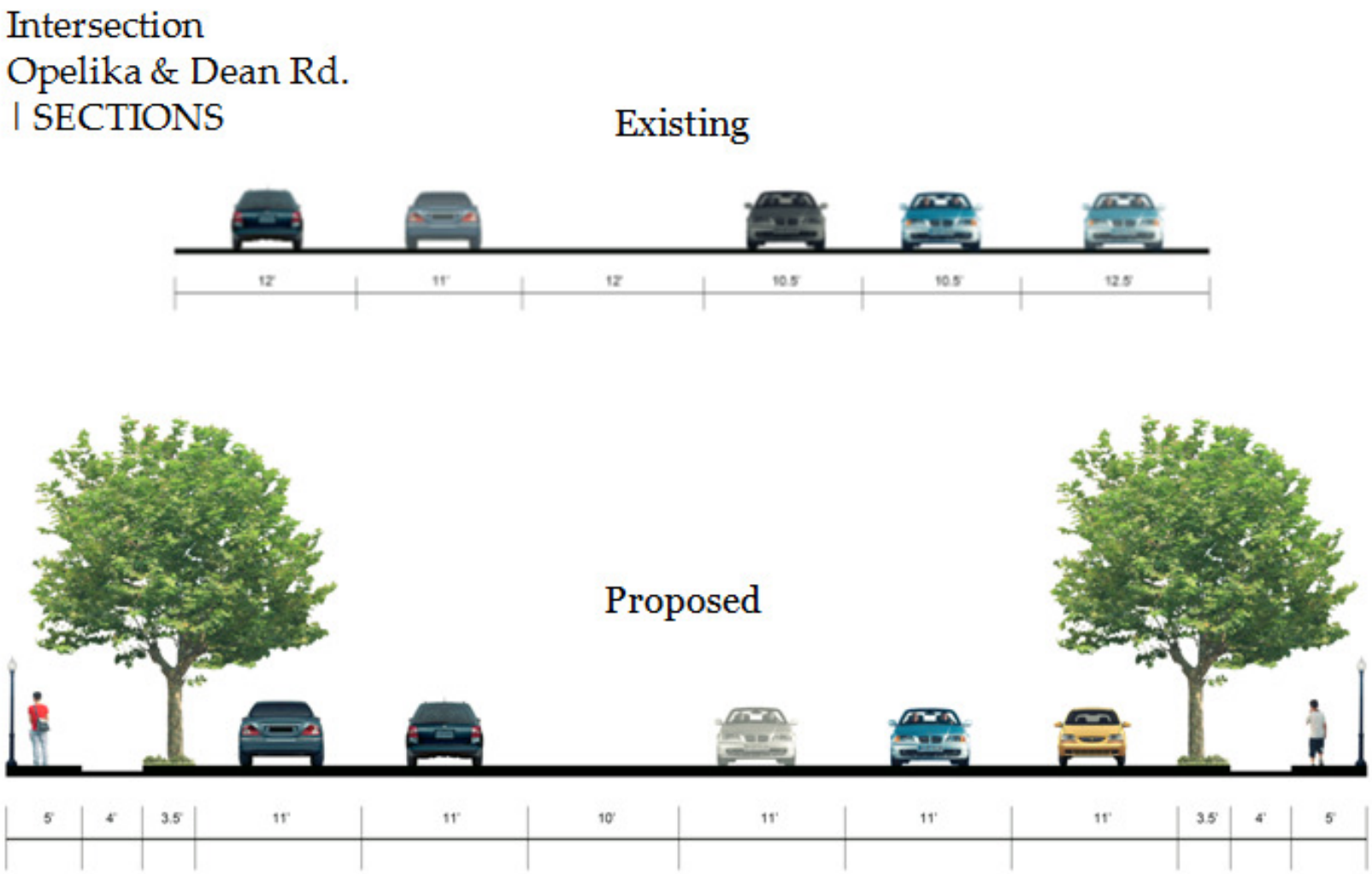

Figure 43 – Existing and proposed conditions - sections: Intersection Opelika and Dean Road

3.3. Plans

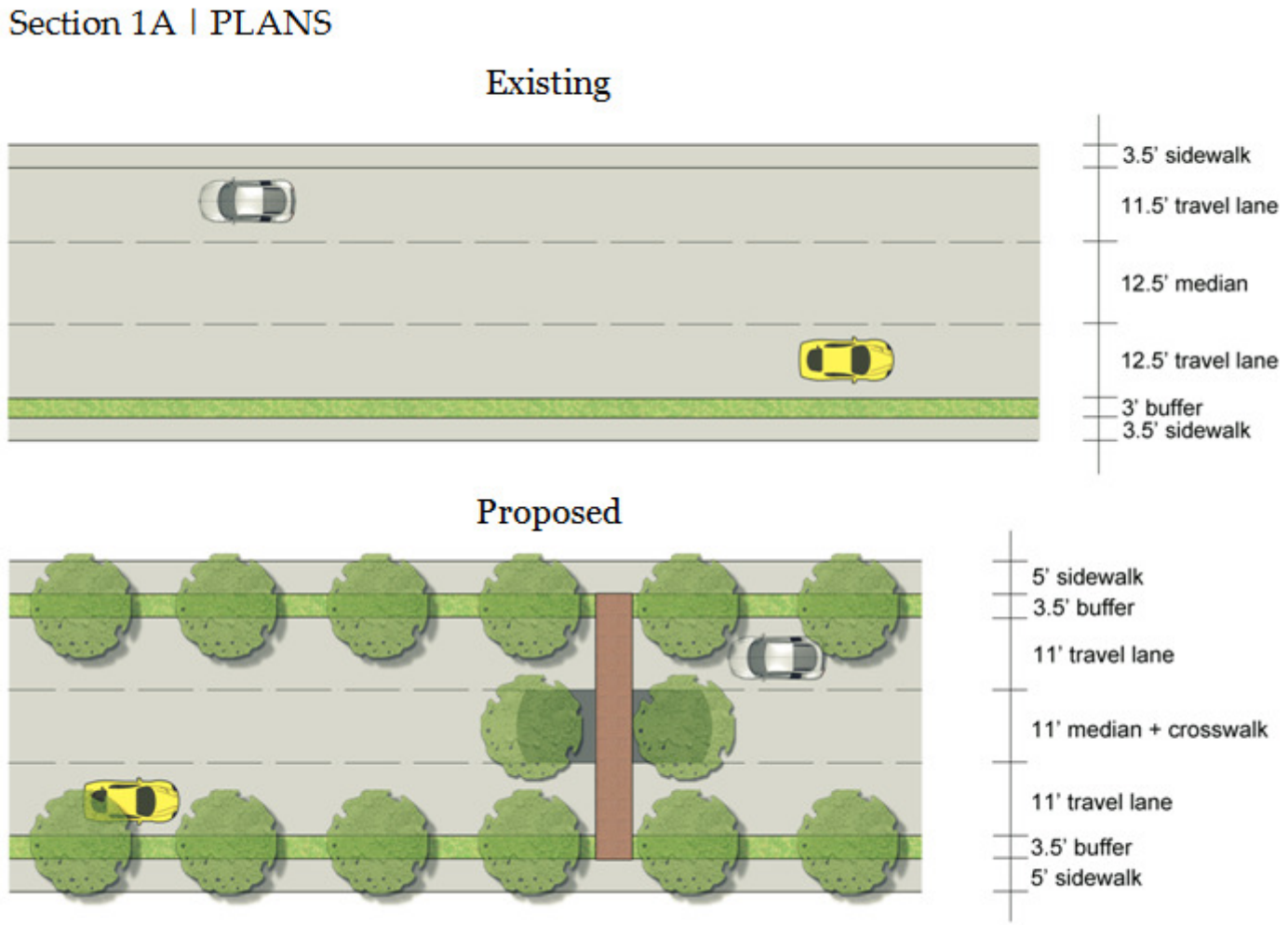

Figure 44 – Existing and proposed conditions – plans: Section 1A

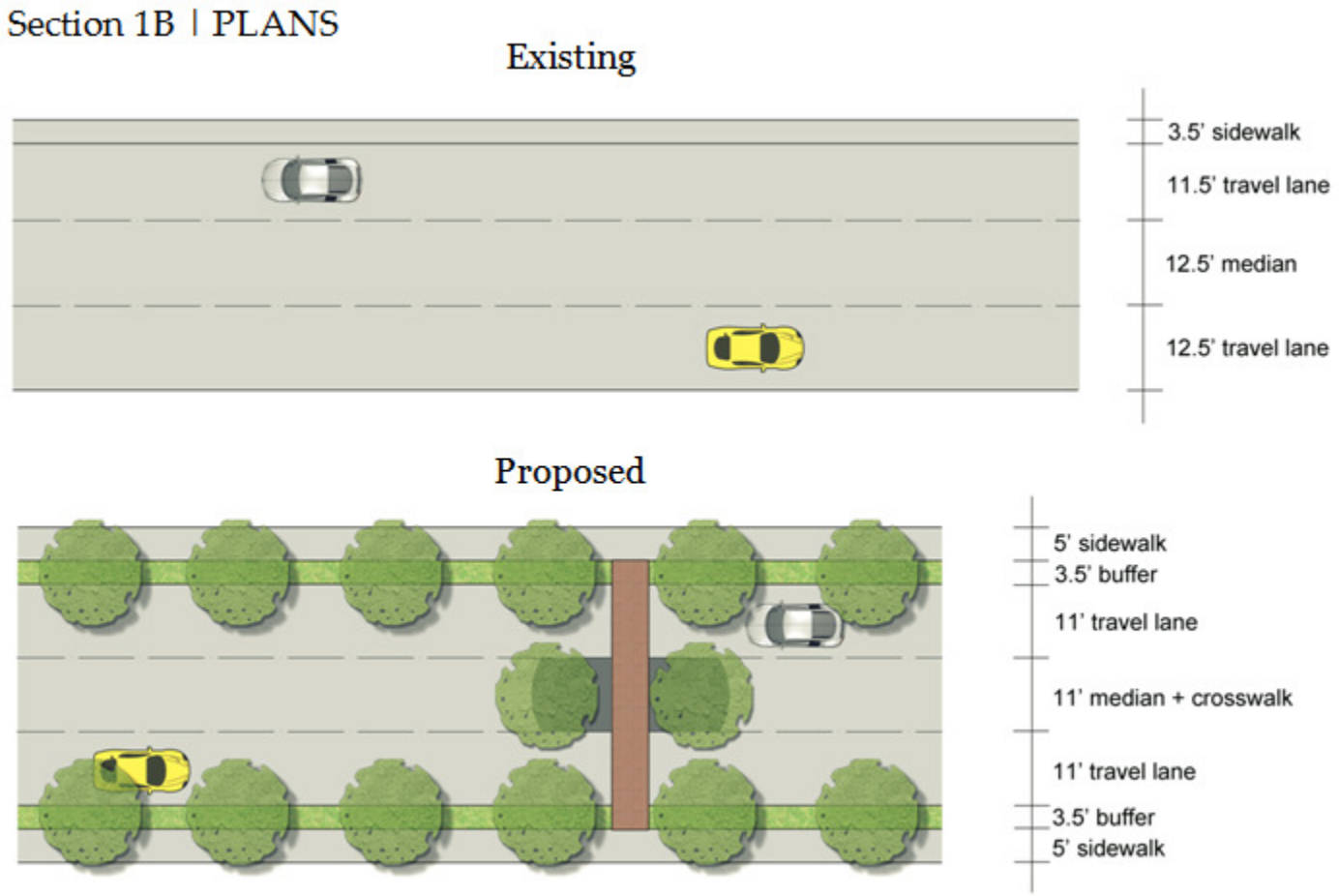

Figure 45 – Existing and proposed conditions – plans: Section 1B

Section 1C | PLANS

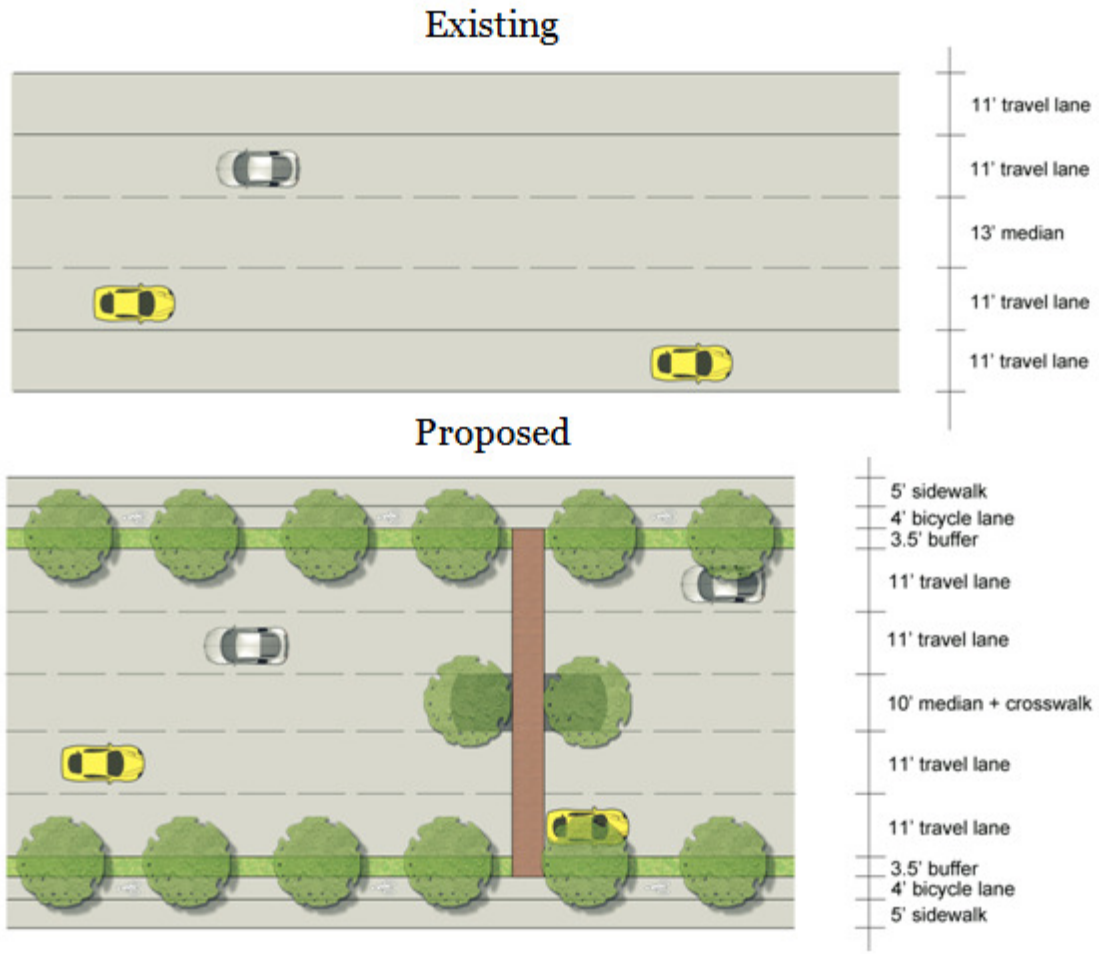

Figure 46 – Existing and proposed conditions – plans: Section 1C

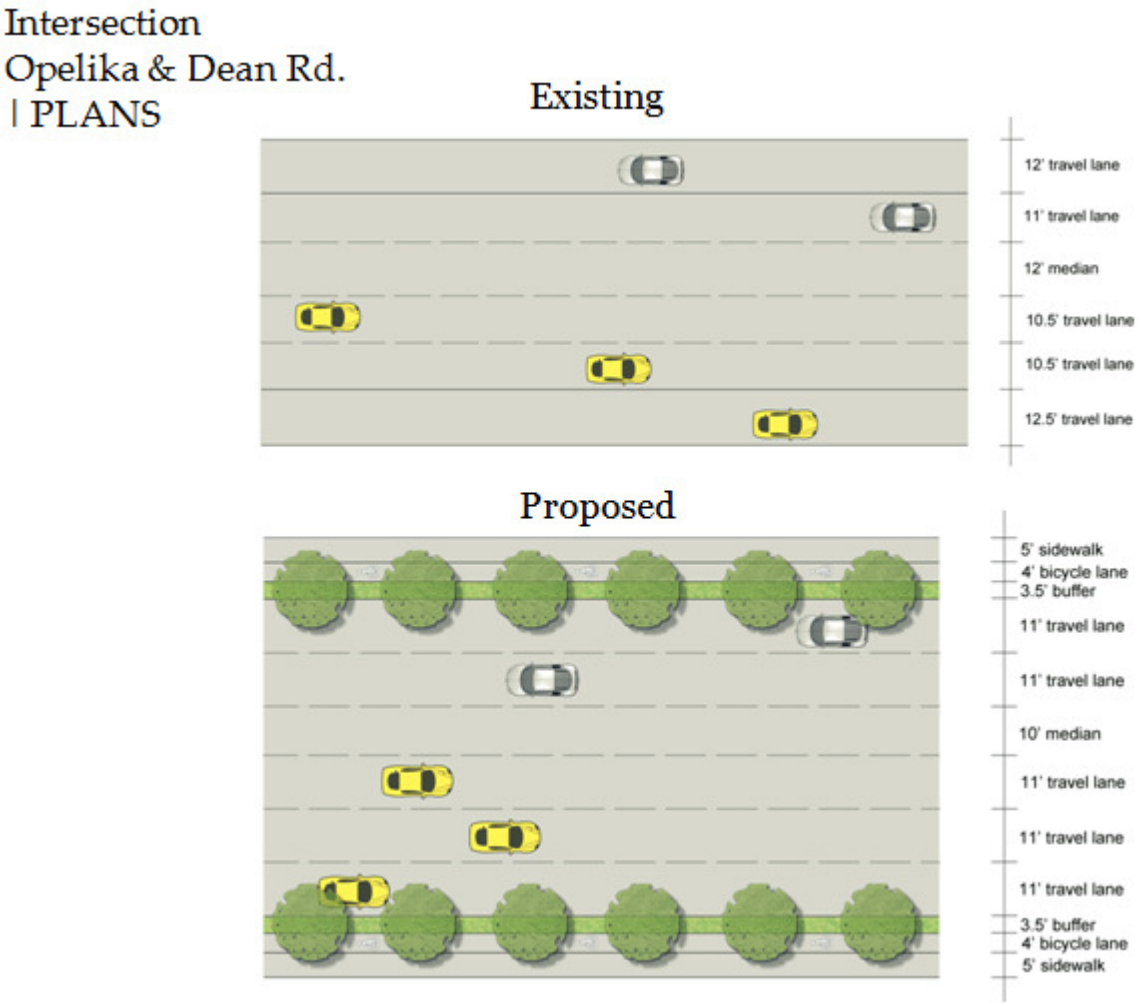

Figure 47 – Existing and proposed conditions – plans: Intersection Opelika and Dean Roads

4. ZONING

The existing zone for the area of study basically includes Redevelopment Districts (RDD), Comprehensive Development Districts (CDD), and Planned Development Districts (PDD). A RDD promotes the renewal of the transitional areas of the City of Auburn that have undergone several changes in land use type and density/intensity. At these areas, there may have been a non-organized transition from low density residential land use to a higher density residential land use and small scale commercial, office and institutional use. At this district it is possible to redevelop an urban character; it provides for intermediate residential densities and necessary commercial and institutional uses (City of Auburn, 2012).

A CDD is a district intended to accommodate most of the growth expected in the undeveloped areas of Auburn. This district allows most used by right and all public facilities such as schools, sewers, water, and highways should be present. The objective of this district is provide zoning and capital improvements that attract development. At this district, it is possible that the development assumes a suburban or urban character and it provides for low to moderate density residential development and for necessary commercial and institutional uses. Finally, a PDD is a district that can provide an opportunity for land development process with the greatest flexibility available to the developer. This flexibility has to be consistent with the provisions of these regulations and also the provisions in the master development plan for the considered property (City of Auburn, 2012).

In this project, a new Zoning Overlay District will be proposed for the study area in Opelika Road. This will suggest regulations to be added to the zoning that already exist in our area so it just overlays on top of the current zoning. The proposed zoning follows the Proposed Bike and Pedestrian Overlay District (BPOD) defined in the City of Auburn Zoning Ordinance.

A BPOD district allows the creation of a walkable and bike able environment by increasing density and mixed-use land investments. Slightly higher height limitations and mix of uses are permitted in this district. The allowance of mixed use will enable restaurants and other businesses to open up on the street level, and upper levels will provide more housing and, as a consequence, increase density.

Table 7 shows information related to the dwelling units per acre for the different zoning classes. The current zoning for the area that is affected by the proposed overlay district is highlighted in yellow; the new proposed overlay zoning is highlighted in green. Table 8 shows the permitted use for the considered districts. Figure 48 shows a map with the existing zoning and Figure 49 shows a map with where the overlay district will be implemented.

Table 7 - Performance standards for residential uses by district

District/ Subdivision Type	Maximum Gross Density (du/ac.)	Minimum Open Space Ratio[1]
Rural (R)		
Conventional	0.33	0.00
Performance	2.35	0.45
Comprehensive Development (CDD)		
Conventional	4.00	0.00
Performance	9.50	0.25
Limited Development District (LDD)		
Conventional	2.00	0.00
Performance	5.00	0.30
Development District Housing (DD-H)		
Conventional	4.00	0.00
Performance	5.50	0.30
Redevelopment District (RDD)		
Conventional	5.00	0.00
Performance	16.00	0.20
Bike and Pedestrian Overlay District (BPOD)		
Conventional	10.00	0.00
Performance	20.00	0.20
Urban Core (UC)		
Performance	**See Article V, Section 506**	
University Service (US)		
Performance	34.00	0.15
Neighborhood Conservation (NC)	**See Article V, Table 5-2**	
Planned Development District (PDD)	**See Article V, Section 504**	

[1]No open space shall be required in a performance residential development consisting of 4 dwelling units or less on an existing lot of record. No open space shall be required for town houses constructed in the Urban Core (UC) and University Services (US) districts.

SOURCE: City of Auburn, 2012

Table 8 – Permitted uses by district

ARTICLE IV GENERAL REGULATIONS

Table 4-1 TABLE OF PERMITTED USES

Category

Use

Agricultural Uses	***NAICS***	***SDS****	***UC/CEOD***	***US***	***NC***	***DD-H***	***CC***	***RDD***	***BPOD***	***R***	***LDD***	***CDD***	***I***	***PDD***
Agriculture	1113									**P**				
Forestry	113	x				**C**				**P**	**C**	**C**		

Conventional Subdivision	***NAICS***	***SDS****	***UC/CEOD***	***US***	***NC***	***DD-H***	***CC***	***RDD***	***BPOD***	***R***	***LDD***	***CDD***	***I***	***PDD***
Single family residential S/D		x			**P**	**P**		**P**		**P**	**P**	**P**		**C**
Manufactured home S/D		x								**C**		**BP**		**C**

Performance Residential Development	***NAICS***	***SDS****	***UC/CEOD***	***US***	***NC***	***DD-H***	***CC***	***RDD***	***BPOD***	***R***	***LDD***	***CDD***	***I***	***PDD***
Single family detached S/D		x		**P**		**P**		**P**			**P**	**P**		**C**
Zero lot-line S/D		x		**P**		**C**		**C**	**P**		**C**	**P**		**C**
Town house S/D***		x	**C**	**P**		**C**		**C**	**P**		**C**	**P**		**C**
Twin house S/D		x		**P**		**C**		**C**			**C**	**P**		**C**
Duplex development		x		**P**		**C**		**C**				**C**		**C**
Multiple family development***		x	**P**	**P**		**C**		**C**	**P**			**C**		**C**
Manufactured home park		x								**C**		**P**		**C**
Manufactured home S/D		x								**C**		**C**		**C**
*** UC See Section 506.03					*See Section 502.02F*									

Outdoor Recreational Uses	***NAICS***	***SDS****	***UC/CEOD***	***US***	***NC***	***DD-H***	***CC***	***RDD***	***BPOD***	***R***	***LDD***	***CDD***	***I***	***PDD***
Golf course	793910				**C**	**C**		**C**		**P**	**C**	**P**		**C**
Park (Private)			**P**	**P**	**P**	**P**	**P**	**P**	**C**	**P**	**P**	**P**		**C**
Tennis court				**P**	**C**	**C**	**P**	**C**	**C**	**C**	**C**	**P**		**C**
Swimming pool				**P**	**C**	**C**	**P**	**C**	**C**	**C**	**C**	**P**		**C**
Commercial Stables	711219									**C**				**C**
Nature and Wildlife Preserves	71219				**C**	**C**								**C**
Bicycle, Jogging and Hiking Paths				**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**		**C**

Institutional	***NAICS***	***SDS****	***UC/CEOD***	***US***	***NC***	***DD-H***	***CC***	***RDD***	***BPOD***	***R***	***LDD***	***CDD***	***I***	***PDD***
Day Care Center	624410	x	**C**	**C**			**P**	**C**	**C**		**C****	**P**	**C**	**C**
Nursing Home	623110	x		**C**			**P**	**C**	**C**		**C**	**P**		**C**
Assisted Living Facility	623311	x		**C**			**P**	**C**	**C**		**C**	**P**		**C**
Independent Living Facility	623312	x	**C**	**C**			**P**	**C**	**C**		**C**	**P**		**C**
Private Libraries & Museums		x	**C**	**C**			**P**	**C**	**C**	**C**	**C**	**P**		**C**
Cemetery	812220	x		**P**	**P**	**P**	**P**	**C**		**P**		**P**		**C**
Church	813110	x	**P**	**C**	**C**	**C**	**P**	**C**	**P**	**P**	**C**	**P**		**C**
Aquariums	712130	x	**C**	**C**			**P**	**C**	**C**		**C**	**P**		**C**
Day Care Home	624120	x	**P**	**C**	**C**	**C**	**P**	**C**	**C**	**P**	**C**	**P**		**C**
Group Day Care Home		x	**C**	**C**			**P**	**C**		**C**	**C**	**P**		**C**
Private Schools	6111	x	**C**	**C**	**C**	**C**	**C**	**C**		**C**	**C**	**C**		**C**
Dormitories	721310	x	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**
All Other Uses		x	**C**	**C**			**C**	**C**	**C**		**C**	**P**		**C**
Indoor Recreational	NAICS	SDS	**UC/CE**	**US**	NC	DD-H	**CC**	**RD**	**BPOD**	R	**LD**	**CD**	I	**PD**

Community Rec. Center	713990	x	C	P	C	C	P	C	C		C**	C		C
Skating Rink (Roller & Ice)	713940	x		C			P	C				P		C
Bowling Alleys	713950		C	C			P	C			C**	P		C
Billiards	713990		C	C			P	C	C		C**	P		C
Gymnasium	713940		C	C			P	C	C		C**	P		C
Indoor Athletic Facilities	713940		C	C			P	C	C		C**	P		C

Special Residential	*NAICS*	*SDS**	*UC/CEOD*	*US*	*NC*	*DD-H*	*CC*	*RDD*	*BPOD*	*R*	*LDD*	*CDD*	*I*	*PDD*
Group Home	623990							P	P			C		C
Boarding/Rooming House	721310	x	C	P				P	P			P		C
Monastaries/Convents	813110			C	C	C	P	P		C	C	C		C
Bed & Breakfast	721191	x	P	P	C#	C	P	P	P	C	C	C		C
Halfway Houses	623990 623220		C	C			P	P	C		C	P		C
Accessory Dwelling Unit		x		P	P	P		P	C	P	P	P		C

 # Limited to NC zoned property within the City of Auburn Historic District, as adopted by Ordinance No. 2377, and as may be amended.
Bed and Breakfasts are otherwise not a permitted use in the NC District

Office	*NAICS*	*SDS**	*UC/CEOD*	*US*	*NC*	*DD-H*	*CC*	*RDD*	*BPOD*	*R*	*LDD*	*CDD*	*I*	*PDD*
Office			P	P			P	P	P		C**	P	C	C

Commercial and Entertainment	*NAICS*	*SDS**	*UC/CEOD*	*US*	*NC*	*DD-H*	*CC*	*RDD*	*BPOD*	*R*	*LDD*	*CDD*	*I*	*PDD*
Auto accessory store	441310	x	P	P			P	C	C			P	C	C
Barbershop/beauty shop	812111		P	P			P	C	P		P**	P	C	C
Brewpub	312120	x	C	C			C	C	P		C**	C	C	C
Building material sales	444190	x	C	C			P	C				P	C	C
Clothing Stores	448		P	P			P	C	P		P**	P	C	C
Commercial or trade school	611511	x	C	P			P	C				P	C	C
Copy shop	561439		P	P			P	C	P			P	C	C
Electronics Repair	8112		P	P			P	C	P		P**	P	C	C
Florists	4531		P	P			P	C	P		P**	P	C	C
Garden Supply	44422		C	C			P	C			P**	P	C	C
General Merchandise Stores	452		C	C			P	C	C			P	C	C
Health & Person Care Stores	446		P	P			P	C	P		P**	P	C	C
Hotel/motel/condotel	721110	x	C	C			C	C	C			C	C	C
Office Supplies, Stationery, Gift Stores	4532		P	P			P	C	P		P**	P	C	C
Package store	445310		C	C			P	C	C			P	C	C
Pet/Pet Supply Store	45391		P				P	C	P		P**	P	C	C
Restaurant			P	P			P	C	P		P**	P	C	C
Private club	813410	x	C	C			C	C	C			C	C	C
Specialty Food Stores	4452		P	P			P	C	P		P**	P	C	C
Sporting Goods, Hobby, Book & Music Stores	451		P	P			P	C	P		P**	P	C	C
Lounge			C	C			C	C	P		C**	C	C	C
Veterinary office/kennel	541940	x	C	C			P	P	P	P	C**	P	C	C
Banks	5221		C	C			P	C	P		P**	P	C	C
Dry Cleaners	812320		C	C			P	C	P		P**	P	C	C
Grocery Stores	4451		C	C			P	C	P		P**	P	C	C
Funeral Homes	812210	x	C	C			P	C			C**	C	C	C
Professional Studios			C	C			P	P	P		P**	P	C	C
Theaters/Indoor Auditoriums	512131		C	C			P	C				P	C	C
All others			C	C			C	C	C		C**	C	C	C

Road Service	*NAICS*	*SDS**	*UC/CEOD*	*US*	*NC*	*DD-H*	*CC*	*RDD*	*BPOD*	*R*	*LDD*	*CDD*	*I*	*PDD*
ATMs		x	C	C			P	C	P			P		C
Auto dealership	44111						C	C				C	C	C
	44122													
Auto repair, paint/body work	8111	x					C	C				C	C	C
Car Wash/Detailing shop	811192						C	C				C		C
Convenience Stores/Small Grocery	445120			C			P	C				P		C
Flea market	531190	x					C	C				C	C	C
	531120													
Gasoline/service station	447190	x		C			C	C			C**	C	C	C
Outdoor/Drive-in theatre	512132	x					C	C				C	C	C
Small engine repair/ Sales	811411		C	C			C	C				C	C	C
Bank w/Drive Thru			C	C			C	C			C**	C	C	C
Parking Garages/ Lots	812930		C	C			C	C				C	C	C
Fast Food Restaurant	722211		C	C			C	C				C	C	C

Commercial Recreational Use	*NAICS*	*SDS**	*UC/CEOD*	*US*	*NC*	*DD-H*	*CC*	*RDD*	*BPOD*	*R*	*LDD*	*CDD*	*I*	*PDD*
Miniature golf/driving range	713990	x								C		C	C	C
Amusement park	713110	x								C		C	C	C
Fairground	711310	x								C		C	C	C
Amphitheater		x								C	C**	C	C	C
Race track	711212	x								C		C	C	C
Stadium/arena	711310	x								C		C	C	C

Recreational Rental Dwellings	*NAICS*	*SDS**	*UC/CEOD*	*US*	*NC*	*DD-H*	*CC*	*RDD*	*BPOD*	*R*	*LDD*	*CDD*	*I*	*PDD*
Campground	721211									C		P	C	C
Cottages/cabins	721199									C		P	C	C
Recreational vehicle park	721211	x								C		C	C	C

Public Service	*NAICS*	*SDS**	*UC/CEOD*	*US*	*NC*	*DD-H*	*CC*	*RDD*	*BPOD*	*R*	*LDD*	*CDD*	*I*	*PDD*
Communications tower	237130	x		C^		C	P	C		P		P	C	C
Municipal Office/Facility			P	P		C	P	C	C	C	C	P	C	C
Hospital	622	x	C	C			C	C	C			C	C	C
Public utility station or facility			C	C	C	C	P	C		P	C	C	C	C
Utility service yard or garage							P	C		C		C	C	C
All other Public Uses			C	C	C	C	C	C	C	C	C	C	C	C

^Only if mounted on an

Agricultural Support	*NAICS*	*SDS**	*UC/CEOD*	*US*	*NC*	*DD-H*	*CC*	*RDD*	*BPOD*	*R*	*LDD*	*CDD*	*I*	*PDD*
Farm equipment sales/rental/leasing	532490	x								C		C	C	C
Farm equipment sales/repair	811310	x								C		C	C	C
Farm produce sales (permanent)	445230	x								C				C
Farm produce sales (temporary)	454390	x	P	P			P	P		P	C**	P		C
Farm produce supply										C		P	C	C
Farm product processing		x								C		C	C	C
Nurseries	NAICS	S	UC/CEO	US	NC	DD-H	CC	RDD	BPOD	R	LDD	C	I	P
Wholesale	444220									P		P	C	
Retail	444220	x					P	C		P	C**	P		C

Commercial Support	*NAICS*	*SDS**	*UC/CEOD*	*US*	*NC*	*DD-H*	*CC*	*RDD*	*BPOD*	*R*	*LDD*	*CDD*	*I*	*PDD*
Bottling plant/bakery	333993	x					P	C				C	C	
	333294													

Contractor storage yard		x						C				C	C	
Printing/publishing	323	x					P	C				C	C	
Recycled materials collection/storage	562111	x					P	C				C	C	
Sales/minor storage of gaseous fuels		x					P	C				C	C	
Sales/repair of heavy equipment	811310	x										C	C	
Vet. office/kennel w/outdoor pens	812910									C			C	
Warehouse	236220	x					C	C				C	C	
Mini-warehouse	531130	x					C					C	C	C
Wholesale distributor		x					C	C				C	C	
All others							C	C	C			C	C	

Neighborhood Shopping Center	***NAICS***	***SDS****	***UC/CEOD***	***US***	***NC***	***DD-H***	***CC***	***RDD***	***BPOD***	***R***	***LDD***	***CDD***	***I***	***PDD***
Neighborhood Shopping Center		x									C	P		C

Community Shopping Center	***NAICS***	***SDS****	***UC/CEOD***	***US***	***NC***	***DD-H***	***CC***	***RDD***	***BPOD***	***R***	***LDD***	***CDD***	***I***	***PDD***
Community Shopping Center 100,000 - 499,999 s.f. floor area		x					P					P		C

Regional Shopping Center	***NAICS***	***SDS****	***UC/CEOD***	***US***	***NC***	***DD-H***	***CC***	***RDD***	***BPOD***	***R***	***LDD***	***CDD***	***I***	***PDD***
Shopping Ctr. 500,000+ s.f. floor area							P					P		C

Industrial Uses	***NAICS***	***SDS****	***UC/CEOD***	***US***	***NC***	***DD-H***	***CC***	***RDD***	***BPOD***	***R***	***LDD***	***CDD***	***I***	***PDD***
Bulk storage of chemicals or fuels	493190	x											C	
Commercial incinerator	562213	x											C	
Food processing/packaging	311	x											C	
Freight/trucking terminal	488490	x											C	
Manufacture of building materials	326199												C	
Manufacture/storage of explosives	325920	x											C	
Outdoor storage of machinery													C	
Recycled materials processing													C	
Scientific testing/research laboratory													C	
Slaughterhouse	31161	x											C	
Storage of sand/gravel/blocks		x											C	
Auto salvage yard	493190												C	
Mine/quarry	212321	x								C				
All others													C	

SOURCE: City of Auburn, 2012

Zoning

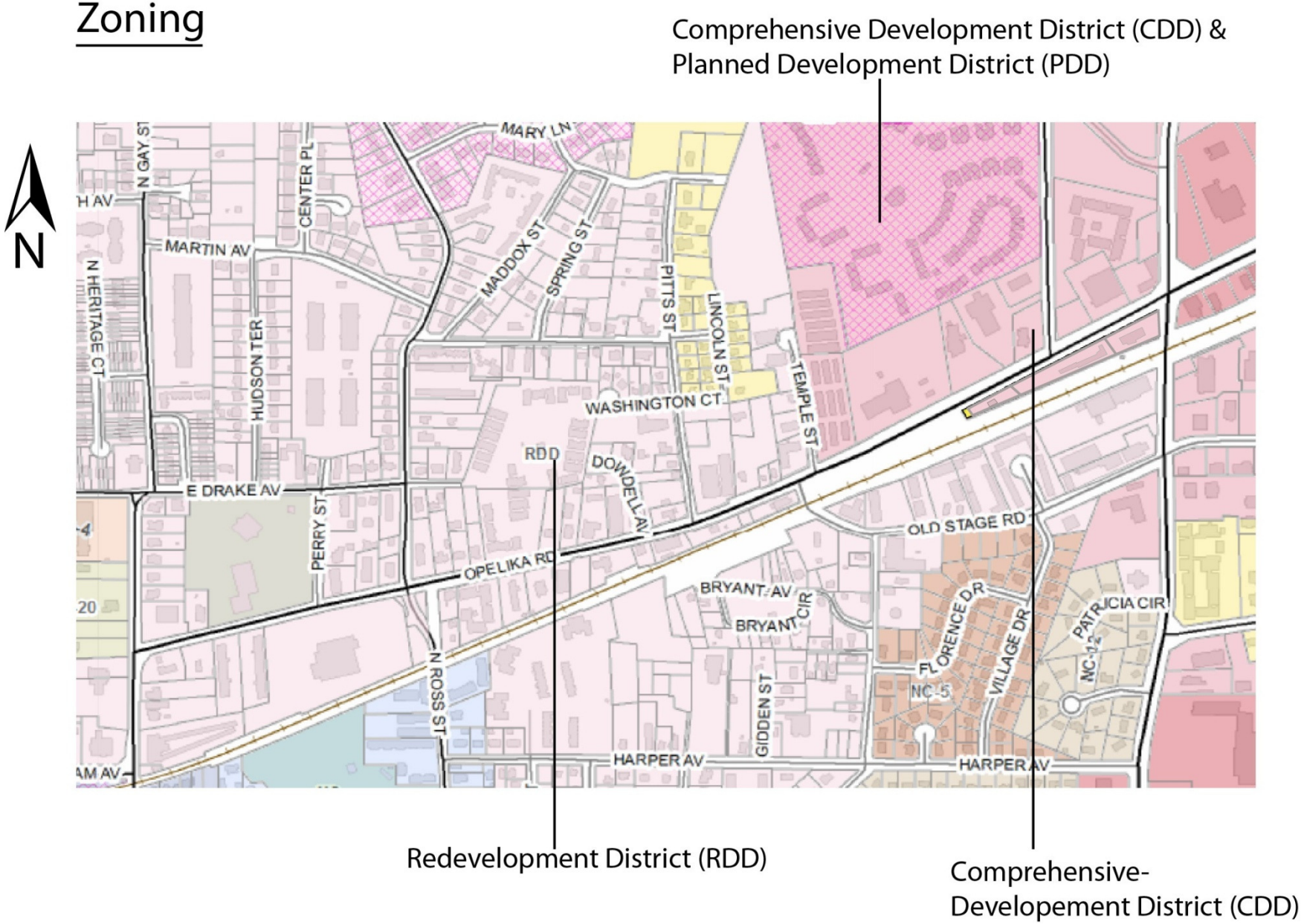

Figure 48 – Current zoning

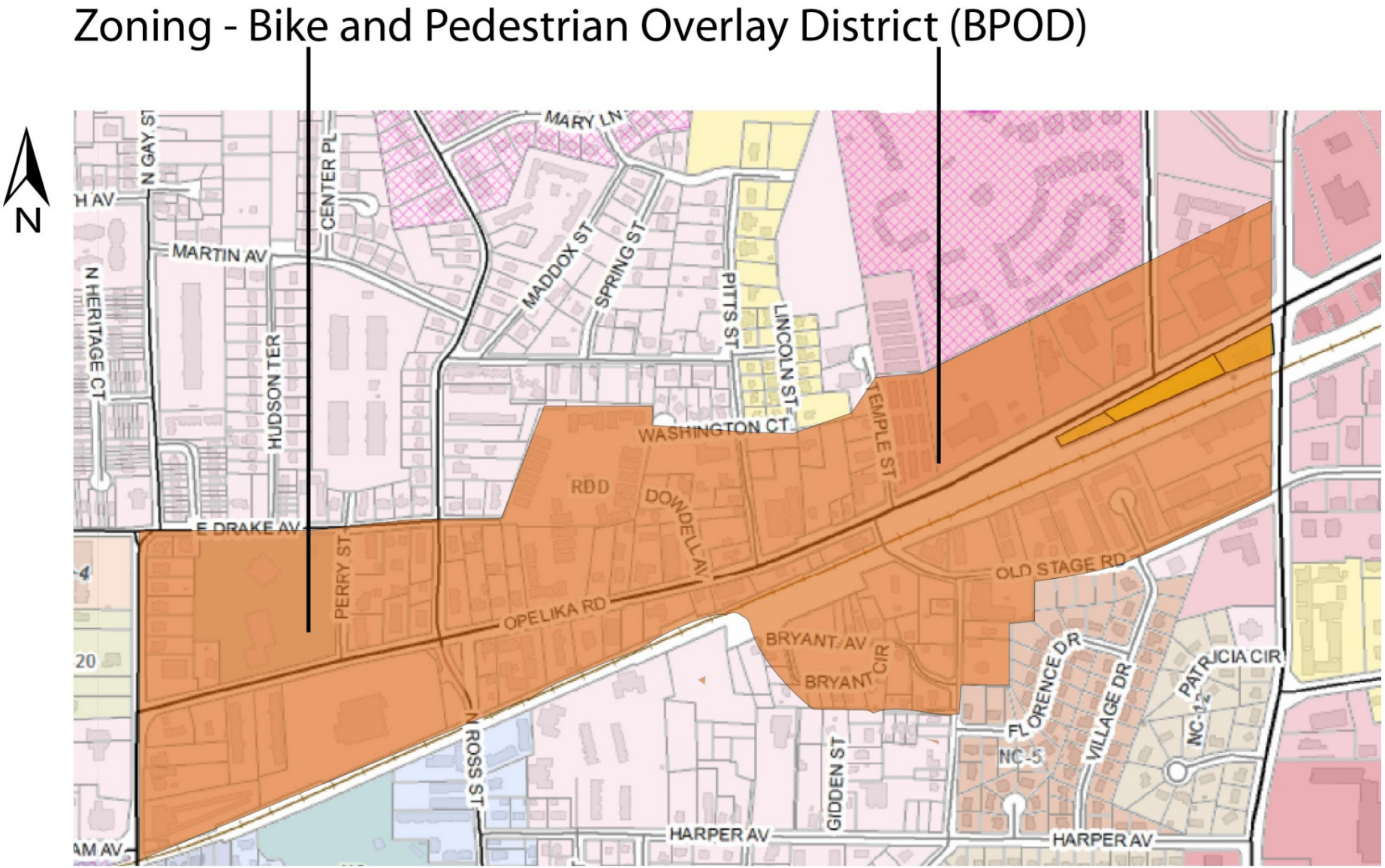

Figure 49 – Proposed overlay district

REFERENCES

Americans with Disabilities Act (ADA) and the Architectural Barriers Act (ABA) *Accessibility Guidelines for Buildings and Facilities.* Available at <http://www.access-board.gov/ada-aba/final.htm#Surfaces>. Accessed November 5, 2012.

American Association of State Highway and Transportation Officials (AASHTO). (2011). *A Policy on Geometric Design of Highways and Streets.*

American Association of State Highway and Transportation Officials (AASHTO). (2012). *Guide for the Development of Bicycle Facilities.*

American Association of State Highway and Transportation Officials (AASHTO). (2004). *Guide for the Planning, Design, and Operation of Pedestrian Facilities.*

City of Auburn. *Zoning Ordinance.* Available at <http://www.auburnalabama.org/zo/Default.aspx?PageID=140>. Accessed November 4, 2012.

City of Baltimore. *Streetscape Design Guidelines*. Available at <http://www.godowntownbaltimore.com/docs/StreetscapeGuidlelines.pdf>. Accessed November 2, 2012.

Dixon, L. B. (1996). *Bicycle and pedestrian level-of-service performance measures and standards for congestion management systems*. Transportation Research Record 1538, 1: 1-9.

Federal Highway Administration (FHWA). *Designing Sidewalks and Trails for Access. Part 2 Best Practices and Design Guide.* Available at <http://www.fhwa.dot.gov/environment/sidewalk2/sidewalks204.htm#sid. Accessed November 5, 2012.

Foresite Group. Signal timing and traffic counts for Dean Road/Opelika Road intersection. Via email from John Karnowski, P.E., PTOE, AICP, Transportation Practice Leader of Foresite group. Email from October 22, 2012.

Institute of Transportation Engineers (ITE). (1998). *Design and Safety of Pedestrian Facilities. A recommended practice of the Institute of Transportation Engineers.*

McTrans. *Highway Capacity Software.* Available at <http://mctrans.ce.ufl.edu/hcs/> Accessed November 6, 2012.

Transportation Research Board. (2010). *Highway Capacity Manual.*

Transportation Research Board. *Highway Capacity Manual Information.* Available at <http://hcm.trb.org/>
Accessed November 6, 2012.

Urban Tree Foundation. Available at < http://www.urbantree.org/list_trees.asp?t=street>. Accessed November 2, 2012.